CCCE 2016 International Conference on Information Communication Technologies in Education

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The International Conference on Information Communication Technologies in Education 2016

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Rhodes, Greece 2016

The Proceedings of the International Conference on Information Communication Technologies in Education 2016

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PREFACE TO THE PROCEEDINGS

Greg Anderson Chair, ICICTE 2016 Scientific Committee

Understanding how to support teaching and learning, and the learning needs of the next generation of learners, is important for students' intellectual development and their readiness to contribute to a thriving economy upon graduation. In the context of student-centered instructional models, the proliferation of new technologies and diminishing institutional budgets, there is a need for more focussed dialogue concerning which educational technologies best support student learning, and are sensitive to the different needs of students in academic, trades, or vocational programs across the sector supporting lifelong learning "from womb to tomb." To this end, the International Conference on Information Communication Technologies in Education (ICICTE) has met each year since 2000 to discuss the appropriate use of technology in education, seeking to address the many challenges and new directions presented by technological innovations in educational settings.

It is my pleasure, on behalf of the Scientific Committee, to welcome all presenters and participants to the 16th annual conference where we gather an international community of scholars and practitioners. The ICICTE family has grown over the years, and each year we build on the success of years past, honoring the past, living in the present, and looking toward the future. Our gathering this year on Rhodes will bring fond memories to many who have attended previous conferences here, but is also certain to facilitate meaningful dialogue between delegates new and old. ICICTE strives to maintain a venue that fosters a community of scholarship that allows knowledge dissemination, information exchange, and lasting relationships to develop. The conference and social program provide ample opportunity to renew old acquaintances, and spawn new ideas and collaborations. Greece provides a perfect backdrop for this activity, owing its contribution to ancient scholastic activity.

With the continued support of the indefatigable Nancy Pyrini, the Conference Director, the conference continues to support new and seasoned scholars, first time and returning delegates, sustaining a global learning community with deep and stable roots in educational and scientific excellence. The legacy of the conference is captured here within these *Proceedings*. It will be immediately apparent the amount of work that went into creating a record of our scholarly activity at the conference. As with other years I must acknowledge those who have worked tirelessly in this regard. This includes those on the Scientific Committee who review multiple proposals multiple times, to the skillful editing and formatting by Dr. Linda Morris. The masterful work of Dr. Gorg Malia then assembles the papers into a collected *Proceedings* that captures the essence of the conference itself.

As in years past, this conference has been successfully organised by Southampton Solent University (UK), represented by Dr. Chris Barlow, in collaboration with the Justice Institute of British Columbia (Canada), represented by myself. We are aided and abetted by Dr. Costas Tsolakidis of the University of the Aegean, George Sarrigeorgiou, and Marie Louise Kold, among others. Whether you have joined us for the first or sixteenth time, or are reading these *Proceedings* from afar long after the conference has concluded, we urge you to reach out to the presenters with whose papers you find resonance. We look forward to your active participation in our learning community and hope to see you at the conference next year.

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FUTURE CONSIDERATIONS IN THE ADOPTION OF EDUCATIONAL TECHNOLOGIES

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Abstract

Higher education institutions are increasingly incorporating innovation in education into institutional strategic and academic plans. Yet, they grapple with defining and implementing the concept and articulating and measuring the results of their efforts and investments. Drawing from a research foundation and her experience, the author presents a perspective about what innovation is and isn't in the context of higher education in Canada then provides considerations for creating a culture of innovation and some steps for ensuring that innovation is relevant and meaningful within an organization.

Introduction

Innovation in education in increasingly associated with institutional strategic and academic plans, and has even resulted in the emergence of job titles such as Vice Presidents and Directors of Education and Innovation. Parallel to this situation, educators are also faced with technology-driven hype that often seems driven by a Silicon Valley agenda. For example, in the past five years, higher education has seen the rise and descent of MOOCs, MOOC platforms, learning management systems that promise to be more mobile, feature and user friendly, and the growth of cloud based technologies whose primary purpose is to collect user data for goals that are not obviously revealed to the user.

At some point as educators we find ourselves asking the question: are these 'innovations' solving higher education problems? In my own institution, where students are incredibly mobile, programs are built around two- or three-day intensive courses, and where applied, experiential learning (often scenario based) is the norm, we having been critically assessing the mother of all educational technology tools – the Learning Management System (LMS) – for its ability to meet our own pedagogical needs. In a context where funding for public higher education is increasingly at risk, we have had to ask ourselves whether we have over invested in the LMS (which is often the most costly educational technology an institution will acquire) at the expense of innovation that solves our own higher education problems.

At the same time, the word *innovation* has become overused to the point where a certain degree of skepticism is expressed by many of us who feel that our institutions have been unable to live up to its promise. I feel that innovation is important – even critical - to higher education, and that there are practical steps that can be taken to get to a place where innovation is no longer thrown around as a vague buzzword.

Innovation in the Context of Higher Education

But first, I'd like to establish my position, how I think about what innovation is and isn't in the context of higher education (in Canada). Then I'll talk about some considerations for creating a culture of innovation, and conclude with some steps for ensuring that innovation in your institution is relevant and meaningful.

Some Observations About Innovation

1. One innovative initiative does not make an innovative institution. Often institutions identify a high profile flagship imitative (e.g., MOOCs, OERs, a tablet program, videoconferencing, flexible learning) but not only is it an "eggs in one basket" approach, but it's difficult to gain momentum if there is only one innovative initiative, since you're essentially banking on the majority of the institution being (a) interested in it and seeing value in it and; (b) it succeeding.

2. Innovation requires an institutional tolerance for a certain amount of

failure. This is why a flagship innovation approach can be problematic...if you put all your eggs in one basket and it's not as successful as your marketing and communications department has promoted it to be, you have few wins to celebrate and difficulty maintaining momentum.

3. *Innovation requires momentum*. When innovation is truly happening, it engages everybody and inspires spin offs. I think of innovation as a snowball that becomes big and then spins off other snowballs.

4. *Innovation is not a project, a policy, or a committee.* Innovation is first and foremost an institutional attitude that needs to be embraced and supported. Innovation is messy and sometimes isn't successful. This makes administrators uncomfortable, from which emerge project plans, policies and steering committees to control what is perceived as risky, chaotic activity. These efforts lead to what could be called in academic terms "inhibiting boundary objects" or gatekeeping devices that will essentially void any strategic plan or job title change efforts. But it also doesn't mean that innovation is a rogue "anything goes" activity that costs institutions large amounts of money either. More on that below.

5. *Innovation is not retroactive catch up or large tech projects*. Sometimes institutions mistake their latest enterprise software implementation as innovation, when it's usually status quo with a new twist. Just because your institution's implementation is a lot of money and resources, it doesn't mean it qualifies as innovation. In fact, if your efforts are taking money away from your innovation initiatives, your institution should take a critical view of why that is happening, and for what benefit. (Sometimes expensive implementations are about taking the path of least resistance, and this is where I think institutions should be looking at whether a more innovative approach could have saved money.)

6. *Innovation doesn't have to be expensive*. In fact, if you are fighting the bean counters on the value of innovation when you've said that it sometimes fails, and failure is okay, you will want to minimize the financial risk. So showing the institution how much you can do with a small pocket of change is a great way to get momentum and buy in.

Some Steps in Defining Innovation

One of the first steps in creating a culture of innovation is figuring out what your institution means when they say they want innovation. This should be obvious, but chances are different stakeholders (the Deans, the President, the CIO, the faculty) all have different ideas as to what is innovation and what they want. Innovation is a relative construct, and within an institution there will be small, medium, and large understandings as to what will constitute innovation. Rather than impose your view, you will need to work with theirs, but without losing sight of where you think the institution needs to go, of course. This requires doing a good job of the following:

- 1. Develop a clear vision for innovation based on what you learn about the institution. Articulating a vision for innovation is a key step in making sure that the path that emerges is meaningful and relevant to the institution. For example, there is a temptation to jump on the latest and greatest ed tech buzz (e.g., mobile learning, e-portfolios) and roll it out as an institutional must-do innovation. But if mobile learning or e-portfolios makes no sense at your institution because of the types of programs, students, professions, etc., don't do it. This doesn't mean that you have to abandon it completely this leads us to #2.
- 2. Distinguish between institutional innovation and program level innovation initiatives. In the previous section, I cautioned against flagship innovation initiatives, which are often rolled out and positioned as institutional must-do projects. Flagship initiatives aren't necessarily bad, but you will want to make sure that you are sensitive to innovation initiatives that might only make sense to one or two programs. For example, moving all your history students to a tablet program probably doesn't make any sense, but for your medical program it might be a no-brainer. Program level initiatives also have the advantage of snowballing into other programs in more of a grassroots way, which is good for buy-in.
- 3. Look for opportunities for convergence of smaller initiatives. The method to the madness with flagship initiatives is that you are introducing a big, broad bucket of options that faculties will be able to identify with. The risk with this approach is that it is (a) too big of a bucket for faculty to see how flagship program will solve their immediate problems and (b) so broad that it intimidates or disengages since faculty feel like the learning curve is too big. I think there's a better chance of success in converging separate, smaller initiatives gradually. For example, a WordPress initiative can converge nicely with a tablet initiative into a bigger bucket called mobile learning, rather than starting with mobile learning and trying to have faculties understand all the options in that bucket.

Of course, all of this is nice in so long as you have an environment that facilitates innovation (as opposed to inhibits innovation). This is often where institutions get stuck and is the focus of the next section.

Removing Barriers to Innovation

Rogers' (1962/2003) *Diffusion of Innovations* is a well-known and cited tome on innovation, and I've found that senior administrators really grasp the idea of diffusion and innovation. But in order to get a better understanding of what is happening in an organization at a macro level to inhibit or foster innovation, and what to do about it, I

structure my thinking around Engestrom's (1987, 1999, 2001) activity theory and the concept of boundary objects (Fox, 2011). I think of boundary objects as organizational artefacts – people, committees, money, positions, policies, procedures – that can be *inhibitive* or *facilitative*. They sit at the boundary of many spheres of activity, and sometimes institutions also need to create new boundary objects. The key is understanding which ones are important to the innovation vision that you have proposed (and has been endorsed) so that you can move ahead with your plans.

There are some obvious first places to examine in your institution and assess whether they are facilitating innovation or inhibiting it. The most obvious place to start is the teaching and learning centre.

Teaching and Learning (T&L) Centres. Teaching and Learning centres in my experience are a bit of an innovation paradox, in that they are well positioned to be an innovation hub for the institution but often need to be reinvented and transformed in order to do this. This is especially the case with well-established T & L centres that have become highly invested and good at doing one or two things (curriculum development, faculty development) at the expense of others. While the role of T&L centres is generally to enhance teaching and learning at the institution, my view is that given that these centres are often centrally funded, ultimately their role is to make the lives of teaching and learning staff easier. As with *innovation*, this means different things to different people. The Vice President Academic might very well see the T & L centre's priority to increase the quality of teaching at the institution, but is this the dean's immediate priority? The dean's priority might be to have a simpler way of managing curriculum in its faculty. The faculty members might just want some support on the online course environment that they've been asked to teach in. Within this context, innovation competes with numerous other priorities.

If this is the case at your institution, then I like the idea of invoking (in academic terms) a third space (Gutiérrez, Baquedano-López, & Tejeda,1999) – a sort of fail safe zone or zones for innovation and transformation that is separate yet connected to the T & L centre. Plenty of institutions do this, and sometimes it can look like off-the-side-of-the-desk rogue activity, or unofficial clusters of activity, but I think it stands a better chance of succeeding if it has been endorsed and supported by the senior administration and the budget, rather than being an under-the-radar secret.

In order for these third spaces to work, they need to consider other barriers to innovation: time, money, people, and bureaucracy. Simply put, if the innovation space requires a lot of effort to access the equipment, money, people, then it's not really helping anybody. This might be stating the obvious, but here are a couple of examples I've seen:

- 1. *Innovation equipment locked up in a separate room 3 or 4 buildings over from the teaching site.* Only the most keen and confident instructor will bother getting to campus early to go and grab the equipment and set it up.
- 2. Innovation funding processes that require filling out long, elaborate forms, that then have to be endorsed by multiple committees over a several month process. Faculty are busy, and if it takes more hours to get the money than to use the money then there's little ROI for them. Also, if they have an idea

they want to implement, it's usually time sensitive. This process also doesn't support the notion that innovation is messy and sometimes fails.

3. Innovation that has to fit into existing systems, technologies, world views, e.g., an e-portfolio project that has to use the institutionally endorsed (read: expensive) e-portfolio tool. This is a tricky one. On the one hand, supporting innovation means that it should support the innovation vision of the institution and it's not an "anything goes" environment. But on the other hand, you have to know where you can let it go and challenge existing thoughts on this. For example, does the innovation really have to tie into the institutional LMS, SIS, or existing policy XYZ? For me, third spaces should challenge the status quo where appropriate, otherwise it's not really innovation.

Institutions often get into trouble with #3, because they've over invested in certain technologies and want to see a measurable return on investment, have created overly inhibitive structures (steering committees, policies), or lack vision and leadership on innovation. Which unfortunately means that if you're in a senior position with innovation as part of your job title/portfolio, and you don't have the means or senior support to remove the barriers, then you've got a really tough job ahead of you.

Creating a Culture of Innovation

In the previous section I mentioned the importance of the idea of third spaces in creating a culture of innovation and in removing barriers to innovation. I focused solely on the T & L centre as an obvious starting point for a third space or facilitative boundary object, but it is also important to identify the inhibitors, which are often administrative departments, steering committees, and processes. I find that often these inhibitive structures don't really know how to be facilitative of innovation and, like T & L centres, need some transformation. Since you can't always dismantle these structures, what can you do to keep innovation from devolving to a *project* (see the first section as to why innovation shouldn't be a project) that only you care about?

I see this as a series of steps with various inherent mechanisms. Some of these might seem to be a bit obvious, so often go unacknowledged.

Talk to people and find the innovation on the fringes. Chances are there are some people in your institution doing some really interesting, innovative stuff that not many people know about. Find out why that is, how they are getting stuff done, and what is getting in the way. Then figure out how you will be able to help them move from the fringes to key examples of people doing great things that the institution supports. You might also find out (as I did on more than one occasion) that something that they are doing that wasn't on your innovation radar should be a key initiative.

Support the people who want to do some great stuff, but have no idea how to get going or get the support they need. Higher education by design is full of smart, creative people who want to do cool things. But sometimes the smallest things become barriers to getting them to implement their ideas. For example, I've come across a situation where a faculty member's amazing idea required purchasing a 500\$ flip camera that he couldn't get his department to buy. His idea was simple, cheap, and would have had a great effect on student learning. Making sure you have some budget for supporting people on the cheap is a great way to get some quick wins and momentum – in the first

year we did this we were able to support 5 or so projects with less than \$3000, and these projects became highly showcased and led to other great developments.

Don't kill the innovators with process. In our T & L Centre we have an innovation pilots initiative (see above) where people with ideas can access money and/or expertise support in order to try out their idea. This is available at any time of the year...there are no calls for proposals, blessings by committees, or long discussions about *what ifs.* We don't require success, in fact we let people know that they are allowed to fail. But since it's not a free for all, we have a one-page project plan that is filled out. Knowing that this is a barrier for people with little time, we ask them to come to a one hour meeting with us where they tell us verbally what they want to do and what they need from us, and we fill out the form for them in the meeting. Our one pager covers the following:

- Strategic Goals Addressed what Academic plan, strategic plan or ed tech plan does the project align with?
- Purpose of the pilot—what is the problem/s you are trying to solve?
- How are you planning on doing it?
- Equipment/people needs
- Evaluation: How you will know if it is successful/not successful?
- Timeline

We find that this process becomes a collaborative conversation between the people with the idea and the people that can support it, and it sets the right tone for the relationship and the project. We want people to feel empowered by the step they've taken rather than intimidate them with "how are you going to do this, what if XYZ happens..."

Pilots are your friend. At every institution I've worked with, small innovative ideas have a habit of becoming complexified when certain stakeholders throw the *but what ifs*, the *we can't becauses*, and the *but we don't haves*. Often this is a fear driven reaction to culture where unknowns are viewed as a risk. To counter this, I've had good success with using pilots as a sort of boundary object that is introduced as a way to alleviate fear of failure. Pilots by definition are ways of trying things on and figuring out whether an idea is worth pursuing through more formal channels, once a good assessment is made of the value and potential to the institution. I like to point out that they are actually a low risk way of innovating in that they give the institution time to properly assess and learn about whatever is being implemented.

The other nice thing about pilots is that you probably have a good idea of some musthave tool/innovation that you want to introduce to the institution, but don't quite yet have the buy-in. You can keep a tool/innovation in pilot until it has enough momentum and buy-in to transition it successfully to being institutionally supported. Basically, once it becomes indispensable to the institution (WordPress in our case) you have plenty of examples to demonstrate your case without trying to convince people why the tool is needed. Keep in mind that the key with this whole approach is that you need to have the authority to initiate and support pilots. Finally, pilots are useful in showing that you actually do have a process and guidelines for introducing innovation to your institution – this is important because you don't want people to think that you are jumping on any new shiny thing without having thought about it, or that you are shoving your favourite pet technologies/innovation onto the backs of already busy people.

Considerations for Educational Technology and Innovation

The previous sections have really been about establishing and defining parameters for innovation. I've organized the talk in this way, because innovation is such a big topic and such an important influence on our activities. However, in many ways, starting with innovation is not the place to begin with considerations for educational technology. This section is about applying some considerations at a very practical level to the decisions that need to be made in establishing innovation initiatives and a culture of innovation. I use my own institution to illustrate the process.

For starters, it's important to highlight <u>Tony Bates' well-established SECTIONS model</u> for selecting educational technologies or media. It's a great place to start if you are an instructional designer trying to make decisions about educational technology in course and program design. But when talking about innovation and educational technology at an institutional strategic level, I think it can be a good idea to take a step back and ask some bigger questions of your institution.

To begin, I think it's important to begin with a thinking (or erasing) exercise that asks you to forget everything you know or think you know about educational technology and start over. At many of our institutions ed tech thinking starts with the LMS, and whether we like it our not the LMS's institutionally friendly attributes have an important role in shaping our thinking about teaching and learning.

Once you've erased your educational technology slate, you are ready to embark on some considerations:

- 1. Consideration #1: What is the learning trajectory of students who interface with your institution? What data do you have about your students, and does it tell an accurate story about the trajectory?
- 2. Consideration #2: What is the key driver of educational technology decisions at your institution (e.g., access, best possible learning environment, institutional profile, institutional differentiation). You have to pick one, but you can acknowledge that others come into play.
- 3. Consideration #3: What does innovation mean at your institution by the various stakeholders? Does it line up with #1 and #2?
- 4. Consideration #4: What are the problems that need to be solved that could be solved by ed tech? Is your current ed tech environment solving or hindering these problems?
- 5. Consideration #5: Can you afford to not be/go open in some areas of your activities?
- 6. Consideration #6: What can be done to get at 4 and 5? This is innovation.

If I were to go back in time six years when I started my role at my institution, JIBC, I would try to systematically engage in a process to get at some of these questions. In reality, the questions emerged over time and in a different order - #2, 3, 4, 6, 1, 5. This is how it played out for us:

Consideration #2. It was pretty consistently stated that JIBC's driver for educational technology came from a provincial mandate, meaning we have to deliver our programs across a very large geographic area, including rural and remote communities. So for us, educational technology was primarily about access – making it possible for rural and remote communities to avoid expensive travel to Vancouver and to give greater opportunity for BC communities to access our programs.

Consideration #3. Given #2, there was a very strong collective desire to innovate on how to do this. We had an LMS, and had a web conferencing tool, but there was a sense that this wasn't enough and was producing satisfactory but not good enough results. So innovation meant finding new models of delivery, new formats for our courses and programs, and better tools. There was also a common theme in that JIBC felt like it had been a leader in educational technology in the past, but hadn't evolved or kept up enough to maintain that status.

Consideration #4. JIBC had a huge appetite and appreciation for educational technology, and unlike other institutions I'd worked at previously, there wasn't a need to sell the importance at the institution. There was a greater need to push the envelope, but it took a while to get at the problems that needed to be solved. For example, it took some innovative people in some of our programs to turn me onto mobile (Consideration #6) by putting it into a real professional context. The President, and JIBC generally, didn't feel like the ed tech environment that existed was solving the problems that needed to be solved. But being able to translate this collective dissatisfaction into an articulation of a future direction emerged over time. This is partly because we hadn't really unpacked #1.

Consideration #1. We arrived at a clear articulation of the JIBC learner trajectory through a number of data points. Institutional data showed that approximately 50% of our students come back to do additional programs and credentials, many of which are very niche, unique kinds of course and programs not offered elsewhere. In other words, we are truly a lifelong learning institution for many of our students, partly because of the kinds of programs we offer. And because of the kinds of professions and communities that we work with, we know that our students often have a relationship with JIBC before enrolling in our programs. Additionally, one of our research surveys showed data that most of our students are working full time while attending our institution (see Figure 1), and age group distribution is fairly equal between 18 and 60+ (see Figure 2).

How many hours per week, on average, are you employ	ed? Response percent	Response total
Not employed	9.8%	106
1-5 hours 🔜	2.2%	24
6-10 hours 🤜	2.7%	29
11-20 hours	5.1%	55
21-30 hours	6.3%	<u>68</u>
31-40 hours	43.5%	473
More than 40 hours	30.5%	332
	Total # of respon	dents 1,119.
	Statistics based on 1.087 respondents: 0 filtered:	32 skinned.

Figure 1. JIBC student employment data.

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Please indicate the age range which applies to you	Response	ise Response nt total
19 or less 🦳	2.8%	• <u>30</u>
20-24	8.3%	• <u>90</u>
25-29	11.5	% <u>125</u>
30-34	9.8%	<u>107</u>
35-39	12%	<u>131</u>
40-44	13%	<u>142</u>
45-49	12.49	% <u>135</u>
50-54	13.19	% <u>143</u>
55-59	8%	87
60 and over	9.1%	• <u>99</u>
	Total # of resp Statistics based on 1.089 respondents: 0 filtered	ondents 1,119. 30 skipped.

Figure 2. JIBC student age distribution.

The different data points about our students lead us to the following description of a JIBC student trajectory, where we tried to articulate the student relationship with the JIBC before, during, and after taking a course or a program (Figure 3). This, of course, had important implications for educational technology decisions and innovations, namely, that things that we create or implement should be things that students not only use while they are at JIBC but have direct application and use in the professions or communities in which they work. This is also how we ended up at # 5.



Figure 3. JIBC student trajectory illustrating student relationships with the JIBC before, during, and after taking a course or a program.

Consideration #5. In British Columbia we are fortunate to be part of a higher education sector that encourages and supports open practices, facilitated by BCcampus. Once we had an understanding of #1, the rationale to go open in some areas of our activities was clear. Using WordPress to make courses and parts of courses available to students at any phase of their learning trajectory ended up being a win for both students and the communities with whom we work.

Our Current Ed Tech/Innovation Formula

JIBC didn't go the flagship innovation initiative route, but instead focused on a few smaller initiatives that have converged. (We also do a lot of scenario-based experiential learning and simulations, but this was already well established at JIBC.) Our new innovation *formula* -for lack of a better word – ended up being mobile + wordpress + open = innovation (Figure 4). However, it has to be underlined that the context for this is a combination and result of considerations 1-6, which obviously will be variable depending on the institution. This is why I think it's important to scrutinize both current ed tech environments and the latest innovation flavours of the month, be they e-portfolios, mobile, augmented reality, etc., since it's quite possible that it doesn't make sense in a particular institutional context.



Figure 4. JIBC innovation formula.

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ORACLE ACADEMY 21ST CENTURY, NEW SKILLS, NEW JOBS... ARE YOU READY?

Danny Gooris, Senior Manager EMEA Oracle Academy

Europe's challenge is not just to improve skill levels, but also to match people with the right skills to the right jobs. Working life is becoming much more complicated. The information revolution is gradually dispensing with many jobs that had seemed to be a permanent fixture of our societies, while the jobs it generates need an ever widening skill base, especially ICT skills.

Consequently, it is becoming more difficult to find the right people for the right jobs. Skills intensive economic and technological change is making the issue of skill mismatch more prominent. It's not just a matter of having enough skilled people in the economy as a whole, although that is an important condition. Most of the new jobs the European economy is expected to create over the next decade will require high-level qualifications. The good news is that qualification levels are rising, particularly among young people and women.

It is estimated that, in 2020, 31.5% of all jobs will need tertiary-level qualifications and that around 34% of the labor force will have them. Some 50% of jobs will require medium-level qualifications and around 48% of the labor force will be qualified to that level. Around 18% of the labor force will have no or low-level qualifications and 18.5% of jobs will need no or only low level qualifications. Given these trends, although not perfectly aligned, Europe does not seem to be doing so badly.

As with most things, however, the real problem lies in the details. The right balance between supply and demand also means that people need to be a good fit with their jobs. Although forecasted skill levels may be broadly in line, in 2020 the European labor market is likely to have a surplus of some skills and a shortage of others. People may have academic qualifications while employers may want vocational ones. Europe's challenge is not just to improve skills, but also to match the people with the right skills to the jobs available.

We need to look today at the jobs of 2020 and define what skills are needed, in order to address the skill set gap.

In today's world, technology is ubiquitous across industries, and an understanding of computer science is essential to effective participation in the global economy. As a global program supporting computer science education, Oracle Academy enables educators everywhere to inspire and prepare millions of students to become the innovators and leaders of the future.

The Oracle Academy provides a complete portfolio of software, curriculum, hosted technology, faculty training, support, and certification resources to K-

12, vocational, and higher education institutions for teaching use. Faculty can flexibly insert these resources into computer science and business programs, ensuring that students gain industry-relevant skills prior to entering the workforce. The Oracle Academy supports over 2.2 million students in 96 countries. Oracle Academy recently expanded its curriculum to include Java.

The Oracle Academy program is made to help students to obtain the skills they need in today's 21st Century job market.

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CONTRASTING VIEWS: STUDENT AND TEACHER PERCEPTIONS ON ICT IN EDUCATION

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Abstract

This paper reports on a study of upper secondary school teachers' and students' perceptions of information and communication technologies (ICT) in education. Data for the study are interviews with teachers and students that are part of a Swedish fouryear project concerned with the advanced use of ICT in education. The results show that teachers use ICT for several different purposes, and that students expressed an extensive use of ICT. Data reveals a difference between students' in- and out-of-school use of ICT, out of school they rely more on their smartphones than they do in school.

Introduction

This paper addresses the question of ICT in education from the perspective of upper secondary school teachers and students. Major expectations have been put on ICT in education, but according to research studies and evaluations, ICT has yet to prove its potential to improve education (Pedro, 2009; OECD, 2015; Wastiau, Blamire, Kearney, Quittre, Van de Gaer, & Monseur, 2013). Given this situation, several questions can be posed. For instance, could the uptake and use of ICT in education ever meet the expectations of policy-makers? And if so, what can be possible grounds for understanding the current situation? Is it, as is suggested by Schleicher in the foreword to the 2015 OECD report, a question of developing a way of thinking, a pedagogical design that makes the most of using ICT, or do we overestimate the digital competences of both teachers and students? This paper is limited to the perspectives of the teachers and the students.

ICT in Education – Complicated Expectations

Expectations on ICT to reform education have been around for several decades (Cuban, 2001). On a policy level, the expectations are often overrated (OECD, 2015), and they have been repeatedly questioned by research from different parts of the world (e.g., Håkansson Lindqvist, 2015). In a recent review of research, Olofsson, Lindberg, Fransson, and Hauge (2015) concluded that the uptake and use of ICT in education, both in theory and practice, can be understood from several different points of view and that there is a need for educational research to go beyond smaller case studies of what is described as successful implementation activities towards larger, longitudinal studies that have the potential to consider the potentials or difficulties in using ICT in a complex educational environment in a more thorough way. A reasonable assumption here is that the digital skills of teachers influence their use of ICT for teaching and learning (Sipilä, 2014). Another reasonable assumption is that the digital skills of students influence their possibilities of learning how to use ICT for educational purposes and that they are of equal importance for all students (Male & Burdon, 2014). To further complicate matters, students' use of ICT outside of schools might also

influence their view on the way they use ICT in schools for learning (Ben-David Kolikant, 2012). There seems to be relatively few studies that focus on both teachers' and students' perceptions of ICT targeting the same contexts and conditions (Ingleby, 2013). Given this backdrop, how teachers and students perceive ICT as a tool to support and develop the process of teaching and learning in education is therefore interesting to further explore.

Teachers' Use of ICT in Education

Recent research on teachers' use of ICT in education (Sipilä, 2014; Vrasidas, 2015; Ward & Parr, 2010; Wastiau et al., 2013) shows a concern for the difficulties teachers face when trying to use ICT in their daily educational practices. One way to frame these difficulties concerns the many and varying ways in which ICT can be used (Ward & Parr, 2010). Ward and Parr point out the necessity for teachers to feel a need for ICT in education and their readiness to use ICT as factors in need of consideration. Sipilä (2014) reports that teachers with advanced digital skills use ICT frequently in education, but there are differences in relation to gender, different forms of ICT and use in different school subjects. Vrasidas (2015) reports that challenges related to the use of ICT in Cyprus include lack of time, ICT and support, school curriculum, and the need to provide flexible teacher professional development. Similar recommendations on professional development and ICT support is reported by Wastiau et al. (2013) based on the *Survey of Schools: ICT in Education* commissioned by the EU.

Student Use of ICT in Education

Lately, a large body of research concerning the way students use ICT in education and at home has been published (Beavis, Muspratt, & Thompson, 2015; Beckman, Bennett, & Lockyer, 2014; Crook, 2012; Gronn, Scott, Edwards, & Henderson, 2014; Hinostroza, Matamala, Labbé, Claro, & Cabello, 2015; Ben-David Kolikant, 2012; Plowman & McPake, 2013; Vekiri, 2010a, 2010b). Vekiri (2010a) studied how socioeconomic factors correlated with students' views of ICT for learning and their confidence in their ICT skills. Vekiri found that all students shared a positive view on ICT, but that students from low socioeconomic backgrounds tended to rate their skills lower, partly as a question of access. Hinostroza et al. (2015) found surprisingly similar student user profiles in ICT use outside of school among different groups of secondary students. Once students have access, they seem to use ICT in very similar manners. Vekiri (2010b) also studied the relation between student efficacy and value beliefs regarding ICT and teacher expectations and found that teachers' expectations matter regardless of gender. Considering students' use of digital games out of school and in school, Beavis et al. (2015) reported positive student responses towards using such games for learning, but the researchers also note that it is important to listen to students' experiences and meet students where they are. This is stressed further by Beckman et al. (2014) who argued for including student use in and outside of school in order to better understand students' technological practices within which the usage occurs. Ben-David Kolikant (2012) also found that students were enthusiastic for using ICT outside of school but much more ambivalent towards ICT being integrated into their school curriculum. Crook (2012) identified tension between in-school and out-of-school cultures when it came to Web 2.0 use in education, tensions reflecting different ambitions and expectations on the use. Gronn et al. (2014), on the other hand, found in their study that students use similar technologies at home and in school, suggesting that the digital divide or digital disconnect between home and school is a simplified explanation to a more complex dilemma. Plowman and McPake (2013) further

scrutinize seven myths about children and technology, providing arguments to question several assumptions about children's use of technology, including the idea of children being digital natives or hindered in social interaction by technology.

Purpose

The purpose of this paper is to investigate upper secondary school teachers' and students' views on ICT in education. What are their perceptions on the challenges and possibilities in using ICT in education? Are they in agreement, or do they hold contrasting views that might be restricting the use of ICT in education?

Methodology

This study is conducted within a four-year national research project concerning the use of ICT in Swedish upper secondary schools. The project is multi-dimensional, meaning that it includes managers at a municipality level, school leaders, teachers and students. The project runs between the years of 2015-2018, and it is carried out in three schools that are all known for their advanced use of ICT. It includes both theoretical and vocational programmes. Students in all three schools have their own laptops that they bring to each class. The data for this paper consists of interviews with 25 teachers and 46 students. The teachers were interviewed individually and the students as part of 11 focus-group interviews. The individual interviews with the teachers lasted between 40 minutes and 90 minutes; the group interviews between 30 minutes and 60 minutes. The number of respondents in each group interview varied from 3 to 6 students. All 36 interviews took place within any of the three school buildings and were recorded using a sound recording smartphone app called "Diktafon." The interviews were semistructured, and, for both teachers and students, they concerned issues such as challenges and opportunities related to the use of ICT in education. All interviews were transcribed before analysis. The analysis was made using content analysis (Krippendorff, 2004) and concerned teachers' and students' perceptions of using ICT in education. The results from the analysis are presented in a qualitative manner.

Results

In this section, the results from the study will be presented. The results are based on the major themes that emerged in the analysis. First, the teachers' perceptions will be presented, followed by the students' perceptions.

Teachers' Perceptions of ICT in Education

Preliminary analyses show that the teachers hold a rather uniform view on both ICT in education and on the students' abilities to use ICT for learning purposes. The students are regarded by the teachers as having the skills necessary to use ICT at schools based on how they perceived the students to use digital technology at home. The analyses also show that the teachers use ICT for a number of reasons, administrative as well as educational.

Teachers' views on the use of ICT in education. According to the empirical material, the teachers use ICT for different purposes. Both for teaching in different forms of software (e.g., Geogebra) and for administrative purposes, such as providing information through the learning management system (LMS) of the school and communicating with other teachers, students or parents through email. ICT is also used

for taking attendance and communication with parents concerning students' progress in school. As one teacher puts it:

[I] use our XX [software] a lot in the teaching. That's how I communicate with the students. Work is distributed, presentations, planning they have them in their rooms. Feedback and responses on what they have done are also in the XX [software].

Some teachers provide links to websites through the LMS, as well as links to lectures and lecture-notes uploaded on sites such as YouTube. This is in addition to other digital learning resources that the teachers find useful for the students, such as web-based dictionaries, wikis, blogs, and newspapers. Some teachers use Facebook for continuous teacher professional development and for seeking discussions concerning teaching and lesson-plans in their subjects. Some teachers use ICT for test and examination purposes.

At two of the upper secondary schools in this study the main part of one of the programmes uses digital teaching materials that cover almost all of the courses within the programme. Students work through lessons with materials and assessments online and are supported by the teacher at the school in their work. This is considered by several teachers to be convenient, or as one teacher says:

I think that XX [software] works fine, but you need to use it in a reasonable way. It mustn't be too much just sitting with it, then the students get tired. But I still think that the students find it ok. You need to balance the practical with XX [software]. And they are rather independent when working with it.

The use of ICT in general seems to depend on which subjects the teachers are teaching. For example, teachers in English use ICT to support communication and writing practices, whereas teachers in mathematics use ICT as a tool to visualise different mathematical relations. In the more practical programmes, for instance, students studying to become electricians, ICT is used to simulate practices that students might meet when they are working as electricians. Some teachers have started to experiment with clickers, and there are a few teachers who use smartboards in their teaching.

According to data, teachers in general seem to perceive ICT with a kind of ambivalence. For some purposes, ICT is easy to use, for others it is unnecessary and difficult. LMS are considered useful but not that intuitive and easy for teachers to design and use. The different rooms teachers are required to design and maintain for their teaching in the LMS require digital skills and time, which are both something that teachers report a lack of. This is apparent when teachers move their material from a traditional way of teaching to digital rooms. As one teacher says:

But rooms... I have such a heritage, that needs to be digitalised. And certain assignments I need to scan and such examples when I find a text. Then I have to scan and scan and then put it in the rooms, and I am not there yet.

Another example of ICT not being easy to use is smartboards. They have functionalities that teachers have trouble learning, and technology is often referred to as unpredictable. Using ICT requires a plan B for situations where the technology fails.

Teachers' views on possibilities with ICT in education. Considering possibilities with ICT data reveals that some teachers refer to the way simulations are possible in school settings, something that was previously not as easy to accomplish. ICT is also considered to provide flexibility in time and space, giving students online access to

lectures and lecture notes at all times. Documenting students' learning and assessment is also considered by some teachers to be easier and less time consuming with ICT. Having students do audio-visual recordings of their learning progress instead of always relying on written text is also mentioned by some teachers as a possibility. By one teacher, this was expressed as:

So I like to use this with filming a sequence and they work, out here we have done this with the workstations. They get to film and document it and comment on how it works. Can you film this and show me?

The possibility to use ICT for drills and rote learning is also mentioned by some teachers, giving accounts of rather simple use with effective learning potentials. Using online search engines to get access to new and relevant information, as well as helping with spelling, are two other possibilities mentioned by teachers.

Teachers' views on challenges with ICT in education. Challenges reported by teachers mainly seem to concern time, curriculum and subject. The time given the subject in the curriculum is by some teachers perceived as too restricted to be used with the support of ICT, it is time not well enough spent. Time is also an issue for some teachers when it comes to designing and preparing lessons with support of ICT. In short, it takes too much time to find relevant digital teaching and learning resources. Connecting interesting use of ICT to school subjects is too time consuming. One example here put forth by the teachers is to find relevant YouTube links for certain contents. As one teacher put it:

There are lots of possibilities. The problem is rather finding the time to sit down and find good software and good webpages to use.

Challenges are also formulated by teachers in relation to local policies that restrict certain uses that the students might need. Several teachers here mention challenges in relation to their own knowledge of how to use ICT in education. Their technological as well as pedagogical knowledge is lacking, and they sometimes have difficulties in identifying how ICT can be used in a well thought through pedagogical way in their subject. This is also mentioned by several teachers as a difficult area for continuous professional development, keeping pace with technological development and at the same time keeping pace with the demands of teaching and of the students. Challenges in relation to technological infrastructure are also present for the teachers in the three schools. Some teachers put forth that they would like the technology to be more transparent and consistent. As one teacher said:

No, it is... next...problem you would wish, for example if I should enter, if I am in the attendance view and is to enter these rooms for collaboration as they are called, so I should have to click there and loose contact with... wherever I am. I should just have to place the mouse there and get a view and click.

Others claim that the current limits in broadband and Wi-Fi are real challenges for teachers who plan to use ICT in their teaching. This is especially the situation when teachers have an ambition to provide teaching situations that are simulations of a real life setting that students might meet in working life. Infrastructure for learning is a real challenge for these situations. Yet another challenge teachers see when students use ICT is trouble keeping them on task. Access to the Web provides possible distractions for students, and the teachers have to consider this when planning to use ICT for learning,

as well as challenges related to the trustworthiness of different sources on the Web. A final major challenge according to data is the efficient use of the local LMS.

Students' Perceptions of ICT in Education

Students view their teachers' use of ICT in education in a similar way as teachers view the students'. Some teachers use ICT in more advanced ways than others. A main difference with students' use of ICT in and out of school is their use of smartphones.

Students' views on the use of ICT in and out of school. According to data, the students in all three schools seem to use ICT in education on an everyday basis. The students also report that in some of their school subjects it is difficult to use ICT for learning purposes. Some even say that ICT is not at all needed in their learning activities. For example, when talking about using ICT in mathematics one student put it:

The feeling is that it is unnecessary to spend time on it [ICT] now when we work with rather challenging mathematics, [as it is] something that will be time-consuming and demand a lot of work in order to learn.

It shall also be mentioned that the case can also be completely different, that in some subjects the students consider it impossible to follow the lesson without using their laptop. Student are in general positive about the use of ICT in education, and they are in general aware of the potential distractions provided through the Web and through different apps on their smartphones. When talking about the potential of using smartphones as a learning tool, one student said:

No, I really don't think that is a good idea. As you [the interviewer] noticed when visiting our class, there are many of us [students] who have a hard time concentrating.... some are looking at streams or are playing some kind of game [on the smartphone]. They don't concentrate, they do their own things resulting in them not understanding.

Students also report differences in use depending on the teachers' preferred style of teaching. Students report that teachers provide lectures and lecture notes through the local LMS, but that they also use YouTube to search for resources on their own. Only a few students report using ordinary computer-based games for learning. Students report using the local LMS on a regular basis, but find it in general unnecessarily difficult and time consuming. In school, students are mainly restricted from using smartphones unless the teacher specifically allows them. Students' out of school use of ICT is, according to data, to a large extent divided into games and use of smartphones. Online computer gaming dominates in some of the student groups. Smartphone use for social media and watching movies and video clips are common for all students. When students use ICT at home for school purposes, it seems to be a mix of laptop use and smartphone use depending on the software being used or if there are any apps available that can support their work. Students also talk about using ICT for student collaboration when doing school assignments at home. One student, though, went beyond seeking support among her classmates and consulted her father, who was located in a different geographical location. She says that they:

...mostly use the phone or Facetime. Sometimes we also use SMS. I send him a mathematical problem that he first solves by himself and thereafter sends it [the solution] to me. When that is done, he phones me so we then can discuss how he solved it [the mathematical problem] and what the right answer is.

Students' views on possibilities with ICT in education. Some of the possibilities students see with ICT in education are related to future use and purposes, using ICT for simulations and programming. Students also talk about ICT as a means to visualise complex relations and to provide structure in their everyday schoolwork. When talking about Google Docs, one student says:

It is a really good place for collecting your work. I can create folders and I am sure that everything is stored in them. When using the computer [e.g., the hard drive], it can end up anywhere. I use that [Google Docs] and then I write all my assignments on the computer.

The use of a local LMS is considered to be positive for administrative issues, collaborating on shared documents and communicating with teachers and other students. In all three schools, the LMS especially functions as a container for handing in assignments. One of the students put forth that:

We hand in all our school assignments through Fronter [one of the LMS used]. Well, I even think that the written assignments provided [by the teachers] in a different way are possible to count on one hand.

The laptop is considered to be a good tool for writing and communicating, searching, using different forms of software for educational purposes, and collaborating.

Students' views on challenges with ICT in education. Challenges that the students see for ICT in education can be related to teacher digital competencies. Teachers teach different age ranges and have different motivations and enthusiasms for integrating ICT in education, and students can see that the use varies. One of the students reflects upon this issue in terms of:

Many teachers really don't know how it [the LMS used at the school] works or why it works. My feeling is they [the teachers] are already in teacher training and need to learn how and why it works so they can use the LMS properly.

Another student exemplifies his opinion about the teachers' digital skills when saying that:

My teacher in XX [subject] is always anguished when using ICT. Every lesson, when starting up the smartboard, he complains about it not running perfectly. For example, if he needs to re-start the smartboard, or if it has been on during the whole night and went to sleeping mode. People [e.g., the teachers] really don't know. Instead of learning how things work and solving the problem, they just see the difficulties and say that it is supposed to work. That might be one of the most stupid arguments: "I just want the technology to work." Technology is not some kind of magic that just works, it is often a kind of programme, a machine, which does something because it is told to do so. If you know how it works, you know what the problem is and are capable of solving it.

They perceive some teachers as being more digitally competent than others. Students also see that there are challenges related to software and to the development of an efficient LMS for schools. In schools, use of smartphones is not explicitly asked for by the students, other than for accessing the LMS in a more convenient way for administrative issues. As mentioned above, smartphones are recognized by some of the students at all three schools as distractions rather than useful digital learning tools.

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Discussion

The possibilities and challenges of using ICT in education reported on in this study mirrors, to a large extent, earlier research on teachers' use (Sipilä, 2014; Vrasidas, 2015; Ward & Parr, 2010; Wastiau et al., 2013). Teachers' use is rather diverse, but, at the same time, restricted by factors and barriers identified by other studies. Students' use in and out of school is also similar to what was reported before (Beavis et al., 2015; Beckman et al., 2014; Crook, 2012; Gronn et al., 2014; Hinostroza et al., 2015; Ben-David Kolikant, 2012; Plowman & McPake, 2013; Vekiri, 2010a, 2010b). According to the results, teachers and students seem to perceive some similar challenges for using ICT in education. One of these challenges concerns time and subject. The time given to subjects in the curriculum is perceived by the teachers, on one hand, as too restricted in order to be taught with an appropriate and well thought through use of ICT. Put differently, it is time not well enough spent. Some students, on the other hand, often put forth that they would rather spend time learning the subject instead of spending that time on learning some kind of ICT that could support them in their learning process. But at the same time, other students provide examples of how, for instance, lectures uploaded on YouTube can serve as a supporting learning resource. Another challenge present at all three schools seems to be related to the use of the LMS. Both teachers and students talk about advantages in terms of educational issues related to providing or handing in assignments, the dissemination of information or leaving a message to a teacher through the LMS system. Thus, the students are not seldom critical when talking about the functionality of the LMS systems. In particular, this critique concerns the LMS systems in several aspects: being outdated, not user friendly enough and apps for mobile use of the LMS being missing. A third challenge that is shared between teachers and students relates to teachers' digital skills and the area of continuous professional development. The teachers talk in the interviews about the difficulty they perceive of keeping pace with the technological development and at the same time keeping pace with the demands of teaching and of the students. The students reveal thoughts about several teachers at their schools who need to develop their digital skills and that time from the lessons on and off is used in order for the teachers to make the classroom technology work as expected.

What also is noticeable is the discrepancy in the in and out of school use of smartphones by the students. Teachers use the ICT infrastructure that is provided for them to the best of their abilities, at least according to what data reveals, but the infrastructure is based on an ICT hardware that is a generation older than the one the students use. Students access their education using their smartphones in combination with their laptops, and teachers plan for the students to use their laptops under teacher surveillance. Students sometimes surprise teachers by Googling relevant information on their smartphones, and providing resources for themselves in their learning of which the teachers were unaware.

Conclusions

The main conclusion to be drawn from this study is that to some extent the teachers and students were in agreement with the way ICT was used and could be used in education. There is one large difference that stands out, and that is the potential for smartphones to hold educational purposes that can be predicted by the students' out of school use of ICT. If teachers were to plan lessons and make educational choices together with students, who seem quite aware of the potential pitfalls of using ICT in education, such

as distracting social media and computer games, it might be possible to plan for a more elaborate use of ICT in education that might include the use of smartphones as well as other parts of the students' everyday use of ICT.

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CAN VLE BRIDGE DIVIDES BETWEEN INSTITUTIONS, ACADEMICS AND STUDENTS ON THE NATURE AND FUNCTION OF WRITTEN ASSESSMENT OF LEARNING?

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Abstract

Building on previous research investigating the purposes of assessment from a student perspective (D'Esposito & McPhee, 2015), this research explores teachers' insights in the nature and purpose of written assessment using electronic means, in particular the use of virtual learning environments (VLEs). Using a mixed methods research design, a questionnaire was created based on previous research tools and emailed to teachers familiar with information communication technologies (ICT) in education. In-depth semi-structured interviews were conducted with seven randomly selected participants. Results indicate academic writing remains a key factor in assessment of academic success, how this is achieved remains a challenge.

Introduction

The ability of both students and teachers to engage in new and novel ways of assessing learning on and off campus in conventional, online and hybrid contexts is increased by technological advances (Larreamendy-Joerns, & Leinhardt, 2006). However, despite these advances, academic writing remains a key factor in assessment of academic achievement and one of the challenges in teaching in conventional, online and hybrid contexts in higher education institutions, being considered a central aspect of assessment of academic success (D'Esposito & McPhee, 2015).

Theoretical Constructs

VLEs, Assessment, E-assessment, and Feedback

Larreamendy-Joerns and Leinhardt (2006, p. 572) describe two complementary movements occurring in higher education: the merging of online teaching and learning into everyday practices at universities, and the increasingly salient role of off campus study in higher education institutions (HEIs). Concomitantly, an increase in off campus learning using VLEs has led to diverse techniques of assessment.

Assessment is at the core of formal higher education Angus and Watson, (2009) and Bransford, Brown, and Cocking (2000) suggest that it is a crucial element for effective learning. Assessments serve several functions such as to assess and monitor learning and teaching, and to target resources to students who require additional support.

Pachler, Daly, Mor and Mellar (2010, p. 716) coined the term *formative e-assessment* as "the use of ICT to support the iterative process of gathering and analysing information

about student learning by teachers as well as learners and of evaluating it in relation to prior achievement and attainment." Their definition incorporates how assessment is applied in e-learning settings in on campus blended and online learning environments.

Technology plays a positive role in student learning (Bakerson & Rodriquez- Campos, 2006), and, if done correctly, VLEs can "provide student and lecturer with richer, more immediate feedback" (Bajzek, Brooks, Jerome, Lovett, Rinderle, Rule, & Thille, 2008, p. 1), which, in turn, will increase learning. Assessment in this type of environment benefits students and instructors (Dewald, Scholz-Crane, Booth, & Levine, 2000).

Several developments have been created particularly the use of VLEs and specialist software that allows both teachers and students to send and receive feedback on assessments. One of these commercially available assessment tools is Turnitin¹, which has become popular as a method of providing formative and summative feedback.

Academic Capitalism

As learning via the World Wide Web has increased opportunities for students to study on and off campus and a blended mix of both, assessment of learning remains a key issue in retention, progression and employability of students. A central challenge in HEIs are the business models that require increased numbers of students, particularly international students, to remain viable, retaining and progressing an increasingly diverse student population. These processes termed academic capitalism (Rhodes & Slaughter, 2004) have created several consequences that contribute to the conflict between institutions, students and academics on the nature and function of assessment of learning.

Methods

A questionnaire focusing on six major themes was designed by the researchers using Google docs based on previous research tools, validated and a link emailed to teachers familiar with the use of ICTs in education from various parts of the world. It was answered by 75 respondents. In addition, 7 participants were recruited using purposive sampling and interviewed using a semi structured interview schedule revealed several key themes.

Results

The questionnaire and the interviews allowed the researchers to reflexively explore teacher's ability to engage in new and novel ways of assessing learning on and off campus in conventional, online and hybrid contexts using electronic means (in particular the use of VLEs), and academic writing in terms of assessment of academic achievement, which is a teaching challenge.

The Questionnaire: Respondents' Data

While 26 (36%) respondents were based in Northern Europe; 13 (18%) were in Southern Europe, 12 (16%) in North America, 8 (11%) in Australia, 6 (8%) in South America; 6 (8%) in Asia, and 2 (3%) in Africa. Most of them (55 - 74%) teach primarily at University, followed by 18 (24%) in Higher Education, 4 (5%) at Lower or Primary School, 1 in Higher or Secondary School (1%), 1 in Further Education College (1%) and 2 in other types of institutions (3%).

Subjects Taught

A total of 26 respondents (36%) taught Social Sciences & Humanities; 21 (29%) were in teacher training; 18 (25%) in Science, Engineering & related professions; 2 (3%) taught Medicine, Nursing & related professions, and 5 (7%) taught unspecified programmes.

Teaching Experience

In terms of teaching, 37% of the respondents have considerable experience (more than 26 years), while (34%) have teaching experience varying from 6 to 15 years. Just 7 (10%) have less than 5 years of experience. Also, 39% of them have been using a VLE for teaching for more than 10 years: 25% from 5 to 10 years, 30% from 1 to 5 years, and 5 (7%) for less than 1 year. Further, 45% of the respondents teach on campus, 42% use a blended mode of teaching, and 9 (12%) teach online off campus.

Use of VLE

As for use of VLE 40 (55%) respondents use one to grade written essays and give feedback, and 49 (68%) find it a useful tool in presenting formative and summative feedback. Out of 63 respondents who use a VLE with this purpose, 12 (19%) find it extremely useful (19%) and 8 (13%) not at all useful.

Use of Specialist Software

While 22 respondents out of 71 (31%) use Turnitin to give formative feedback on written assessment, 20 (27%) use it primarily to give summative feedback. Out of 54 respondents, 6 (11%) found this software extremely useful when giving feedback while 12 (22%) did not; 10 (14%) use other software to grade essays. Interestingly, 53 (73%) of them do not use any software to give feedback on written assessments.

Table 1

Purpose of Assessment No. Respondents (Percentage)					
Not at all usefulSomewhat UsefulNeutralVery UsefulExtremely Useful					
Demonstrating subject specialist knowledge	24 (35%)	29 (42%)	15 (22%)	1 (1%)	
Aiding employability	13 (19%)	34 (49%)	19 (27%)	3 (4%)	1 (1%)
Demonstrating academic writing skills	40 (56%)	19 (27%)	11 (16%)		1 (1%)

Written Assessment

Table 1 indicates that most respondents (68%) consider written assessment to be useful to aid employability; while 76% believe it unhelpful to demonstrate subject specialist knowledge. Interestingly, 56% of the respondents consider writing assessment 'not at all useful' to demonstrate academic writing skills. This is an interesting finding given that academic writing is an important method of assessing students in HEIs.

A total of 27 (38%) respondents report using electronic means to provide consistency when grading; 23 respondents (32%) find using technology makes assessment grading an easy task, while 29 of them (40%) considered it very easy.

When asked about sources of support to help students complete written assessment, 48 (66%) respondents indicated that the most commonly used source were teachers; 32 (44%) answered the library; 25 (34%) indicated a personal tutor; 16 (22%) general

institutional support; while only 10 (14%) respondents reported that their institution offered specialist academic writing support. As teachers were the most common source of support, this infers an impact on teacher workload.

Respondents were asked about their views on the essential qualities an effective teacher should possess to support students through assessments. Seventy-three (74%) respondents believe that the teacher should have good communication skills, 48 (66%), have subject specialist knowledge; while 23 (32%) considered having a teaching qualification was an essential part of being able to provide support.

When asked about the qualities students should possess to do well in assessment, 62 (84%) respondents answered that students should demonstrate commitment, 46 (62%) answered organisational skills, 36 (49%) answered that attendance was important, and 22 (30%) stated that students should demonstrate academic writing skills.

The Semi-structured Interviews: Participants' Data

Table 2

Participants' Profile

Name & Residence	Type of	Programme	Teaching e	xperience
	Institution		Overall	VLE
Ms L - North America	University	Linguistics	40 years	Over 20
				years
Ms G - North America	Polytechnic	Communication	27 years	13 years
Ms R - South America	University	Languages	45 years	21 years
Ms C - South America	HE& University	Languages	31 years	12 years
Mr G- Southern Europe	University	Communication	38 years	10 years
Mr H- Northern Europe	University	Careers Guidance	20 years	10 years
Ms J - Northern Europe	University	Careers Guidance	22 years	12 years

Table 2 indicates that participants had teaching experience varying from 20 to 45 years, and teaching experience using a VLE varied from 10 to more than 20 years.

The analysis of the semi structured interview schedule revealed several key themes:

The Assessment

Participants were asked to express what the term assessment meant:

... assessment is finding out for me first what the industry thinks a good document for producing for the work place and then creating a criteria sheet for what industry expects and then having the students look at that criteria sheet and then me assessing if they are meeting those criteria or not. (Ms G)

Help. Evaluate. Help. Organize. Those are words that come to my mind. To organize the learning process and the teaching courses. (Ms C)

Assessment was a method of assessing learning and to aid in course content evaluation.

 \dots I think it is measuring whether the objectives of a specific task have been reached. It can also work as a diagnosis for the design of new and more adequate activities. (Ms C)

Assessment is an ongoing process (...) Assessment is important to help teachers and students to understand what is working and what is not in a course. (Ms C)

... It measures what they have learnt and what they are able to do ... Understand is in the head. You don't know what a student understands. It's not a learning objective and it is not an assessment you know. The assessment has to measure something, it has to measure performance ... (Ms L)

Evaluation and assessment should be continuous suggests Ms C:

I think that assessment, feedback should be given very frequently. We cannot wait for the end of the course to give the feedback to the students ... (Ms C)

Consistency in Grading and Feedback

Consistency in grading is achieved using several means, rubrics, and advanced features in specialist software:

... And we try to come up with as homogenous and universal method of assessment as possible. (...) Students are aware of what is needed in each. The higher we get, for example, at Master's level or PhD level we have a handbook that actually explains in much more detail what is demanded of the students and the way they would be graded. (Mr G)

Others gave students' work to other colleagues to check:

... I will take some of mine and give them to another teacher and show her and yes, that is a pass. (Ms G)

Ms R uses both criterion referenced grading, and norm referenced grading, where all students work is read, graded, and then checked against the best examples of each grade. Ms R explains her process:

... What I do in general is to look at all of them and then I start grading... (Ms R)

Using Software in Assessing Students

Some participants used specialist software to give both summative and formative feedback, however some institutions had chosen not to purchase a licence for branded software such as 'Turnitin'. Ms L explains:

(Our university) does not have a license because Turnitin owns anything which is submitted and it was perceived as a privacy violation ... (Ms L)

Some teachers used a search engine, which performed the plagiarism detection function too:

I do not use a program. I just ... I would have a hunch on the sentence so I usually grab a sentence and throw it into Google and usually it comes up. But what I have been doing is doing a really heavy front loading on what is plagiarism and our department has created videos (...) So ... there are fewer cases

of plagiarism happening because of all the teaching we are doing on what it is. (Ms G)

Ms G does not expect to see plagiarism to occur because how to avoid it is part of the curriculum. If plagiarism was detected, this was punished severely. Ms L and Ms R explain:

 \dots there is no second warning (\dots) if you borrow someone's ideas you have to cite that person you know or write something in your own words. So, a second offence, then, I report them to the office of students conduct. (Ms L)

... But sometimes I use parts of it and jut put into Google to check, you know? (...) Well, if there is any kind of plagiarism ... the grade is zero. (Ms R)

While considering Turnitin useful for students, to check their work prior to submission, and avoid using it punitively:

Turnitin is useful. Very. I find that I usually recognise plagiarism before Turnitin does but I use Turnitin to confirm if that is the case but with things like dissertation projects which is of course so important. It's very very useful even for the students who once they try themselves realise that there might be too many things that they have sort of quoted too literally if you know what I mean. So, it's useful. It is a useful tool. (Mr G)

I think my goal is always learning and that means assessment is not punitive, assessment is a way to guide students to learning more. So, with written assessments I always provide the opportunity for revision because I believe that revision will lead to a better product. I have no problem with everybody in the class getting an A ... (Ms L)

Support

While technology allowed standardisation of the assessment process, face-to-face interaction remained a very useful way of checking understanding and learning. Ms L used clicker technology:

In the classroom clickers are a great way to know that you know. And I love using clickers because then you can see, uh, 20% got it wrong, that 20% knows that everybody else got it right. 50% got it wrong? We have a problem we need to go over something again you know? (Ms L)

As institutions require attracting international students to survive in a competitive environment and to mitigate against cuts in funding, this has some unintended consequences. Ms G explains the situation:

... having 20% international students on our campuses is creating problems because our government is requiring us to accept international students but they are finding their way in without a total test or a standing of any kind. Somehow they get allowed to come in and then we find out that their language skill is not what that test should have indicated so they are failing ... (Ms G)

Having to teach into a class where the language skills are lacking can cause some problems, particularly for the native speakers. Ms G explains:

... So grammar for us having 20% international students on our campuses is creating problems because our government is requiring us to accept international students but they are finding their way in without a total test or a standing of any kind (...) it is demoralising and awful for the native speakers because they are in classes with these students and they feel so bad and they are charged so much and then they can't even function because nobody did a proper language assessment of them. (Ms G)

The international students were unwilling to seek help as this was not standard practice in the country of origin:

... And cultural awareness; they come from countries in which it is not polite to interact with the teacher and so they don't. So we have to train them ... (Ms G)

Participants explained the types of institution support that were made available to all students:

We have a library peer tutoring centre and a writing centre and we have so peer tutors and we have at the library they are offering this new online tutoring system where you can submit your document and get feedback so that they can get help from each other, from me, from the library, from the writing centre, the peer tutors and from their classmates. (Ms G)

Lots. There are courses that are given regularly by the computer department, by the library department, so it is up to the student. Students are aware of these courses. It is up to the student to think about. And I think, out of my head, not many students do ... (Mr G)

However, in some countries, particularly South America, Ms R explains that no help at all is available.

Peer assessment is used by Ms R to break down the barriers between institution, academic and student. She explains:

... I think the way of doing that is to make students correct their friends work because they have to point out what is there that is not so right according to them and then go back, correct, and give back so that he could compare, This is something I used this year, last year. And somehow it works. (Ms R)

Beyond the VLE and Specialist Assessment Software

While the institutional VLE was used by several participants, there were other ways to provide feedback to students including using the advanced features of Word and using rubrics mapped to learning outcomes and criterion, which then uploaded to Dropbox. Ms L and Ms G explain:

 \dots will use track changes to respond to (the written assessment) and then I will return it via the Dropbox \dots (Ms L)

I give summative and formative feedback using the comment and track changes features in Word. (...) I upload the documents anonymously into Google docs then create a tertiary link so that somebody has that link and then the anonymous peer reviewer and anonymous writer don't know whose is what and then they are still offering higher order concern comments. (Ms G)

So, generally I use email. I send them by email. (...) I just go into word, do the corrections, sometimes make comments and use the word processor just to make comments and correct things. Sometimes I use different colours, red or yellow just to say that something is not so good and some comments aside. (Ms R)

Students were encouraged to take the opportunity to read the formative feedback and resubmit their assessment. Ms L explains:

... rubrics make clear to the students exactly what it is I am looking for... I realised that unless you have the students rewrite those marks up (...) as a result of that feedback. So, I always give my students the option to revise and resubmit. (Ms L)

Students in addition created their own spaces to interact, forcing teachers to meet with them online outside the institutional VLE:

I don't use Facebook. They use Facebook a lot. They use, they do electronic exercises, assignments; everything is on the tablet or on the cell phone or WhatsApp ... (Ms R)

... we do have a Facebook page for all communication students that is a closed group and wherever I find that there is a question there that is constantly being asked I actually put the answer on the Facebook group and that means that all the students in all the course actually in communications at this point of time have the answer ready. For me there is a sort of extension to the VLE and all the other tools I have used. (Mr G)

Participants did mention that the assessment had to in some way aid employability by consulting the industry allied to their subject specialism:

Huge. There is an annual survey of employers (...) every year they are asked what are the criteria that you believe are most important when you are looking to hire, what skills are the most important to you and communication skills is always at the top of the list and the ability to work as a member of a team is also always at the top of the list and that is why wherever I am teaching I incorporate both of those things. Some type of the group (...) They have to make a time to meet, they have to negotiate differences, they have to listen to each other, they have to incorporate different people's opinions, synthesize; all of this involves really higher order thinking skills. (Ms L)

Well, depends on what you do. (...) if you are working, in any kind of job, let's say, in a company, you are at least supposed to write with some kind of norm. (...) So sometimes the person is really very very good but not good at writing. Writing is not a guarantee that you are a good employer, employee. Or a good teacher. (Ms R)

Experience is often superior to technology. Mr G explains his 'intuitive' process of grading assessments:

I have to admit that after twenty years of grading academic papers I can now know exactly what grade I can give anybody at any point in time. It is intuitive. It is something that is based on a lot of experience that I had with grading papers, with grading exams etc, etc... (Ms G)

I don't use Facebook. They use Facebook a lot. They use, they do electronic exercises, assignments; everything is on the tablet or on the cell phone or WhatsApp ... (Ms R)

... we do have a Facebook page for all communication students that is a closed group and wherever I find that there is a question there that is constantly being asked I actually put the answer on the Facebook group and that means that all the students in all the course actually in communications at this point of time have the answer ready. For me there is a sort of extension to the VLE and all the other tools I have used. (Mr G)

However, using Facebook to communicate did not necessarily help with academic writing skills. Ms L explains:

Well, that's a huge piece of it too because some of them now when their writing is on Facebook or text messaging do not have enough experience writing in the manner that it is expected \dots (Ms L)

Not all participants used institutional available technology in assessment, the following quotes illustrate this:

...it is forbidden to evaluate students in Brazil using online things. If it's let's say an institutional evaluation they have to be face to face. So, most of the courses that I have taught we were supposed to evaluate face to face. Even if everything happens online. (Ms R)

... honestly I find the VLE to be quite rigid. It is very, very difficult to be flexible within the VLE and there is why there are times when I just say to hell with it I (...) I actually create my own website and communicate with students like that. I am still one of those people, unfortunately really old fashioned who uses email a lot. (Mr G)

Barriers

Participants reported that the pressure of teaching large numbers of students impacts on their ability to provide formative feedback:

Well, when some of us have 150 students what we have been trying to do is shorten the assessment times. (...) Simplifying the streamline and do the assessment before they come for the assessment time with each other. Make sure they really understand what the requirements are. That's what I think is important. (Ms G)

... If you got a class of 200 what opportunity do you have for formal written assessment? Right? (Ms L)

While even the best feedback is often not read by students causing some frustration, Ms C explains:

... they are open to receive what you are saying but most of the time they simply don't ... if you leave them alone they don't look at it. (Ms C)

The pressure of teaching large classes made giving feedback difficult, often impeded by student inability to make deadlines or submit assessments late:

 \dots They send the assessment at the last minute. There is the space. If there is time I can read the papers, send the feedback and ask them to do again but sometimes they don't use it. Just a few make use of this. (Ms C)

Qualities of the Effective Teacher

Participants were asked to explain what in their opinion makes a good teacher. The following quotes are illuminating:

Empathy. Empathy and being qualified. Being capable. (...) To have a heart and know your stuff. (Ms G)

... Passion, and commitment to being a lifelong learner. I am teaching right now a workshop for quality matters and students have to introduce themselves to the class. And one person said something like "... I was so happy when I finished my last course because to me it meant ... ok I was done learning and now I could start doing". And I thought: oh, dear! When are you ever done learning? (Ms L)

(Sighs) if I have to say, I really don't know nowadays ... I think I am a good teacher. (...) I think I prepare my classes, I pay attention to the students but sometimes I have...relationship problems because I am very very strict. (Laughter). I am very demanding and nowadays people don't like this kind of thing, you know ... (Ms R)

... Worst teachers I have found are teachers who have a ready lesson plan that needs to be followed irrespective of who the individuals in the class are. (Mr G)

Participants were asked to explain what in their opinion makes a good student in relation to assessment. The following quotes are illuminating:

Willingness to learn and thick skinned \dots I find in writing students get very personally if you give them feedback on their writing. It's part of them. It's like you've written on their skin and it hurts them (\dots) this isn't personal attack. (Ms G)

Uh! Students who don't say: will this be on the exam? (Ms L)

 \dots is looking for answers and \dots the aware of their learning process and \dots trying to improve, making use of the resources that are available, look for feedback. (Ms C)

... they are proactive... They go further because they go and look into more things than the ones that you asked them to do which I think it's fantastic. But this is one in a million. So, if I have a class just like last semester I think that I just got two students that were this type among 15. I think it's good. Some of them were just there but they are not there. (Ms R)

Well, a good student listens. A good student researches (...) and actually produces something that is entirely his or hers. (Mr G)

Discussion and Conclusions

The participants interviewed had varying degrees of experience using VLE and specialist software to standardise the assessment process. Overwhelmingly, the more experienced teachers rejected institutional imposed VLEs, such as Moodle and Web CT, and communicated with their students via email, telephone, and using corporate walled gardens such as Facebook, where students had already created their own supports beyond that offered by the institution.

There is little use of commercially available software to grade and provide feedback. Both formative and summative feedback was often given using the advanced features of Word and sent to Dropbox. As a participant explained, his 'intuitive' process of grading assessments is superior to technology.

North American, Northern and Southern European based teachers report some consistency in the use of rubrics and clear criteria (for both teachers and students) with attempts at standardized procedures and the use of peer assessment as formative in learning. South American participants reported little use of rubrics with few standardized procedures, with learning criteria not always made explicit to students. However, peer assessment is encouraged as formative in learning and was reported as useful in breaking down perceived barriers between institution, academic and student in relation to how and in what way they are assessed.

There were several barriers to the use of technology in assessment with South American participants due to institutional requirements for compulsory face-to-face tests. The Brazilian government, for example, does not allow assessment that relies exclusively on online assessments. In South America respondents and participants described limited institutional support to help students' complete assessments; there, the teacher remains a key component in providing student support, which in turn increases teacher workload.

Can a VLE bridge the divide between institutions, academics and students in understanding the nature and function of written assessment? A large number of participants indicate that students often show little interest in formative and summative feedback, particularly when it is made available online in institutionally provided VLE. This fostered creativity in how feedback is delivered by academics to their students. While academic writing remains a key factor in assessment and considered a central aspect of assessment of academic success, how this is achieved remains a challenge in teaching (D'Esposito & McPhee, 2015).

Limitations and Future Research

While this study is small in scope, and findings cannot be considered valid beyond the small group of respondents and participants, the data reveals that teachers engage in novel ways of assessing learning aided by technological advances (Larreamendy-Joerns & Leinhardt, 2006) using tools available to them beyond that provided by their institution.

The data reveals ambiguities in the nature and purpose of written assessment. Assessment feedback, formative and summative, remains a demanding task for teachers and despite their efforts and creativity; gaps remain in how and in what way the written assessment is considered useful in aiding employability, and demonstrating subject specialist knowledge. Further research is required to investigate the barriers both real and imagined on the nature and purpose of written assessments in HEIs from the perspectives of the institution, the students and the teacher.

Note

1. Turnitin is an Internet-based plagiarism-prevention service that requires a license to use its functions. Students submit essays to Turnitin, which checks the documents for unoriginal content. The results can be used to identify similarities to existing sources or can be used in formative assessment to help students learn how to avoid plagiarism and improve their writing.

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INTELLECTUAL PROPERTY DEVELOPMENT RECIPROCATION ON DISTANCE LEARNING EDUCATION: A REVIEW OF THE LAW & POLICIES, CHALLENGES AND RECOMMENDATIONS

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Abstract

Distance learning education via computer enabled technologies had created nontraditional off-site learners where better student engagement shifted towards organized content leadership to facilitate courseware delivery. The new teaching model caused concerns with regards to course material ownership and intellectual property rights (IPR), which prompted new legislations and policies to be put in place. University policies, while acknowledging ownership should be maintained by faculty, have a higher number of exemptions tailored for collection of a certain percentage of royalties. This reinforced faculty concerns of infringement of academic freedom of expression. Studies demonstrated raising awareness of IPR among faculty and students should be exercised.

Introduction

Distance learning education might seem to be associated with advancement of knowledge through technology; however, its roots can be traced back to ancient Greeks who issued correspondence letters to their future students (Lockmiller, 1971). With technology development in the state of rapid flux and the advent of the Internet, which has transformed education and learning models to reach the masses, it is challenging for intellectual property laws and policies to keep up to pace with technology proliferation. Therefore, the historical intellectual property rights development, which is still evolving, will be discussed, encompassing North America and European Union (EU) regions, and the reciprocating impact of Intellectual Property (IP) legislation on open and distance learning will be presented, addressing the core challenging issues and policies.

The main challenges associated with distance or open learning is that once the course material is transmitted through the Web, the receiving party may modify the material and distribute it to a third party. Therefore, the original contributor has no control on his or her copyrighted material or intellectual property. In the United States intellectual property rights are derived from the constitution, which states that IP is the conception of ideas that once put in order is protected by copyrights (Daniel & Pauken, 2005). An idea that is put in a fixed tangible form such as in writing or in a phono record is deemed protected by the copyright laws. Initially, copyright protected the inventor or the original owner for a period 14 years with an option for renewal of one time, but the law was updated in 1976 and now provides a lifetime protection plus 50 years' extension after the death of the owner. If a university or college owns the copyrights, the protection period is for 75 years (Burk, 1997).

The Copyright Act of 1976 in the United States had incorporated the Fair Use Doctrine, which allowed the use of copyrighted materials without the permission of the author, subject to certain restrictive usage. The Teaching, Education and Copyright Harmonization (TEACH) Act legislation extended Fair Use Doctrine usage to distance learning (Dames, 2005). Both laws aimed to address fair dissemination of knowledge but caused concerns to faculty about putting their original material on the Web, as a third party can take it, modify the content, and retransmit it electronically, just by the click of a mouse (Gasaway, 2002). Material ownership is another issue that is being debated: If the work is done for hire, do administrators maintain ownership or does it lie within the faculty domain? The interpretation of this is subject to each individual university's IP policies, though studies have showed differences in policies between private and public universities. These might be attributed to copyright law that was revised in 1976 in the United States, as earlier court decisions are anchored on the 1909 copyright law, which favored ownership for faculty. Though, as has been suggested (Burk, 1997), a ruling in favor of administrators or faculty is subjective to the judge handling the case, university ownership of the material might infringe on the principle of academic freedom, which implies that faculty can engage in academic work without undue influence (Hart, 2008; Burk, 1997) from outsiders and administrators. Furthermore, university ownership will impose limitations on academic output and enable administrators to control course content, which will restrict faculty independent thoughts and expressions.

Another legislative effort aiming to bring up to date copyrighted digital media is the Digital Millennium Copyright Act (DMCA) signed by William Clinton in 1998. The aim of the act is to integrate the legislation from the World Intellectual Property Organization (WIPO) with regards to copyright infringements of digital media (Daniel & Pauken, 2005) into Unites States copyright law in order to prevent conflicts between the two laws. The DMCA limits the liability of non-profit higher education institutions on copyright infringement for basic digital media services.

Intellectual Property Rights and Policies

Teachers and educators should not be concerned during traditional delivery sessions about copyright issues since teaching is not something tangible to be commercialized. However, if the course material is owned by the university, then this will impose limitations on academic output and publication of textbooks, as the course content and ownership does not belong to faculty. The other ramification -- faculty cannot take the material and engage in delivery in another physical venue (Townsend, 2003). In the case of distance learning, things are more complicated since the likelihood of the university being embroiled with copyright infringements issues is higher. The challenges stem from the fact of ownership of the course content. For example, let's assume a scenario where course content was on a university server, and a third party managed to download it, modify it, and retransmit it. Therefore, the material is beyond the control of faculty; so in case of copyright infringement. who is responsible the faculty member or the university? The responsibility in case of copyright infringements is in the domain of a faculty member since the material is owned by the educator (Castagrena, Fine, & Belfiore, 2002). However, others assert that liability is within the domain of the institution (Packard, 2002). This stems from the lack of clarity of the revised copyright law.

University ownership of course material will impose a limitation on course content and publication. This is analogous to a corporate environment where the corporation rather than the employee owns intellectual properties that were developed during the course of employment. In higher education the basis of the copyright issues is derived from faculty academic freedom (NLTN, 1999), which implies that faculty can engage with academic work without undue influence from outsiders and administrators (Hart, 2008). The notion that administrators can own course materials degrades this principle, as shaping of the material is controlled by the administrators rather than the faculty. Therefore, the validity of academic freedom is in danger; though experience in the UK did not indicate significant influence of administrators on shaping curriculum development (Hawkridge, Armellini, Nikoi, Rowlett, & Witthaus, 2010). It is clear that technology proliferation made the copyright and intellectual property law and policies difficult to keep up with. Due to the fact that technology is in a state of rapid flux, research on intellectual property rights associated with online pedagogy is limited and continues to evolve to keep up with advancements in online technology.

A comparison between US private and public universities policies has yielded somewhat surprising results. It appears that public universities have put in place IPR policies that are likely to better protect copyright work of faculty than private universities (Loggie, Barron, Gulitz, Hohlfeld, Kromrey, & Venable, 2006). Though, most of US universities have published their policies on their websites, the situation related to IPR policies is relatively more challenging in other parts of the world. A study in Saudi universities (Al-Jarf, 2013) recommended the Ministry of Education adopt and inforce the 2011 Ministry of Information's electronic publishing rules in addition to establishing offices in Saudi universities in order to craft policies associated with online copyright materials' fair use integration of protected digital resources.

Case Studies

There have been a variety of cases (Twigg, 2003) that highlight various aspects of intellectual property rights issues impacted by distance learning in general, and that contributed to repercussions on the role and model of higher education institutions in general. The widely known case of Arthur Miller, a professor of law at Harvard University who sold videotaped lessons to Concordia University is worth noting. As the Internet and distance learning become more prevalent, the demand for high quality learning materials from the best professors will skyrocket, generating a windfall of income that administrators will likely tap through writing IPR polices tailored for collecting royalties. The university argued that the university provided the right setting for the professor to reach a high status in addition to the financial support and the accessories, such as computers and software, to deliver content. While the professor argued limited competition and no conflict in commitments because Concordia University is an online university and therefore the business model is different from that of Harvard University. The second case is focused on a company that contracts with well known universities to develop courseware for training employees of large corporations. In this model the universities are not involved with delivery, just in providing the course content. The drive for generating income by the universities might compromise academic values and quality by contracting with a third party, since this resembles the role of a publishing power house as the content is not delivered towards credit for a degree. The third case highlights faculty entrepreneurship, where faculty embarked on their own to develop courseware tailored to promote problem solving skills and addressed whether the university should intervene to curb these activities. The fourth case, is related to whether universities should be engaged in commercial enterprise opportunities related to developing in-house courses delivered online, or should they delegate this mission to a third party by creating spinoff companies.

The four cases have highlighted the importance of writing clear IPR policies that address the issues of courseware ownership and control and further emphasize that distance learning has opened the way for universities to be engaged in commercialization of course content-- in other words of a product, which created a healthy debate of universities being focused on education rather than being focused on enterprise.

Quite often technology can impose great challenges to the judicial system. This can be highlighted in cases related to software computer programs where certain programs can be categorized as a form of speech and at the same time have some sort of functionality to operate a device. Courts and litigants have struggled to determine whether software has expressive or functional nature. Functionality of the software will restrict distribution outside the United States due to government restrictions on exporting certain technologies overseas without a license. But if the software can be considered as a form of speech, then no restriction can be imposed. This is highlighted (Burk, 2000) in the case of a law professor at Case Western Reserve University where he wished to upload class material including an encryption source code on his website. The US commerce department found that there is no problem in publishing his book on the website. However, it did restrict the publication of the source code subject to license requirement. The outcome of the litigation was that the professor argued that the software has expressive nature, although to limited audiences that can understand cryptology programming; the court accepted the argument. This case highlighted complexities and challenges facing the judicial system when cases related to technology, distance learning and freedom of expression are intertwined.

Courseware Motives and Concerns

The online courses are normally developed by faculty in collaboration with the IT department at the university or institution. The central role of the faculty is to develop course materials to facilitate teaching and to provide better student learning experiences. Based on this, faculty are hired and paid for by the institution. Therefore, the course material ownership lies in the domain of the university, in an analogy to a product or patent developed during employment at a company, though it is worth noting that in the past universities rarely asserted claim of ownership on the course materials (Twigg, 2003). Once the course material has been developed, universities have realized that the turnover time to transform it into online format is fast, and, therefore, the university can reach wider audiences by distribution of the course materials online. As a consequence, the university approval policy that permitted the faculty to sell their original work subject to maintaining quality and commitment to teaching and no competition was broken. This idea of transformation of the course material developed by faculty into an online product has changed university polices, as previously universities encouraged faculty to engage in textbook writing and did not claim ownership and responsibility for the content, nor opposed publications, since the material was written by the faculty on their own time -- though universities did provide rewards for such achievements. The assertion of ownership of online material by administrators might be attributed to the resources utilized in the process of developing the course, such as uploading the material to the university server, web design and programming and involvement of the

IT department in maintaining and upgrading the versions of the course. However, these assertions might be challenged as all course materials developed will utilize university resources in one way or another (Twigg, 2003). So the main question is why the sudden change to claim ownership of course materials by the universities? It is due to the fact of the possibility to generate extra cash by packaging those courses and either sell them or claim royalties by licensing them to other institutions. Furthermore, universities were concerned about faculty generating these profits and selling the courses to other universities, so they wanted to minimize the competition. But, looking at the other side of the coin, providing the courses online will impose redundancy of faculty members, and therefore universities might hire less skilled faculty members to cut costs and reduce overhead payrolls. The main anxieties associated with online higher education is how likely the online market will generate profit and to what extent the courseware will create a redundancy among faculty members. To answer these questions, we first define certain terminology associated with online course content and delivery, as quite often we use course and course material interchangeably. It is clear that course definition encompasses course materials, and it became obvious that course encompasses five distinct components. These are, content, course material to explain the content, the program of study that includes the syllabus, aims and learning outcome and strategies to be implemented to achieve them, interaction planned and spontaneous and institution to offer the course and award credit. To sharpen our understanding further, consider: While course materials can be bought or sold or repackaged, can a course be owned or can it be only offered? And if the course material can be packaged and sold, are we talking about the institution's involvement as a publishing business?

Selling online courses can generate income, but in today's competitive markets the likelihood of making high profit margins is small. Furthermore, selling courses is a business venture, and history has shown that universities or higher education institutions were not successful in the business environment. Are commercial ventures viable for pursuit by universities? The answer for this question is probably not. The likelihood of universities and faculty developing business ventures will face major hurdles due to multiple factors -- among them lack of experience in developing new products. Creating creative and competitive apps requires a mix of skills, design and experience the university setting lacks. The university cannot recruit, retain and compete with the high flying salaries prevalent in the Internet and media industry. The time scales of corporate and institutional operation and decision making are quite different. In industry, timing is set by customer and not by institutions and operations and adaptability. Decisions are made by faculty committees that likely favor working in traditional old ways. Higher institution and corporations operate on different business models. The former is based on providing the best learning experience, high quality research and retention and recruitment of the highest skilled faculty. The latter on focusing on high earnings ratio, productivity measures and high profit returns on investments. Therefore, the main outcome of the above discussion is that institutions of higher educations should be focused on the learning experience, research and good service for the community. Thus, income generation should be based on tuitions and royalties based on commercialized patents. However, during this process universities can extract extra income that would be beneficial, but that extra cash will likely be marginal as compared with tuitions and fees generated based on the services provided, and the more universities enter commercial business, such as publishing, this will likely degrade their main missions of providing high quality teaching and research.

After the faculty put their course materials online, their services are no longer valued, since they fixed the materials into machines, and those machines are owned by the administrators. The question is: How likely is it that this scenario will happen? In order to answer this question, we need to look in the context of traditional delivery versus interactive online course instruction where the lecturer role is a facilitator and a person packaging the course material to promote better online student learning experience. So in this context of a changing learning environment, the faculty was leading and controlling the content delivery where in the new model he or she is a leader of a community. So there will be transformation and adaptability for the new role in this changing environment. The transformation is a blessing for large number of students attending introductory courses where the help of innovative learning interactive software will require fewer faculty teaching them. freeing resources for more contact time with other subjects. The intellectual property issues that might arise (Twigg, 2003) are due mainly to redefining the teaching missions of higher education in this new environment.

Who Is Responsible for Addressing the IPR Challenges?

Lawyers are asked to create policies that can address the intellectual property issues. However, the main task of a lawyer is to alert the customer to potential risk associated with taking a certain action, and the responsibility of taking the risk is on the customer. Therefore, the institution is the entity that sets the policies, and the role of the lawyer is to craft this policy and highlight the risks associated with it. It is obvious due to copyright law, that the ownership of a course or a course material is a legal issue. It is worth noting that law of ownership has a lack of clarity. The lack of clarity stems from the fact the copyright law revision of 1976 has stated the work for hire doctrine, and the work of regular employees that receive a salary and fringe benefits are bound by the work for hire (Loggie, Barron, Gulitz, Hohlfeld, Kromrey, & Sweeney, 2007); however, faculty members enjoyed exceptions despite the fact that this was understood implicitly in the revised copyright act.

Conclusions

In order to maintain high content quality and academic freedom and to recruit highly skilled staff, the university policies should insure that course ownership and control are maintained fully or partially with faculty. This is essential in order to retain and recruit the best skilled faculty; this will also provide incentives for the faculty to work harder and be more productive. The institution should provide an atmosphere that is conducive for faculty support and transparent in all matters related to IPR. However, where the institution developed substantial ownership of course material, the university might reach out to faculty and negotiate an agreement so that copyright owner will assign a limited rights or permission to use the material by allocation licenses. In certain circumstances the institution can develop substantial ownership of the course material due, for example, to significant contribution from the IT department in programming and web design. The university might approach the faculty member and negotiate an agreement in order for the copyright owner or the faculty member who developed the course material to assign limited rights to the university to be able to distribute the material and share the proceeds.

In order to address issues associated with intellectual property it is suggested that all institutions should have a framework and procedures for decision making. It is noted that many institutions have policies in place, but those policies are somehow

cumbersome as they try to address all possible scenarios, despite the fact that it is unlikely that those institutions will generate any source of income. Institutions should develop a default policy that states that ownership of the material is maintained by the faculty. But this primary policy will have certain exceptions. In the case that the material is commercialized, the university or the college will recoup royalties, though of small percentage, to cover the investment it has made. It is critical that the university maintain an office to deal with commercialization and market distribution. With the aim that if the faculty needs help on such efforts, there is going to be assurance from the institution that they are there to help. Furthermore, the IPR laws and policies will continue evolving, subject to needs and facts on the grounds rather than to academic ideas based on speculations that certain scenarios might occur.

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FINDING THE SWEET SPOT: CONNECTING PERSONAL, CLASSROOM, AND FIELD-BASED LEARNING EXPERIENCES THROUGH THE USE OF PROFESSIONAL LEARNING PLANS

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Abstract

The purpose of this research study was to investigate how teacher candidates in a Bachelor of Education (B.Ed.) program are using a professional learning plan to document and demonstrate their achievement by digitally connecting their personal, classroom, and field-based learning experiences. Findings suggest that teacher candidates use the professional learning plan to digitally connect their learning by: having all their program competency artifacts in one place to connect, critique, and reflect upon; being able to document their professional growth; journaling in each of their courses; and peer mentoring and collaboration.

Introduction

The purpose of this research study was to investigate how teacher candidates (TCs) in a Canadian Bachelor of Education (B.Ed.) program were using a professional learning plan (ePortfolio) to document their achievement of the knowledge, skills, and attributes (KSA's) related to the Alberta Education Interim Teaching Certification by digitally connecting their personal, classroom, and field-based learning experiences.

The TCs use digital applications such as Google Sites to create their professional learning plans, which currently consist of the components described in Table 1.

Table 1

Page	Description
Home	Introduction and overview to personal teaching goals and aspirations
Resume	Documenting personal experience related to the K to 6 teaching profession
Teaching Evaluations	Evaluations by mentor teachers from K to 6 school placement and practicum experiences
Teaching Philosophy	Ongoing development of a personal teaching philosophy
Journal	Link to course and practicum journals in Google Docs
Course Reflections	A brief summary of the courses that students have taken at MRU. These include a link to the MRU course description and key "learning take-aways" from each course.
Teaching Competency	Planning, facilitation, assessment, environment, professional roles & responsibilities, with related artifacts, reflections, goals, and strategies

Key Components of the Professional Learning Plan

All teacher candidates (TCs) in this program are currently required to design, develop, and maintain a professional learning plan (PLP) throughout the four years of the program. The purpose of this learning plan is for students to document and articulate professional growth and development related to the B.Ed. program competencies: planning, facilitation, assessment, environment, and professional responsibilities. This is the space for TCs to develop and communicate self-understanding and create learning goals and strategies that will allow them to be most successful in their future teaching practice (Johnsen, 2012).

The questions that guided this research study were:

- 1. How is the professional learning plan process (PLP) helping teacher candidates digitally connect their personal, classroom, and field-based learning experiences?
- 2. What challenges are the TCs encountering with the PLP process?
- 3. Recommendations for improving the PLP process?

Guiding Frameworks

The Alberta Education Interim KSAs, the Leader in Me, and professional learning plan frameworks from local school districts and other post-secondary institutions were used to guide this study. There are seventeen Interim KSAs, which have been grouped into the following five categories (Government of Alberta, 2012):

- 1. Planning
- 2. Facilitation
- 3. Assessment
- 4. Environment
- 5. Professional responsibilities

These five categories were used to develop the learning outcomes and associated assessment activities for each of the courses and field-based experiences in the B.Ed. program (http://tinyurl.com/bedcompetenices). TCs maintain a Google Docs journal (http://tinyurl.com/bedjournal) to reflect on their learning experiences and develop a professional learning plan in Google Sites to document how they are achieving the Interim KSAs (http://tinyurl.com/bedplp).

The Leader in Me framework was developed by Sean Covey (Covey, Summers, & Hatch, 2014) and is based on *7 Habits of Highly Effective People* (Covey, 2004) created by his father Stephen. The rationale for using these seven habits is to help the TCs use their PLPs to develop a "growth mindset" where they are taking responsibility for their learning and collaboratively supporting their peers in the program. Table 2 provides a description of the seven habits associated with this framework.

Table 2

Seven Habits of Happy Kids (Covey, 2008)

Habit	Description
1. Be proactive – you're in charge	Take charge of your own life and stop playing the victim
2. Begin with the end in mind – have a plan	A goal not written is only a wish
3. Put first things first – work first, then play	Do what you have to do so you can do what you want to do?
4. Think win-win – everyone can win	TEAM – together everyone achieves more
5. Seek first to understand, then to be understood – listen before you talk	Listening – less than 10 percent of communication is contained in the words we use
6. Synergize - Together is better	Alone we can do so little; together we can do so much
7. Sharpen the saw – balance feels best	Let us never be too busy sawing to take time to sharpen the saw

A number of school districts and postsecondary institutions have already developed guidelines for professional learning plans, and Table 3 demonstrates the five frameworks that were used to inform this study.

Table 3

Professional Learning Plan (ePortfolio) Frameworks

Institution	Framework focus
Calgary Board of Education	Student learning plan - documenting and articulating personal learning processes (see <u>http://habaneroconsulting.com/customer-portals</u>)
University of Victoria	Personal growth (Hopper & Sanford, 2010)
University of Houston	Storytelling (see <u>http://digitalstorytelling.coe.uh.edu/)</u>
Alverno College	Competency and curriculum mapping (Ehley, 2006)
University of Auckland	Sense of wonder and inquiry (Lee & Pohio, 2012)

Our hope was that these guiding frameworks would empower the teacher candidates to use their PLPs to document how they were achieving the required teaching competencies by digitally connecting their personal, classroom, and field-based learning experiences. Conversely, we also wanted to study how these frameworks were creating challenges for the TCs. Finally, we wanted to gain insight and recommendations from the TCs with regards to improving the PLP process.

Methods of Investigation

An action research approach was used to direct this study. Gilmore, Krantz and Ramirez (1986) define action research as:

Aim(ing) to contribute both to the practical concerns of people in an immediate problematic situation and to further the goals of social science simultaneously. Thus, there is a dual commitment in action research to study a system and concurrently to collaborate with members of the system in changing it in what is together regarded as a desirable direction. Accomplishing this twin goal requires the active collaboration of researcher and client, and thus it stresses the importance of co-learning as a primary aspect of the research process. (p.161)

In addition, Stringer (2014) indicates that action research is a reflective process of progressive problem solving led by individuals working with others in teams or as a part of a *community of inquiry* to improve the way they address issues and solve problems. This research approach should result in some practical outcome related to the lives or work of the participants, which in this case is the effective digital integration of personal, classroom, and field-based learning experiences in a B.Ed. program.

We utilized this research approach as we wanted the TCs to be *active* rather than *passive* participants in the study. Our hope is that by actively participating in this research process the TCs will now have the insight and confidence to facilitate a PLP process for their own K to 6 students in the future.

Data Collection

A mixture of quantitative (i.e., student surveys) and qualitative (i.e., faculty interviews) were collected. During the fall 2015 semester, the co-investigators conducted semistructured interviews with faculty members in the B.Ed. program, which were digitally recorded and transcribed (n=9). All teacher candidates enrolled in the four year B.Ed. program (n=187) were invited to complete an online survey during the final week of the Fall 2015 semester by the two undergraduate student research assistants (USRA). The purpose of this survey was to collect data about how students had connected their personal, classroom, and field-based learning experiences to document and demonstrate how they were achieving the Interim KSAs. The SurveyMonkey (http://www.surveymonkey.net) application was used to administer this online survey. The studies two USRAs and the co-investigators collated the survey results and posted them to an editable gas gle desument.

them to an editable google document. During the month of December 2015, students and faculty were invited to add comments and recommendations to this google doc.

Data analysis

A constant comparative approach was used to identify patterns, themes, and categories of analysis related to the three research questions that "emerge out of the data rather than being imposed on them prior to data collection and analysis" (Patton, 1990, p. 390). Descriptive statistics (e.g., frequencies, means, and standard deviations) were calculated for the online survey items using MS Excel. Comments and recommendations from the faculty interviews and student focus group were added directly to the google document.

Findings

The findings and key themes for this study are reported for each of the three research questions:

- 1. How is the professional learning plan process (PLP) helping teacher candidates digitally connect their personal, classroom, and field-based learning experiences?
- 2. What challenges are the TCs encountering with the PLP process?
- 3. Recommendations for improving the PLP process?

Digital connections

The faculty interview and TC survey results indicate the teacher education candidates perceive that the professional learning plan process helps them digitally connect their personal, classroom, and field-based learning experiences by:

- 1. Having all my learning artifacts in one place to connect, critique, and reflect upon;
- 2. Documenting professional growth;
- 3. Journaling in each education course; and
- 4. Peer mentoring and collaboration.

In terms of having all of the learning artifacts in one place, TCs commented that "I think the professional learning plan really brings together all the components of the program, as well as weaving in our personal experiences" (TC survey participant 17) and "It has for sure helped me connect because I've had to think more about the things that I was noticing in the elementary school classrooms and having to connect it with the Education course content" (TC survey participant 44).

With regards to documenting professional growth, one student stated that the learning plan process "forced me to see the connections and relevance between personal and professional life" (TC survey participant 23), and another student explained that "It allows me to display what I am learning while being able to go back and reflect on what I have learnt. As well it allows me to build on my prior knowledge and to create a stronger professional learning plan" (TC survey participant 33).

Another student commented about the relationship between her course journals and the professional learning plan "I have been able to include artifacts and pictures from my experiences in my learning plan that I have first documented in my field journals" (TC survey participant 6).

And, finally, a number of students emphasized the importance of the peer mentoring and collaboration that was involved in the construction of their professional learning plans, "I found that when I created my learning plan I was able to input all my experiences into one space and other people were able to see them and provide me with feedback, this made our class stay connected and become a community of learners" (TC survey participant 39) and "It has helped me to become more creative by seeing how the other students in my class think and learning from each of them" (TC survey participant 29).

Challenges

Findings obtained from the faculty interviews suggest that there is currently a tension with the professional learning plan process between being a surface versus a deep learning experience for the B.Ed. students. Faculty perceive that many TCs view the learning plan simply as a "check-list" or "set of hoops to jump through" in order to demonstrate their achievement of the Interim KSAs.

In addition, the teacher candidates identified a series of challenges, which have been categorized into the following three themes:

- 1. Clarity of purpose;
- 2. Time; and
- 3. Digital technology support.

The survey results demonstrated that the teacher candidates are increasingly less clear about the purpose of the professional learning plan as they progress through the program (Table 4).

Table 4

Clarity on	the Purpose	of the	Professional	Learning Plan

Program Year	Percentage of TCs clear or very clear on the purpose
One	78%
Two	70%
Three	58%
Four	46%

The TCs indicate this downward trend is because the PLP is not being applied to any of the core 3rd and 4th year education courses. "You only work on the portfolio in 1st or 2nd and there is no opportunity to work on it in 3rd year classes or 4th" (TC survey participant 132) and "It would be have been more useful if the PLP was implemented correctly in every course. Some professors emphasized its importance more than others, and, therefore, there were large gaps in between updates and various inconsistencies that we were required to fix on our own" (TC survey participant 87).

TCs from each year of the program also commented on the challenge of finding the time to work on their PLPs. In the first year, "It does take up a lot of time but overall, I found it useful" (TC survey participant 14) while in the second year, "The least useful part of the professional learning plan process is that it requires time and a lot of thinking to plot information down on each page" (TC survey participant 53). These comments were echoed in the third year, "Unfortunately, time is always an issue. I felt as if I may not have had enough time to include insightful artifacts to my PLP" (TC survey participant 114) and emphasized in the fourth year, "Learning plans are mentioned, but we never focus on them or given time to work on them in 4th year. They seem to always be an afterthought, and now I feel like I will be scrambling" (TC survey participant 156).

In addition, the TCs, especially in the 1st and 2nd years, emphasized the need for more digital technology support for the creation and maintenance of their PLPs. In the first year, "The least helpful part was having to figure out Google Sites on my own after only one workshop. I feel we didn't spend enough time in creating it in class with our peers" (TC survey participant 27) and in the second year, "I am still not 100% comfortable with how Google Sites works. I think it would be really helpful to have a workshop to remind us of the things we learned in year one on how to create and maintain our professional learning plan" (TC survey participant 63).

Recommendations

In terms of creating a deeper learning experience for the TCs, the faculty members recommended that this process should be revised in order to allow TCs to "tell their stories about how they are developing their professional teaching identities through the digital connection of their personal, classroom, and field-based learning experiences" (Faculty interview 3). In order to achieve this outcome we have begun to examine the digital storytelling research literature (Barrett, 2006; Ehiyazaryan-White, 2012; Jenkins & Lonsdale, 2007; Johnsen, 2012; Robin, 2005; Schank, 2012).

The teacher candidates who participated in this research study provided a number of ideas and suggestions for improving the professional learning process. The research team has distilled this "wish list" into four key recommendation themes:

- 1. Designated PLP course for each semester of the B.Ed. program;
- 2. Goal setting versus scrapbooking approach;
- 3. Peer mentorship support; and
- 4. Mentor teacher involvement.

One of the key challenges identified by the TCs was the lack of consistent focus and use of the PLP throughout the entire B.Ed. program. In order to remedy this issue, the research team recommends that each semester a core education course be designated for the PLP. This would involve creating an assignment for each of these courses that would provide TCs with a rationale and dedicated time to work on their PLPs along with assessment feedback to help direct their growth and development. Table 5 provides an overview to the proposed designated PLP course framework.

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Year	Fall Semester	Winter Semester
One	EDUC 1231: The teacher: Professional dimensions I	EDUC 1233: The teacher: Professional dimensions II
Two	EDUC 2325: Understanding current and emerging pedagogical technologies	EDUC 3323: Effective assessment - measurement and evaluation
Three	EDUC 3010: Practicum I	EDUC 3361: Exceptional students, special needs, and inclusive schooling
Four	EDUC 4107: Program of studies and curriculum instruction in teaching social studies	EDUC 4201: Integrating ideas, values and praxis

Designated PLP Education Course Framework for the B.Ed. Program

In many of the faculty interviews, concerns were expressed that the TCs approach the PLP as a "check-list" or "set of hoops to jump through". A superficial scrapbooking process rather than a deep and meaningful learning experience. Chen, Grocott, and Kehoe (2016) emphasize that we need to move our pedagogical and technological approaches from "one of checking off boxes to one of connecting the dots" (p.1). Learning artifacts presented in the PLP should be used to "trigger" growth and development goals and action plans as illustrated in Table 6.

Table 6

Component	Description
Artifacts	Representations of achievement of specific teaching competencies
Reflections	What I learned in the process of achieving this competency
Goals	What future growth and development do I want to achieve for this competency?
Strategies (Action Plan)	What are my plans and strategies for achieving this future growth and development?

Teaching Competency Documentation and Planning

The TCs, especially in the $1^{st_{and}} 2^{nd}$ years of the program, indicated that they would like to have more support for the PLP process. Joubert (1842) is credited with coining the term "to teach is to learn twice," and in a related study Vaughan, Clampitt, and Park (2016) recommend the development of a peer mentoring circle for the B.Ed. program.

In this circular approach, fourth year TCs could receive peer mentor support for their PLPs from recent graduates. Third year TCs could be supported by fourth year peer mentors in their first practicum experience. Second year TCs could receive third year peer mentor support in their assessment course, and first year TCs could receive second year peer mentor support in their introductory courses. The development of this peer mentoring circle would provide all TCs with "first hand" mentoring experience to help them become effective teachers and learners. Friesen (2009) has developed a teaching effectiveness framework that emphasizes "teachers improve their practice in the company of their peers" (p. 6) and a recent Alberta Education (2014) report advocates that an effective teacher "collaborates to enhance teaching and learning" (p.29).

Currently, conversations about the PLP process are limited to the faculty members and TCs in the B.Ed. program and as the African proverb suggests "it takes a village to raise a child." Several of the TCs in the online survey recommended that the mentor teachers for field placements and practicums should be more involved in these conversations. In the first year, the TCs recommend that mentor teachers should be made more aware of the B.Ed. teaching competency framework (planning, facilitation, assessment, environment, professional roles and responsibilities) so that they can provide advice and guidance related to these key outcomes. In the second year, they suggest that this conversation should be broadened to include topics such as inquiry, digital technology integration, literacy acquisition, lesson planning, and assessment. And, finally in the

third and fourth years, they stress that there should be a much greater emphasis on conversations with mentor teachers about unit planning, diversity, and inclusive education.

Next Steps

Based on an analysis of the findings and recommendations, from the faculty interviews and TC online surveys, the research team has begun to develop a guiding document and "roadmaps" for the B.Ed. program's professional learning plan. The guiding document contains the framework, template, examples, and resources for the PLP process (<u>http://tinyurl.com/bedplp</u>). Given the complexity of the PLP process, the research team has begun to create two maps; one for year one and two of the program (<u>http://tinyurl.com/plpyear1and2</u>) and one for year three and four of the program (<u>http://tinyurl.com/plpyear3and4</u>). Each map consists of the core education courses designated for the PLP process with suggestions for artifacts, reflections, goals, and action plans.

The research team speculates that a growing number of Bachelor of Education programs are using a professional learning plan or ePortfolio process to document and assess teacher candidates' growth and development. They hope that other researchers will be able to use and build upon the results of this study in order to help teacher candidates digitally connect their personal, classroom, and field-based learning experiences in order to document and demonstrate how they are achieving their B.Ed. program outcomes.

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THE IDENTIFICATION OF APPLICABLE PRINCIPLES OF ONLINE LEARNING TO SUPPORT NOVICE ICT STUDENTS THROUGH THE USE OF AN LMS

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Abstract

In higher education, learning management systems (LMS) are widely accepted and used as teaching strategies and tools. However, the question that arises is: Which principles are adhered to when LMSs are used to contribute positively to enhanced quality in teaching and learning? This paper explores the application of the identified principles used to support first-year (foundation) Information and Communication Technologies (ICT) students at the Tshwane University of Technology (TUT) when using an LMS.

Introduction

The students at TUT are primarily from underprivileged rural schools in South Africa and its neighbouring countries. Most of these students are underprepared for tertiary studies and therefore need extensive academic support (DHET, 2013). This trend is even more evident when students enroll for ICT courses that require problem-solving and mathematical skills, as the South African education system unfortunately produces students with inadequate mathematical knowledge and skills. In a worldwide study (*Trends in Mathematics and Science Study [TIMSS*]) done in 2011, South African Grade 9 learners (who wrote the Grade 8 tests) performed second lowest overall of the 42 countries that participated in the study (Reddy, Prinsloo, Visser, Arends, Winnaar, & Rogers, 2012). The substandard quality of schooling in South Africa has a severe impact on students' access to and possible success in further education and training (Spaull, 2013).

Prospective ICT students gain access to TUT based on their Grade 12 results, and more specifically their mathematics results. There are two routes of entry into ICT at TUT, the first of which is when students qualify for the three-year National Diploma in ICT with an average of 50% and more for mathematics in Grade 12. The other route is via the foundation programme. If students do not have an average of 50% or more for mathematics, they may be admitted to the foundation programme if they have an average of at least 40% for mathematics. Students are also directed to the foundation programme if they have an average of 60% or more for the subject of mathematical literacy. The foundation programme lengthens the students' studies towards the National Diploma in ICT by one year in an effort to fill the gaps created by inadequate schooling (DHET, 2013). During the one-year foundation programme, students take four subjects, two of which are related to academic and language development, while the other two are specifically focused on preparation for the ICT subjects of the National Diploma curriculum.

An example of a lesson that can be implemented on any LMS platform will be presented in this paper. The purpose of the online lesson is not to replace the lecture given on the topic; it is rather offered as enrichment and much needed support to students. This is therefore done in a blended learning environment that combines the properties of classroom-based teaching and learning with online learning and technology. Furthermore, the online subject content is set up based on the constructivist principles, which describe learning as active, collaborative, meaningful and reflective, while students also construct and control their own learning process (Ally, 2004).

Literature Review

In this literature review, constructivism, blended learning and LMS will be discussed. Constructivism in higher education will be explored and linked to the seven educational principles of Chickering and Gamson (1987). In addition to this, blended learning and the use of a learning management system will be discussed.

Constructivist Principles in Higher Education

Liu and Chen (2010) defined *constructivism* as a theory that describes how learning and thinking with understanding is achieved rather than memorising copious volumes of information. A constructivist approach is therefore student-centred and revolves around the students' "individual construction of understanding, using support from [lecturers] and peers" (Winstone & Millward, 2012, p. 59). Stein, Edwards, Norman, Roberts, Sales, Alec and Chambers (1994) argued that constructivist learning is active learning where students actively construct understanding from their prior and current learning experiences. Lecturers must facilitate the students' acquisition of knowledge as well as their understanding of the content to improve their future learning experiences (Stein et al., 1994). When students are confronted with content based on a known, real-life scenario, they are more likely to engage and collaborate actively and to improve their learning experience (Iverson & Colky, 2004). The role of the lecturer is therefore to select relevant (scenario-based) content that considers students' abilities and improves students' "deeper understanding of the content" and learning environment (Iverson & Colky, 2004, p. 20; Winstone & Millward, 2012, p. 59).

Higher education requires students to work independently, which means that they are expected to take responsibility for their own learning and development (Winstone & Millward, 2012). However, the supportive, guiding role of the lecturer is an indispensable component of teaching when working with undergraduate, and especially foundation (first-year) students.

After higher education had come under fire for not focusing on quality teaching, Chickering and Gamson (1987) conducted extensive research and identified seven principles that are essential to guide good practice in higher (undergraduate) education. The following principles should be applied, encouraged and developed in order to adhere to good practice in higher education:

- Contact between students and lecturers
- Cooperation and collaboration (reciprocity) among students
- Active learning

- Prompt feedback by lecturers
- Time management skills
- Creating high expectations
- Respect for diverse talents and learning styles

Other authors also highlighted the importance and value of the relationship between good practice and constructivist principles. Iverson and Colky (2004) emphasised the fact that learning is "collaborative, constructive [active], contextual and metacognitive" (pp. 17-18). When quality of teaching and learning are considered to be good practice, lecturers should be encouraged to assist students to interact (collaborate) with each other when actively making sense of course content (Moreillon, 2015). Yaman (2010) argued that students "learn more effectively when they work collaboratively with a teacher in a small group" (p. 146). Duffy and Cunningham (1996) concluded that learning takes place when students are actively involved in constructing knowledge, and emphasised that the lecturer plays a supportive role in this process.

Blended Learning

At many universities certain subjects are presented through a blended learning approach. This is also the case at TUT. However, the existing literature makes it clear that researchers have different opinions about what is meant by the concept of blended learning. One opinion is that of Köse (2010) and Osguthorpe and Graham (2003), who referred to blended learning as a combination of the benefits of face-to-face methods with those of online methods. The elements of blended learning are therefore both online and face-to-face learning activities, with both students and lecturers participating. In a study that compared the outcomes of 6 000 students in a blended learning environment, researchers found that supplementing online learning with face-to-face, hands-on activities resulted in a statistically significant improvement in students' understanding of the course content (Chandler, Park, Levin, & Morse, 2013).

Owston, Wideman and Murphy (2008) observed that blended learning provides more flexible access to learning because it allows students to work online at their own convenience. Kotzer and Elran (2012) stated that an online learning environment provides bridging between the classroom, lecturer and student. For the purposes of this paper, the definition of Traxler (2010) will be used. His reasoning is that *blended learning* is the integration of appropriate technologies in the curriculum to support and deliver successful learning. To create this online environment, the use of a learning management system is the most viable solution.

Learning Management Systems

During the late 1990s, ICT started to significantly impact and influence education, and especially higher education, which was under pressure due to increasing numbers of students and limitations to the infrastructure (Dobre, 2015). More recently, another development that impacted higher education was the increased use of mobile devices. This was confirmed when Apple announced that during the first four years since the launch of IPads, more of those devices had been sold than any other product in Apple's history (Dilger, 2014). Based on the development in ICTs and the access mobile devices provide, higher education was forced to investigate new ways to manage learning and therefore explore the use of learning management systems (Dobre, 2015).

The purpose of a learning management system is to create online material for teaching and learning, distribute the material to the users, manage the use of the material and finally assess the knowledge the users achieved (Dobre, 2015). Berking and Gallagher (2013) claimed that a learning management system is the key to enabling technology to provide access to learning content and its administration at any time and from anywhere.

When online learning is investigated, it is pertinent to compare synchronous and asynchronous learning (Hrastinski, 2008). *Asynchronous learning* is self-paced learning independent of space, time, the lecturer or the source of teaching (Hofmann & Eaton, 2009). The implication is that students and lecturers are neither online simultaneously nor in the same physical location (Hrastinski, 2008). Both lecturers and students have the freedom to access the learning material at any time and from any location (Roberts, 2010). *Synchronous learning* is the exact opposite and allows students and lecturers to work together simultaneously in real time and/or at the same physical location (Huang, Kuo, Lin, & Cheng, 2008).

Learning management systems are therefore convenient for students, allowing them to interact in real time with the lecturer and other students, to express opinions, to make suggestions, and to share knowledge and difficulties as a learning community. Coates, James and Baldwin (2005) and Doolittle (1999) argued that a learning management system provides a convenient way to do multiple assessments and provide immediate feedback.

Discussion

After an extensive review of the work of a number of authors (Ally, 2004; Doolittle, 1999; Driscoll, 2000; Hein, 1991; Knabe, 2004; Savery & Duffy, 2001), the following implications (principles) for online learning (LMS) were chosen to be the foundation of this research:

The first principle is that learning should be an active process. For this to occur, students need to apply information in practical situations. This will enable them to interpret the information and discover its relevance. In doing so, they construct meaning from their prior knowledge and experience. This learning should also take place in an authentic real-world scenario. Students need to get accustomed to using processes that will have to be followed when they are confronted with the actual problem in real life.

It is also important for students to be able to construct their own knowledge. Good interactive online instructions can enable knowledge construction. During this process, the student contextualises and personalises the information at first hand so that it is not filtered by the lecturer. Furthermore, learning should be collaborative and cooperative. When students work with other students, it gives them real-life experience of group work. In such situations they learn from each other and use one another's strengths.

Students need to be in control of their own learning processes and accept ownership of their learning. When students are shown a clear, guided learning path they can make their own decisions about their learning goals. Also, students need to have time to reflect on their learning. If they are regularly given questions, they have time to reflect and internalise their learning while answering those questions.

The students should be able to relate to the examples cited in the learning material to ensure that they find the learning content meaningful and that they can make sense of the information and apply it. Students need to interact with information and the environment, and with the content, their peers and the lecturers. That enables them to test and apply that which they have learned.

Students need to be assessed regularly so that adjustments can be made to the course based on their understanding. Lastly, it is important to keep in mind that students need to learn in relationship with what they already know. Their existing knowledge is essential for assimilating the new knowledge and for positioning it in their frame of reference. They do not learn in isolation, but need to see that a particular piece of information forms part of a bigger picture.

To summarise, the ten principles are as follows:

- 1. Learning should be an active process.
- 2. Learning should take place in an authentic real-world environment.
- 3. Students should construct their own knowledge.
- 4. Learning should be collaborative and cooperative.
- 5. Students should control their own learning process and accept ownership of their learning.
- 6. Students need time to reflect on their learning.
- 7. Students should find learning meaningful.
- 8. Learning should be interactive and combined with social presence.
- 9. Students should be assessed formatively.
- 10. Learning is contextual.

The Use of an LMS at TUT: An Example

TUT uses Blackboard, on which the myTUTor system is based. Unfortunately, the LMS (myTUTor) is not used as often and effectively as envisaged and intended. The majority of the students do not have off-campus Internet access because of financial constraints, and, therefore, it is mostly used for enrichment purposes in asynchronous mode in dedicated computer laboratories on campus.

The application of the principles for online learning will now be demonstrated by proposing an activity (lesson) that can be implemented on an LMS (for the subject ICT Foundation Mathematical Skills, which is offered in the first semester). The problems (questions) can be used again in the second semester in the subject ICT Foundation Information and Software Development Skills. The activity will then be redesigned to incorporate programming principles. When designing content for online learning, it is important to realise that it is not always possible to apply all the principles to all activities.

The activity presented was designed to be used in conjunction with classroom teaching (see Table 1). Students are encouraged to work throught this activity after having attended the first lecture on the topic.
Table 1

Application of Principles for Online Learning

Topic: Proportionality (direct and inverse proportions)	Principles applied		
Introduction	Principles 1, 5, 7		
Students watch the following video to introduce the topic:	Students access and watch		
https://www.youtube.com/watch?v=hHiaCx3AQXU	the video.		
Direct proportion			
• Watch the following video:	Principles 1 - 7		
https://www.youtube.com/watch?v=USmit5zUGas	1		
• Students study given example:	Students:		
Notebooks are sold in packs of 8 for R240.00 per pack, and you	Access and watch		
have bought a pack. Your friend wants to buy 5 of the 8 from	the video.		
you. How much must he pay you for 5 books?	Work through		
8 books → 240.00	example (familiar		
5 books \rightarrow x	scenario).		
8 240	• Do an exercise,		
proportion: $\frac{1}{5} = \frac{1}{x}$	either on their own		
$cross - multiply: 8x = 5 \times 240.00$	or while		
$8\mathbf{x} = 1200$	collaborating with		
x = 150 = R150.00	fellow students		
• Students solve the following problem:	(familiar scenario).		
You have your grandmother's recipe to bake bread. The recipe			
makes 6 loaves, but you expect guests and you have to bake 15			
loaves. The original recipe uses 2.4 kg of flour. How much flour			
do you need for 15 loaves?			
Inverse proportion			
• Inverse proportion is when an increase in one quantity causes a	Principles 1 - 8		
decrease in another.			
• Watch the following video:	Students:		
https://www.youtube.com/watch?v=nsdo6-VgYhU	 Access and watch 		
• Students study given example:	the video.		
In a bakery where pies are made, each employee can make 40	Work through		
pies per hour. How long will it take 6 people to make 40 pies?	example (familiar		
Hint: The number of pies is constant.	scenario).		
1 person \rightarrow 1 hour	• Do an exercise,		
10 people \rightarrow x hours	either on their own		
inverse proportion: $\frac{1}{x}$	or while		
10^{-1}	collaborating with		
cross – multiply: 1 = 10x	fellow students (familiar scenario).		
$\therefore \mathbf{x} = \frac{1}{10}$ hour			
$\therefore x = \frac{1}{10} \times \frac{60}{10} = 6$ minutes			
IU I • Students solve the following problem:			
A chicken farmer has enough feed to last his 3 600 chickens for			
10 days. If an additional 900 chickens are brought in how long			
will the original stock of feed last?			
Re-enforcement:			
Watch more videos:	Principles 1 3 5 6		
https://www.youtube.com/watch?y=DfxaLiFLeuM	Students access and watch		
https://www.youtube.com/watch?v=8Ett7n36kbA	the videos		
https://www.youtube.com/watch?v=b30px8W9IIIM			
Self-assessment			
Students do multiple-choice questions. See Table 2	Principles 1-7 9		
Feedback is given when incorrect answers are given (Table 3).			

Topic:	Proportionality (direct and inverse proportions)	Principles applied
Format	ive assessment	
•	Please note that the questions below have also been printed and handed out during lecture time.	Principles 1 - 10
•	Students are encouraged to use the discussion board to collaborate with other groups in order to solve the problems.	
•	A class test will be written (date and time will be published) and questions similar to these questions and all the above examples will be included in the test.	
Questio	ons:	
1.	A train crash requires 24 workers to do 30 hours of work each to clear and repair the line. If emergency conditions require the job to be done in 18 hours, how many workers would be needed to finish in time?	
2.	Altogether 35 000 people can be seated in a stadium if 70 cm is allowed per person. If only 65 cm is allowed per person, what difference will it make to the seating capacity?	

In Table 2 an example of a multiple-choice assessment is given. Students can work through it repeatedly. The feedback for incorrect answers appears in Table 3.

Table 2

Self-Assessment: Do the Following Multiple-Choice Questions

1.	A baker uses 1 800 grams of flour to make 3 loaves of bread. How much flour will he use to make										
	24 loaves?										
	А	75 g	В	14 400 g	С	225 g					
2.	One person can p	out 200 E-toll acc	ounts into envelo	pes in 1 hour. Ho	w long would it	take 15 people					
	to put 200 account	nts into envelopes	s?								
	А	4 minutes	В	10 minutes	С	30 minutes					
3.	Sindane has to travel 420 km. How much time will he save if he drives at a speed of 130 km/h rather										
	than the legal spe	ed limit of 120 k	m/h?								
	А	10	В	16.2 minutes	С	10.2 minutes					
		minutes									
4.	A motor boat has enough fuel to operate its three pumps for 120 hours. If one pump is shut down,										
	how long would the fuel last to operate the remaining pumps?										
	A	360 hours	В	90 hours	С	180 hours					

Table 3

Feedback for Incorrect Answers

Question 1	Question 2
$1800 g \rightarrow 3 \ loaves$	$1 person \rightarrow 1 hour$
$x g \rightarrow 24 \ loaves$	15 people $\rightarrow x$ hours
$\frac{1800}{x} = \frac{3}{24}$	Inverse proportion: $\frac{1}{15} = \frac{x}{1}$
$cross - multiply: 24 \times 1800 = 3x$	$cross - multiply: 1 \times 1 = 15x$
$\therefore 3x = 43200$	$\therefore 15x = 1$
$\therefore x = 14400 \ grams$	$\cdot r - \frac{1}{2}$
	$\therefore x = \frac{1}{15} \times 60 = 4 \text{ minutes}$

Question 3	Question 4
$420 \ km \rightarrow 130 \ km/h$	$3 pumps \rightarrow 120 hours$
distance 420	$2 pumps \rightarrow x hours$
$time = \frac{1}{speed} = \frac{1}{130} = 3.23 \text{ hours}$	3 x
$420 \ km \rightarrow 120 \ km/h$	There proportion: $\frac{1}{2} = \frac{1}{120}$
distance 420	$cross - multiply: 3 \times 120 = 2x$
$time = \frac{1}{speed} = \frac{1}{120} = 3.5 hours$	$\therefore 2x = 360$
$time \ saved = 3.5 - 3.23 = 0.27 \ hours$	$\therefore x = 180 hours$
time saved = $0.27 \times 60 = 16.2$ minutes	

Conclusion

As mentioned above, higher education in South Africa faces a critical challenge since students are underprepared for tertiary studies and consequently need extensive academic support. This is especially true for students that enter studies in ICT-related programmes. Research has indicated a relationship between good practice and constructivism, especially where learning takes place when students are actively involved in constructing knowledge while the lecturer plays a supportive role in this process. This paper explores the application of constructivism and identified educational principles used to support first-year (foundation) ICT students at the Tshwane University of Technology while utilising an LMS. This is illustrated in an online learning model that is set up in an LMS and can be used across subjects. Because the popularity of smartphones and tablets has increased, it would be of great value if students would be able to use Wi-Fi on campus in the future to access the mobile version of the LMS from any location on campus.

These principles may be useful as guidelines for other lecturers in the ICT faculty or other institutions who also want to implement a learning management system for their subjects.

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A COMPARISON OF MOOC DEVELOPMENT AND DELIVERY APPROACHES

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Abstract

We present a comparison of two ways of developing and delivering Massive Open Online Courses (MOOCs). One was developed by the Open University in collaboration with FutureLearn; the other was developed independently by a small team at Northampton University. The different approaches had very different profiles of pedagogic flexibility, cost, development processes, institutional support, and participant numbers. This comparison shows that, several years after MOOCs became prominent, there are many viable approaches for MOOCs. MOOCs on existing large platforms can reach thousands of people, but constrain pedagogical choice. Self-made MOOCs have smaller audiences but can target them more effectively.

The Range of MOOCs

The MOOC, the massive open online course, has a long history. The MOOC phenomenon builds on a long history of distance education, but takes it into the modern online world. Large scale interactions systems, using technology developed for social networks and e-commerce, have been repurposed to deliver education at a large scale to many students at once. Some of the largest courses have had over 160,000 students learning concurrently (Hyman, 2012). This potential large reach, and the changes it allows in educational providers, give MOOCs the potential to foster great innovation in education (Sharples, Adams, Ferguson, Gaved, McAndrew, Rienties, & Whitelock, 2014).

However, different MOOCs can use the different aspects of *massive* and *online* in different ways. Moving a course online frees it from the constraints of a physical teaching environment, allowing students to participate in the course without being present in the same place as the teaching staff, and often not present at the same time as the teachers. Elements of this have been in present in blended learning (Garrison & Kanuka, 2004) courses for several years, where learning activities are moved outside the classroom and students are able to study at the time and place of their choosing, using teaching materials provided, often online.

Since the take off of MOOCs as a phenomenon in 2012, several companies and universities have started to offer a range of MOOCs. This is in addition to the tools becoming more usable by a wider variety of educators. Together, this increased range of MOOC platforms has led to a wide variety of MOOCs offered to different audiences.

The demand for MOOCs varies widely by size, interest, prior experience, and many other factors. There is therefore a challenge for educators to select the correct pedagogic style of MOOC and the correct delivery style to meet the needs of both the educators and the students.

This paper outlines the authors' experiences with developing and delivering MOOCs for two very different audiences with different requirements and delivered on very different platforms. One MOOC was on cyber security and was a large-scale course for tens of thousands of non-specialist participants. This MOOC was produced by The Open University in collaboration with FutureLearn, a UK based MOOC delivery company set up with the backing of several UK universities. The other MOOC was on integrating digital tablets (such as iPads) into teaching across a range of subjects and contexts. This was a much smaller course for a few hundred participants and was produced entirely inhouse by the University of Northampton.

Comparison of MOOCs

As we said above, MOOCs can vary in a number of ways. In this section, we outline some of these variations and indicate some criteria that should be used when selecting the most suitable approach when developing a new MOOC.

Audience

MOOCs vary in both their intended and actual audience. The audience can vary in both size and expertise. For instance, the cyber security MOOC was intended for a large and non-specialist audience, giving them some understanding of risks to individuals and some simple techniques to mitigate them. In contrast, the Teaching with Tablets MOOC was intended for in-service educators (in a school, higher education, or further education context).

These different audiences allow MOOC creators to make different assumptions about the interest, commitment, and level of expertise of the participants, and this affects how the MOOC is designed. MOOCs designed for learners with particular skills or in a particular context will necessarily have a smaller potential audience than those for a less particular audience. In addition, the more selective audiences could have more commitment to the MOOC; if the learning delivered by the MOOC aligns with their professional or personal interests, they may be more willing to engage in more demanding learning activities over a longer time.

In contrast, MOOCs for a general audience should be carefully designed to reduce barriers to participation for their participants. The *open* nature of the MOOC means that large numbers of people can sign up to MOOCs almost on a whim, but then not engage with the MOOC once it starts or drop out before they have completed all the activities. Drop-out rates of over 90% are common (Khalil & Ebner, 2014), particularly on MOOCs for the general public. But even if a MOOC is designed for a large, general audience, it is another matter to enrol that audience on the MOOC. This is a feature where the choice of MOOC delivery platform can have a significant effect.

Pedagogy

The first MOOCs (Stacey, 2014), now termed cMOOCs, used a social constructivist pedagogy where participants developed a shared understanding of the topic simultaneously with forming a community of practice around the subject, but these MOOCs are sometimes considered too open-ended and wooly (Nkuyubwatsi, 2013). Other MOOCs, termed xMOOCs, have adopted a much more didactic approach where students read or watch pre-prepared material and complete automatically-marked exercises. Predictably, xMOOCs have sometimes been criticised for being too directive.

There is a range of pedagogic approaches between these two extremes, and there is potential to adopt a nuanced design that navigates these poles in a way that is appropriate for the audience and subject (Conole, 2013). Again, the pedagogic approach taken in a MOOC will have a significant impact on the design of the course.

Platform and Services

Choice of platform is not just a technical decision, as different platforms have different processes embedded within them and can provide different levels of support for MOOC creators.

A variety of platforms have grown up for delivering education online. Many MOOCs, especially those delivered by larger providers such as Udacity and EdX, use bespoke MOOC web platforms to host all the content and student interaction, as well as provide the back-end services for student registration, content creation by course authors, and so on.

Some MOOCs use existing VLE platforms to deliver pre-prepared content, host student-generated content, and provide a forum for discussion. Some MOOCs, such as the Teaching with Tablets MOOC described below, assemble a particular student engagement platform from a range of VLE and social networking platforms used in concert.

Generally, bespoke MOOC platforms are designed for large audiences of general public as learners. They will often have a single, prescribed pedagogic approach, generally a didactic approach with readings, video clips, and automatically marked formative assessment tasks. There will generally be some facility for student interaction through a forum or question-answer tracking system, but these are often limited in flexibility. Because they are designed for the delivery of a MOOC to a large general audience, the delivery platform is designed to make involvement in the course as smooth as possible for the participant.

MOOC platforms provided by large MOOC organisations have other advantages in the support they can provide educators in creating and delivering MOOCs. As our experience with the cyber security MOOC shows, MOOC providers like FutureLearn have a robust process for creating and refining MOOCs, including technical and editorial support for the creation of learning content. They also tend to have an established base of learners and good publicity mechanisms. This allows the providers to gather large audiences of learners to MOOCs, allowing courses to fulfil the promise of *massive* in their titles.

However, the use of these platforms comes with a cost of reducing the pedagogic flexibility allowed to the MOOC authors. Large MOOC platforms are designed to cater to the lowest common denominator with a didactic approach. Other pedagogic approaches are not supported and may indeed be impossible within the constraints of the MOOC platform. If the pedagogic requirements of the MOOC require an approach different from what the MOOC platform provides, going elsewhere may be mandatory.

Cyber Security: A FutureLearn Based MOOC

The Open University (OU) is the UK's largest university. It offers a range of qualifications from introductory certificates to bachelor's and postgraduate degrees. The

OU was founded in 1969 by royal charter with a mission to increase access to higher education. The OU invests heavily in a so-called 'journey from informal to formal learning' by developing learning resources that can be used by casual learners, including television and radio programming as well as educational material on the OpenLearn platform, iTunes U and YouTube. These materials are designed to encourage users to begin using small resource before moving on to free self-study courses and MOOCs and eventually to begin formal study towards a university degree.

FutureLearm was founded in 2012 as the first UK-led MOOC platform. It is wholly owned by the Open University, but operates as a separate company with its own staff and resources. FutureLearn currently has 40 partners from the UK, Europe, Africa, Asia and the Middle East. Partners include universities and other learning institutions as well as archival bodies such as museums and national libraries.

Motivation and Context

Governments and businesses are gradually becoming aware of the vulnerability of computer networks. Individual awareness of cyber security lags behind that of organisations with many people simply uninformed of the risks from using a computer. Personal threats include vulnerabilities to bullying and extortion by the release of personal information, as well as the destruction of data by means of malicious software or the improper usage of computers. Individuals of all ages and backgrounds are increasingly vulnerable. and it is necessary to help them acquire the skills to protect themselves from malicious attack as well as accidental damage.

An Introduction to Cyber Security is a free MOOC lasting eight weeks that provides information about cyber security to a non-specialist audience. Learners study key aspects of cyber security and take practical steps to improve their own security. Learners perform security audits to discover the strengths and weaknesses of their own computer systems, develop backup strategies, install security software and explore the workings of the Internet as well as discussing topical issues with fellow learners and educators.

The cyber security MOOC was funded as a collaboration between the OU's Faculty of Mathematics, Computing and Technology and the United Kingdom Government's National Cyber Security Programme managed by the Department of Business, Innovation and Skills (BIS). It forms a significant part of an overall UK government information strategy on cyber security, such as the cyber streetwise campaign (Furnell & Moore, 2014). The material was written, reviewed and edited by OU staff and reviewed by UK government officials from BIS, the Ministry of Defence, the Cabinet Office and the GCHQ intelligence agency.

Pedagogy and Structure

The course runs four times a year, with every presentation taking eight weeks. Students must create a FutureLearn account to register on the course and access the course materials. Students can join the course up to four weeks after it starts and continue to study after the scheduled course end date (though they will increasingly lack opportunities to discuss the course material with other learners).

The course consists of eight themed weeks of study, with each week intended to take three hours of study by a typical non-expert learner (Figure 1). However, learners are able to adjust their study patterns according to their circumstances, and many take advantage of that flexibility.

WEEK WEEK WEEK WEEK WEEK WEEK WEEK WEEK WEEK MUTHER MUTHER <th< th=""><th>9 Mar</th><th>WEEK 8</th></th<>	9 Mar	WEEK 8								
26 Jan 2 Feb 9 Feb 16 Feb 23 Feb 2 Mar	9 Mar	16 Mar								
WEEK 5: CRYPTOGRAPHY		6 weeks ago								
Cryptography basics Cryptography is a specialised area of mathematics concerned with securing information so that it can be transmitted safely even when there is a risk it might be intercepted.										
5.1 HIDDEN MESSAGES VIDEO										
5.2 THE SECRET OF KEEPING SECRETS ARTICLE	THE SECRET OF KEEPING SECRETS ARTICLE									
5.3 PLAINTEXT AND CIPHERTEXT ARTICLE	PLAINTEXT AND CIPHERTEXT ARTICLE									
5.4 ENCRYPTION KEYS ARTICLE	ENCRYPTION KEYS ARTICLE									
5.5 THE KEY DISTRIBUTION PROBLEM VIDEO	THE KEY DISTRIBUTION PROBLEM VIDEO									
5.6 ASYMMETRIC OR PUBLIC KEY CRYPTOGRAPHY VIDEO	ASYMMETRIC OR PUBLIC KEY CRYPTOGRAPHY VIDEO									
5.7 WHY ISN'T THE INTERNET ENCRYPTED? ARTICLE	WHY ISN'T THE INTERNET ENCRYPTED? ARTICLE									
5.8 WHAT IS CRYPTOGRAPHY FOR? DISCUSSION										

Figure 1. Cyber security course calendar.

The pedagogy of the course is largely dictated by the FutureLearn platform. It is principally a didactic course where students study course-team-prepared material, generally static text and images, supplemented with short animations and video sequences. The material is chunked into small parts within each week; this increases the flexibility of possible study patterns and allows the materials to be easily studied on a variety of devices (PCs, tablets, and phones). The static material is supplemented with exercises and invitations to discuss the course content in the FutureLearn discussion forums. All material is delivered through the one FutureLearn site.

Learners are expected to complete regular activities giving them an opportunity to consolidate their learning and apply their knowledge. The activities give learners an opportunity to practice their new skills in a safe, controlled environment (Whitten & Tygar, 1999; Sheng, Broderick, Koranda, & Hyland, 2006), gain experience of new technologies, and realise how useful they are in real use. Completing each of the activities greatly increases the learner's personal security, and collectively, across the cohort, significantly improves the security of the population. The activities include performing a personal cyber security audit, installing various security software packages (antivirus, firewall, and password managers), using public key cryptography.

As learners complete each study task (reading or activity), they mark it complete on the FutureLearn site.

FutureLearn courses are structured to keep learners within the learning environment as much as possible. Links to materials outside the course are minimised and confined to a Links section on each page rather than being embedded within the text. This is a

deliberate decision since linking to other sites not only risks learners being directed to a broken site and being unable to continue their studies, but also risks learners becoming lost in a maze of pages and unable to return to the course.

Despite this general FutureLearn philosophy of restricting links, learners on the cyber security MOOC are encouraged to supplement the course materials and follow current cyber security developments by regularly reading relevant news and professional websites. The course team suggests a number of accessible sites including the BBC News, The Guardian, CNet and the Open University's own Safe Computing website.

The course was professionally edited by FutureLearn staff to ensure readability and accessibility for a diverse audience of non-specialist novice readers. Technical language was reduced to the minimum required, and a comprehensive glossary of terms was provided for references.

Assessment

Each week's study has a simple, five-question multiple choice quiz, automatically marked as the student takes the test. Incorrectly answered questions direct the learner back to the relevant part of the course materials. There is a separate end of course assessment, which is another automatically-marked multiple choice quiz.

Learners are not required to pass, or even take, any of the assessment tasks. However, if they complete the majority of the learning steps and pass all the tests, learners have the option of buying a certificate of completion. FutureLearn certificates bear the name of the university offering the MOOC (The Open University in this case) but are not considered a university qualification and do not carry any credit towards any university qualification.

Retrospective

The course has now been delivered several times and continues to be presented on the FutureLearn platform. Table 1 contains student numbers for the first four presentations.

Table 1

	Run 1		Run 2		Run 3		Run 4		Overall	
		%		%		%		%		%
Joiners	24330		21006		14798		13175		73309	
Learners	15606	64%	12811	61%	8541	58%	7695	58%	54815	75%
Active Learners	13391	86%	10539	82%	6763	79%	5662	74%	36355	66%
Returners	8657	55%	6446	50%	3834	45%	3096	40%	22033	40%
Social Learners	5496	35%	4143	32%	2533	30%	1960	25%	14132	26%
Full Part- icipants	4280	27%	2873	22%	1766	21%	1311	17%	11743	21%

Cyber Security MOOC Learner Numbers

In the first year of presentation, over 73,000 learners signed up to the MOOC, 36,000 completed at least one of the learning activities, and almost 12,000 completed the course. This retention rate of 21% is extremely high for this type of MOOC, where completion rates of 5%–10% are more common (Adamopoulos, 2013).

Unfortunately, we do not have more detailed information about partial completions or learner demographics, as that information is retained by FutureLearn for possible future monetisation.

The course materials have been adapted to several other contexts, including presentation in other counties.

By any measure, this MOOC has delivered on its requirements, giving a large number of presumably unskilled members of the public a taste of how to make themselves secure online, and perhaps even taking some simple but effective steps to improve their cyber security at home and work.

The pre-existing MOOC platform allowed the academic staff preparing the MOOC to concentrate on the course content, rather than being distracted by evaluating and selecting different components that could be combined to deliver the course. Similarly, the support of editors and artists meant that the learning material was in some cases of higher quality than the academic course team could produce themselves, while also saving the academic time.

However, there are a number of problematic aspects to the FutureLearn MOOC production. Most significant is the constraint on pedagogy imposed by the platform. FutureLearn MOOCs are designed to be easily accessible to wide populations; this constrains how sophisticated the learners can be assumed to be and limits the demands that can be imposed on them for learning. This means that MOOC learning is necessarily limited in depth and breadth (courses are encouraged to last no more than eight weeks with only a few hours of study per week). In addition, the platform only supports a limited number of activities from which to draw on. Most significant is the restricted functionality of the FutureLearn discussion forums. Different activities have separate and independent forums. Discussions are unthreaded, to ease navigation, but this makes it difficult to follow complex long discussions. In addition, there are limited features for searching and tagging discussions. These features combine to yield discussions that are good at recording quick responses and interactions but militate against more sophisticated and in depth discussions.

Another issue is the relationship between FutureLearn and its partners. While wholly owned by The Open University, FutureLearn is a separate commercial entity that has business relationships with many other universities and organisations. FutureLearn is also seeking ways to monetise its student base and learning analytics. This places pressure on FutureLearn to restrict access to the information it has on students and their behaviour, which in turn limits how much MOOC creators can learn about how their MOOCs are received.

Teaching with Tablets: A Blackboard Based MOOC

Much of the content for this MOOC was drawn from the book Teaching with Tablets (Caldwell & Bird, 2014) and was intended to allow practising educators to translate

current theory into classroom practice. The MOOC was an extension of that idea, with the intent to develop a community of practitioners sharing and learning from each other's practice.

Motivation and Context

This MOOC was initiated by the Education Department in the University of Northampton. It had two main aims. One was to develop a vehicle for disseminating and sharing practice for using tablets (such as iPads) in a variety of educational settings, including schools and higher education institutions (HEIs), and in a variety of disciplines. The other aim was to develop the Education Department's experience with creating and delivering MOOCs, in particular how such MOOCs can create and sustain communities of practice in educational settings.

The use of mobile devices in education is increasing rapidly and is likely to continue to grow (Ally, 2009). However, new technology poses challenges to educators in that it requires new approaches to teaching and learning (Luckin, Clark, Garnett, Whitworth, Akass, Cook, & Robertson, 2010). To ensure mobile devices enhance learning rather than distract from it, educators need timely guidance on these new approaches. Traditional continual professional development (CPD), based on face-to-face seminars and workshops, can reach only a limited number of educators, whereas a MOOC increases accessibility, giving participants more control over the space, place and pace of their learning.

Much of the course content was hosted on the University of Northampton's Blackboard server. The same system also handled student registration.

Pedagogy and Structure

The MOOC used an innovative, hybridised design that combined features of both x- and cMOOCs in a structured *connectivism* approach that sought to harness the acknowledged power of learning in social settings with the power of a structured design. Online synchronous interactions were combined with asynchronous interactions, and participants were encouraged to collaborate and share examples of their developing practice in an online community space.

With this MOOC, the pedagogy drove the structure and the platform. Existing MOOC platforms, such as the one provided by FutureLearn, were a poor fit to the structured connectivist pedagogy of the Teaching with Tablets MOOC. The intent of the MOOC was to develop a community around the MOOC, where participants might bring much of their own experience to the community and share their experiences with their peers. We deliberately included a range of educational contexts as we thought they could be useful to all educators. Tablet-based activities and apps intended for young learners could serve as introductory activities for all ages, while more sophisticated activities aimed at older learners could be adapted, or serve as inspiration, for younger learners.

The MOOC was scheduled to last five weeks, with the course site opening two weeks before the formal course start to allow learners to introduce themselves to the community. We seeded these introductory weeks with simple activities to encourage participants to familiarise themselves with the various apps that would be used often throughout the course. Each week's study consisted of a reading, two main activities, a number of extension activities, and a twitter chat. The readings and activities were hosted on the University of Northampton's Blackboard service and each week's content was only made available from that week onwards. None of the study was compulsory, though participants were encouraged to engage with the reading and at least one of the main activities.

Interaction between learners was important, and most activities in the MOOC required learners to create some artefact using one or more tablet apps and share it with other learners. We created a public community on Google+ for these activities, as it allows learners to create links to online artefacts and comment on their own and others'. Twitter chats were compiled with Storify and shared online. All these online activities encouraged learners to share their existing expertise and learn from other participants.

Assessment

There was no formal assessment on the MOOC, though learners could buy a certificate of completion. Award of the certificate required that a student could provide evidence of participation in the MOOC, either by showing participation in the Google+ Community or other evidence of using tablets in their own learning environment.

Retrospective

The MOOC had 570 students registered, of which 294 accessed the course website and 171 accessed some learning material. The Google+ Community had 248 members. The engagement by week shows a reasonably typical drop-off in participation: though 29% of active learners engaged in the fifth week of content (Table 2). Figure 2 shows how many learners engaged in at least n weeks of the MOOC: of the 171 learners, 50 engaged in at least four weeks, and 36 engaged in all five weeks of material. Generally, responses to the MOOC were positive, with many participants saying they found the MOOC useful.

Table 2

		of registered	of engaged	of learners
Registered	570			
Engagers	294	52%	100%	
Learners	171	30%	58%	100%
1. Manipulating media	162	28%	55%	95%
2. Visible learning	86	15%	29%	50%
3. Technology outdoors	68	12%	23%	40%
4. Digital storytelling	57	10%	19%	33%
5. Talk and collaboration	49	9%	17%	29%

Engagement by Week for Teaching with Tablets MOOC





Figure 2. Numbers engaging in at least n weeks of activity in Teaching with Tablets MOOC.

What is not clear from the numbers is the strength of community that developed from the MOOC. All participants drew examples from their own practice, and significant peer learning took place.

Conclusions

The reviews of the two MOOCs should make the differences clear between the two approaches.

The FutureLearn MOOC had the advantage of large reach and support for the academic staff producing the content. However, it had several drawbacks, including a limited choice of pedagogy and constraints on the learning analytics data that was returned to the authors.

In contrast, the Northampton MOOC was much more flexible in its approach, allowing the MOOC to be delivered using a range of tools and platforms to support the most appropriate pedagogy. The details of learners' journeys through the MOOC were more easily captured and analysed, and the staff had a closer relationship with the learners. However, the development of the MOOC required a broader range of skills than with FutureLearn, as the core academic team had to develop all the resources themselves. Finally, the FutureLearn MOOC had a much larger reach than the Northampton one, as FutureLearn was able to publicise the MOOC to its existing base of registered learners. The MOOC had increased reach through the UK government support of the MOOC as part of its cyber security public education efforts.

In conclusion, the correct platform for MOOC development remains open. MOOCs with simple, mainly didactic pedagogies intended for large numbers of learners are best suited on large platforms such as FutureLearn. If the MOOC is intended to serve a more particular audience, or requires a more collaborative pedagogy, such large platforms may not be suitable.

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THE ÒØØÒÔVÁOF LEARNING MANAGEMENT SYSTEM TRAINING ON TEACHERS' ONLINE TEACHING

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Abstract

Universities invest considerable resources in learning management system (LMS) training for their staff. One measure of the effectiveness of this training is participants' post-training behaviour, which can be obtained from LMS usage logs. In this paper we report preliminary analysis of these logs, showing that both teachers who have received LMS training and their students are more active in their online courses compared to those who have not. This preliminary analysis of usage data in conjunction with training information suggests a positive effect of training and can potentially help to provide information to ensure training is targeted and effective.

The Effect of Training on Teachers' Learning Management System Use

Considerable resources are invested by universities in providing eLearning training to staff, particularly in relation to use of their institutional learning management system (LMS). However, training effectiveness is usually measured by post-training surveys where participants provide their views about the training, such as whether they feel it was effective and whether they were satisfied with the training. A more objective method for evaluating training effectiveness is participants' behaviour post-training, one measure of which can be obtained from LMS tracking logs. In this paper we report on preliminary analysis of these logs, which shows that both teachers who have received LMS training and their students are more active in their online courses compared to those who have not.

Utilisation studies of LMS data are not new. A number of studies have been published reporting on students' use of LMS tools derived from data logs within the system (e.g., Jurado, Pettersson, Gomez, & Scheja, 2014; Lam, Lo, & Lee, 2010; Lam, Keing, McNaught, & Cheung, 2006; Morris, Finnegan, & Wu, 2005; Phillips, 2006; Romero, Ventura, & García, 2008). However, with advances in learning analytics, greater attention is being paid to analysing large data sets to understand learner behavior and optimising learning outcomes for students (Reyes, 2015). In addition to improving learning outcomes for students, learning analytics can also assist institutions in gaining valuable insights to inform strategic decision making, particularly in regard to resource allocation (Lam et al., 2006; Macfadyen & Dawson, 2012). In this paper we report on the application of learning analytics to Blackboard usage logs to understand the effects of LMS training on teachers' and students' activity in online courses.

LMS Usage Logs

LMS usage data have been analysed in a number of studies and for various purposes. In one of the earlier reports on analysis of LMS logs, Phillips (2006) reported that the institutional LMS at several universities was being used mainly for providing students with content and information. This type of use was described as teacher-centred and not

consistent with an online learning environment designed according to constructivist principles. Classification systems based on tool usage have also been developed for analysing LMS usage data. For example, Montenegro-Marin, Cueva-Lovell, Sanjuan and Nuñez-Valdez (2011) developed an ontology of modules common in learning management system platforms, which included *tools*, consisting of administration, communications, course, curricula design, and productivity, and *users*. Another classification system for LMS features was developed by Jurado and colleagues (2014) where tools are categorised according to purpose: for distribution (e.g., contents page, URL, documents, etc.), communication (e.g., mail, calendar, announcements), interaction (e.g., discussion areas, assignments, surveys, quizzes) or course management (e.g., gradebook, student tracking). Their work has shown that tools for distribution are used far more than tools for communication or interaction, which is consistent with Phillips' finding from eight years earlier.

Analysis of usage data at this level provides useful information. For example, counts of tool use have been shown to be significantly correlated with students' final grades (Macfayden & Dawson, 2010; Morris et al., 2005). In their study of student behavior, persistence and achievement in online courses, Morris and colleagues (2005) report a regression analysis showing that the statistically significant predictors of final grades included number of discussion posts viewed and number of content pages viewed. They also found that students who successfully completed the course engaged with online learning activities with greater frequency and for longer durations than did unsuccessful students who eventually withdrew.

Given these results, we compared LMS usage data for courses taught by teachers who have undertaken LMS-related training with those of teachers who have not to provide insight into the effect of training on LMS use. In doing so, we hoped to obtain important evidence to inform support for the effectiveness of training for promoting LMS usage by both students and staff, as well as to inform future training practice at our institution. Understanding how eLearning training, particularly in relation to an institutional LMS, impacts teaching practice and use of the LMS is important for assessing the effectiveness of training and staff development. To help address the question of impact, we have begun to explore use of LMS data to investigate differences in online behavior of students and teachers between courses taught by staff who have attended LMSrelated training and those who have not. The aim was to provide objective data that addresses the question of what changes occur following training and how this impacts students' and teachers' online behaviour. As Picciano (2014) notes, data-driven decision making relies on an appropriate model and valid data. This proof of concept demonstrates that our method for extracting and analysing data results in valid, reliable and useful information that is valuable in decision making relating to both the LMS and staff training related to its use.

The focus on actual behaviour is an important aspect of this approach - research by Saks and Burke (2012) showed that self-report transfer of training is significantly predicted by training evaluation, but only if the evaluation includes analysis of behaviour and outcomes. In particular, they found that organisations report higher rates of transfer of training where more frequent evaluation of training in terms of behaviour and results is conducted. In terms of evaluating LMS training effectiveness, usage data can be used as measures of behaviour and results and represents a new approach to assessing training outcomes. This is important, because, as Weaver (2006) notes, training of staff to support them in using the LMS needs to continually evolve to promote discussion and adoption of best practice, to cater to different staff requirements and to keep up with changes in the LMS itself as well as changes to other elearning tools.

Method

The LMS used at our university is Blackboard. It is a proprietary system and understanding the activity logs in the database (DB) is not an easy task, even though there is an online resource describing each of the tables in the DB. However, as Blackboard notes on its website, no guarantee can be provided in terms of accuracy. Since accuracy is essential for data analysis, we conducted a series of experiments that mimicked the behavior of students and teachers within the LMS and generated logs of the actions to test their accuracy. Using an isolated system was necessary because, under the university's current data security policy, direct access to the live LMS DB is not permitted. Additionally, there are hundreds of thousands of activity logs recorded in the live database every second. To overcome this limitation, an LMS testing server maintained by our department was developed for this study, which served as an isolated system.

Using this static DB of LMS data usage, a methodology for tracking the activities of both teachers and students from the Blackboard LMS web application log (called the Activity Accumulator Table) was developed. This methodology was used to generate a dataset that showed users' access history, which could then be used to conduct analyses to produce custom-made indicators and reports better suited to different stakeholders' wants (e.g., educators and management).

Three semesters (i.e., one academic year) of retrospective data from the university's LMS were obtained for analysis. In addition, data from the training participation information system was used to identify staff who had undertaken LMS-related training conducted by the Univesity in the last four years and those who had not. The retrospective training data and the activity logs recorded in LMS database were copied to a new database, which is protected by the university's Administrative Firewall Registration System to align with the data security policy. Inside the LMS database, information from the 'Accumulator table' recording all activity was used to generate the dataset for analysis. While the dataset can be used to obtain a range of different measures, for this paper we report on click counts as a basic measure of activity in a course, for both students and teachers.

Results

The first step in analysing the usage data was to clean the data set. This included deleting data related to guest accounts and courses that were temporary or test sites. Next, courses related to non-standard subjects, such as "thesis," "practicum," "work integrated education" or "field work," were deleted. Finally, courses with no instructors, no students or both were deleted, along with courses with student enrolments of fewer than 11, as these were considered atypical of subject enrolments at the university. This left a total of 4520 Blackboard courses with usage logs for the 2014/15 academic year with at least one instructor and more than ten students enrolled in the course.

Overview of Blackboard Usage

For each of these 4520 courses, the average clicks per student in the course was calculated. A plot showing the percentage of all Blackboard courses at specific values

for average clicks was produced (see Figure 1). As shown in Figure 1, 70 percent of all courses had an average number of clicks per student greater than or equal to 30, while around 20 percent of courses had an average number of clicks per student of between 0 and 20. At the higher end of the scale, less than 30 percent of courses had an average of 100 or more clicks per student.



Figure 1. Percentage of Blackboard courses with average number of clicks per student.

Based on the distribution of average student clicks, four activity categories were created: inactive (average number of clicks per student less than 1, *n*=62); low ($1 \le average$ clicks ≤ 30 , *n*=1377); medium ($31 \le average$ clicks ≤ 100 , *n*=1827) and high (average clicks >100, *n*=1254).

Activity Classification and Training in the LMS

From the university's training database, all teachers teaching courses that academic year who had undertaken training in the LMS (i.e., through the workshop program the university offered) from 2010/11 - 2013/14 were identified, and this information was mapped to the teachers in each Blackboard course for the academic year being analysed (2014/15). After mapping teachers who had participated in LMS training to the dataset, a total of 1578 courses with at least one teacher who had participated in at least one LMS training workshop were identified, with the remaining 2942 courses having no teachers in the course who had participated in LMS training offered by the university.

The percentage of courses for each activity level with trained and untrained teachers is shown in Table 1. A chi-square analysis was conducted to determine if there is an association between whether or not a course has at least one teacher with LMS training and the level of student activity in the course. This analysis showed that the percentage of courses with different levels of student activity differed according to whether or not the course had at least one trained teacher, $\chi^2(3, N = 4520) = 121.39$, p = .000. While the proportion of courses classified as having a medium level of student activity did not differ in terms of the percentage with at least one trained teacher, there were more courses with teachers who attended at least one LMS training workshop classified as having a high level of student activity.

Table 1

Trained			Activity Level		
Teacher Inactive		Low	Medium	High	Total
With none	1.7%	34.9%	40.2%	23.2%	100%
With at least 1	0.8%	22.2%	40.9%	36.1%	100%

Percentage of Courses at Each Activity Level With and Without at Least One Trained Teacher

To better understand how training and activity level in a course are related, the dataset was refined to only include courses with one instructor and no other teachers in the course. This reduced the number of courses to 2074, of which 563 (27.15%) had an instructor who had undertaken LMS training and 1511 (72.85%) who had not.

Descriptive statistics for the two types of courses (trained teacher and no trained teacher) are shown in Table 2 for the average number of clicks by both students and teachers.

Table 2

Average Clicks for Courses With and Without at Least One Trained Teacher

Trained	Average Clicks Per Course				
Teacher	Student	Teacher			
With none (<i>n</i> =1511)	56.17	118.06			
With at least 1 ($n=563$)	71.31	187.70			

Regardless of whether or not the teacher had participated in training or not, the average number of clicks by students was significantly correlated with the average number of clicks by teachers (r=0.592, p=.000, N=2074). This suggests that the more active a teacher is in a course, the more active their students are.

Table 3 shows the percentage distribution for each activity category broken down by training status (teacher attended training, teacher did not attend training). Chi-square analysis of courses with teachers who were either trained or not trained by activity level confirmed that more courses classified as having high student activity were taught by teachers who had participated in training ($\chi^2(3, N = 2074) = 23.48, p = .000$).

Table 3

Training Status	Activity Level						
Tunning Status	Inactive	Low	Medium	High	Total		
Teacher has not attended training	3.1%	40.8%	39.7%	16.3%	100%		
Teacher has attended at least one training workshop	2.3%	32.2%	40.9%	24.5%	100%		

Percentage of Courses With Only One Instructor at Each Activity Level by Training Status

A comparison of average number of clicks for students and teachers between the two types of courses (trained teacher and no trained teacher) was made using two separate independent samples *t*-tests. The results showed that the average number of clicks by students in a course was significantly higher for courses where the teacher had participated in training compared to those courses where the teacher had not (t(2072)=4.307, p=.000). Similarly, where the course was taught by a teacher with training, the average number of clicks by the teacher was significantly greater than for courses taught by teachers who had not participated in training (t(2072)=5.265, p=.000).

Discussion

Data from online courses taught in one academic year were compared for two groups of teachers – one where teachers had participated in LMS-related training run by the university and one where the teachers had not. Average clicks per student and teacher were used as measures of level of activity in the course and were compared between the two groups. The results showed that regardless of whether teachers had previously attended LMS training or not, the more active a teacher was in a course, the more active their students were. Furthermore, a higher proportion of courses classified as having high levels of student activity were taught by a teacher who had attended LMS training. Given that teachers who have attended training are more active than those who have not, promoting attendance at training seems to be an effective strategy for increasing online activity of both students and staff.

That training is associated with higher levels of online activity suggests that participants have transferred what they learned into practice – after training, participants should have a better understanding of the technical aspects of using the LMS and how to use tools in their online teaching. The greater number of average clicks by teachers who attended training is consistent with this. However, why students are more active remains to be answered.

There are a number of reasons that could explain why students' level of online activity increases with the activity level of their teacher. For example, after training teachers may put up more content for students to access, or they may increase the number of announcements or discussion forums, both of which would result in higher levels of activity by students. However, analysis of average clicks does not provide this level of detail, so these questions cannot be addressed using the analyses we have conducted. This in turn highlights that another measure is needed to conduct fine-grained analysis of what students and teachers are doing online.

To do this more detailed analysis, we intend to look at both number of clicks and time spent for each of the different tools available in Blackboard. However, the accuracy of the data in the Accumulator Table still needs to be confirmed by controlled experiments which mimic specific behaviours (e.g., reading a discussion post, replying to a discussion posting, starting a discussion thread). Once this is complete, we will be able to conduct further analysis at the level of tools. This will allow many more questions to be addressed, including those relating to the effect of specific types of LMS training on subsequent LMS use. For example, our university offers training on using Blackboard's communication features, the effectiveness of which we hope to be able to assess by analyzing usage logs of participants pre- and post-training to determine how their online behavior and that of their students' changes following training.

Our analysis showed that there were a small number of courses taught by teachers who had not attended training that were classified as having high levels of student activity. In terms of understanding training effectiveness and delivery, it would be useful to know why these teachers have not participated in training and whether their use of the LMS could be enhanced if they did. However, these questions and others like them will most likely only be answered by supplementing analysis of data logs with other measures, such as interview or survey data. Just as mapping training information to the usage data provided insights about the effect of training on LMS use, we expect that including measures such as student grades and student ratings of teachers and teaching will greatly enhance the quality and usefulness of the information that can be obtained from analyzing this data.

Preliminary analysis of LMS usage logs presented in this paper suggests that where staff receive LMS training, both students and teachers are more active in Blackboard courses. Although the measure used for the analyses reported here was quite coarse, it still provided useful information and raised many questions that can be explored through further analysis of the dataset. So, while it is time consuming to extract and clean data from the usage logs and then to make sense of the data, once this is done the dataset can be used to answer many questions about the online behavior of teachers and students without having access individual course sites.

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AFFORDANCES AND CONSTRAINTS OF A MOODLE ONLINE DISCUSSION BOARD: THE CASE OF AN UNDERGRADUATE CLASS IN BRAZIL

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Abstract

Among the different cultural artifacts that may mediate learning in virtual environments are online discussion boards. Research, however, has demonstrated that the artifact may become a double-edged sword: Participants may either collaborate toward knowledge co-construction or ignore their interlocutors, behaving individually. What are the affordances and constraints created by participation in a discussion board? To better understand the issue, this paper focuses qualitatively on a corpus of exchanges mediated by a Moodle online discussion board within a sociocultural approach.

Keywords: Moodle, online discussion boards, collaborative learning, sociocultural approach, mediation, affordances.

Introduction

Online group work and collaborative learning have become current practices in disciplines that include a virtual component: learners come together in virtual classrooms and discussion boards to achieve a communicative purpose. One of our concerns as educators is to find ways in which to assess these online pedagogical practices, as well as the digital artifacts that mediate students' actions towards meaning construction. Students' participation in collaborative online events triggers a number of pedagogical questions, one of which is how to evaluate learners' participation in terms of both collaboration and possible affordances and constraints.

This paper focuses on this question, by looking specifically at a corpus of messages posted on a Moodle online discussion board by 13 undergraduates attending a course in Applied Linguistics and the Teaching of Foreign Languages at the Faculty of Letters of the Rio de Janeiro State University, Brazil. The starting point was a sociocultural approach to learning and to the mind (Jones, 2013; Lantolf & Thorne, 2006), from which the paper examines both the quality and structure of the discourse as well as if and how meaning is co-constructed at both the cognitive and social levels. In this way, the research aims at holistically eliciting the affordances and constraints of the discussion board under study. These include discourse strategies and textual practices indexed to concrete mediated actions through which participants position themselves and make claims relative to the task at hand.

Background

The processes involved in computer mediated learning have been studied largely by means of the data logs that students leave behind when using discussion boards on Learning Management Systems (LMS). These logs provide an excellent source for research into the practices of discussion boards. In the last 20 years, the academic

interest on these data logs has gone through three research phases (Hakkarainen, 2009). The first phase focused on examining computer supported collaborative learning from a cognitive perspective, or rather, whether the use of computers elicited conceptual changes in the learner.

The second phase examined patterns of participation in the learning process. Part of the more recent body of research into students' data logs from this perspective may be shown in Beer, Jones, and Clark (2009). These authors found that there is a significant relationship between teacher-student interaction and learner success.

The third phase, still ongoing, seeks to overcome the dichotomy between elements of the cognitive (knowledge construction) and the social-cultural (participation). Here the focus is on the dynamics of learning proper as a sociocognitive practice, in which cognition and sociocultural practices are one and the same. In other words, this latter phase consists of investigating whether the knowledge construction process is a self-organizing system, in addition to examining the agents, cultural artifacts and social communities (Hakkarainen, Paavola, & Lipponen, 2004) inherent to this potential system. The present paper's concerns are related to this third phase.

The Moodle and Its Possible Affordances

The notion of affordances was first proposed by Gibson (1977) in the field of perception psychology. In his view, it is a person's perception of the environment that prompts some course of action. *Affordances*, thus, refer to the properties of an object in a given environment that enable some form of activity. In other words, an affordance can be understood as any use of an object that is perceived as adequate by a user in order to carry out a task. In the fields of technology and language teaching pedagogy, the term affordance is generally used as a synonym for opportunities, attributes or practices that offer learning activities -- "pathways for action" (Allen, Otto, & Hoffman, 2004, p. 226), rather than a physical artifact. These authors also claim that affordances "may enable opportunities and constrain others."

In the case of discussion boards within Learning Management Systems (LMS) such as Moodle, a number of affordances are available to both educators and learners. Most of these affordances have been listed on the documentation of the Moodle 2.2 under *pedagogy*. By working in the collaborative environment which the Moodle provides, one may teach and learn, and do so by observing others and creating something for others to see. In other words, Moodle provides ways in which information can be accessed and transformed by means of peer (and expert) collaboration and communication. In addition to the documented affordances, Moodle discussion boards may offer affordances derived from users' possible perceptions of the artifact, or rather, the users' ability to approach tasks by resorting to what the artifact may have to offer, the most important of which is the possibility of accomplishing a task collectively. In the case of this study, the task is to discuss possible applications of theoretical concepts in foreign language learning and apply them to the collaborative analysis of a movie -- *The Terminal* (Nathanson, Gervasi & Spielberg, 2004).

At this stage in the discussion, it seems appropriate to flesh out the meaning of collaboration, as it is part and parcel of the philosophy underpinning Moodle. To understand collaboration, it is necessary to distinguish it from cooperation. While

cooperative learning can be defined as working together to accomplish shared goals, *collaborative learning* "implies working in a group of two or more to achieve a common goal, while respecting each individual's contribution to the whole" (McInnerney & Robert, 2004, p. 205). In other words, *cooperation* means dividing a task among participants, having participants do their respective parts and finally putting the parts together to achieve a shared goal. On the other hand, successful *collaboration* requires participants to share in the process of knowledge creation, by discussing, negotiating, and accommodating possible conflicting points of view.

Online Discussion Boards as Cultural Artifacts

According to a model proposed by Belenky, Clinchy, Goldberger, & Tarule (1997), there are two possible ways of behaving in online discussion boards: (1) constructing knowledge analytically and objectively – the self-oriented mode; or (2) constructing knowledge in the interaction process – the interconnected mode. In the latter case, learners take the perspective of other participants, exercising not only subjectivity but also intersubjectivity. Yet, there is a third possibility, as explained by Williams (2005): learners may construct knowledge by combining modes 1 and 2, giving rise to the constructed mode. From this perspective, learners not only analyze the problem at hand, but also exercise their subjectivities as they express agreement and disagreement and identify positive and negative points in their peers' postings. Restructuring of knowledge systems and positioning of selves are present in every case. Therefore, from this perspective, online asynchronous discussion boards would arguably be seen as environments that may foster continuous cycles of exposition, analysis and evaluation of new ideas and, thus, yield opportunities for reflexivity and creativity.

The Study

In contrast to most research that has addressed online discussion boards (Wever, Schellens, Valcke, & Keer 2006; Lu, Chiu, & Law, 2011), this study takes a qualitative approach to the analysis of discourse, examining holistically the cognitive and social levels of meaning making. At the cognitive level, the focus will be on the structure of the arguments (presence of claims, grounds, challenges and synthesis), as well as the presence of other metacommunicative actions such as the creation of new insights and integration of knowledge. At the social level, the focus will be on moves to collaborate (the presence of questions, elaborations and evaluations on one another's contributions).

Context: Discipline, Task and Participants

The focus of analysis is the online discourse of 13 undergraduates of a large, public university in the State of Rio de Janeiro (UERJ), Brazil. The online discussion occurred *in tandem* with face-to-face classes in Applied Linguistics and the Teaching of Foreign Languages, a discipline that is a core part of the curriculum of all language majors at the Faculty of Letters. The objective was to allow learners to appropriate tenets of foreign language learning and teaching for themselves. To this end, the professor (the first author of this paper) asked them to watch a movie and relate readings and discussions developed in class to the experiences of the main character in the movie, a learner of English as a second language. The professor set up and moderated the forum.

The task. Students were prompted to discuss how the communicative challenges faced by Viktor Navorski, the main character in the movie *The Terminal* (Nathanson et al., 2004), could be explained in the light of various concepts. These included

interlanguage, the critical period of language acquisition, and scaffolding, among others previously introduced by their readings for the discipline. Students were also prepped not to simply retell the movie plot, but to associate their theoretical understanding to the character's experiences. The online asynchronous discussion went on from June 09 to July 09, the last month of the semester in Brazil. During this time, the professor posted no more than four times, in an effort to foster participants' independence and interconnectivity. In these cases, giving answers was avoided; rather, learners' thoughts were challenged. In their last face-to-face meeting, a debriefing was conducted in order to synthesize and clarify those points where misunderstandings had occurred.

Participants. Out of the 17 students enrolled in the Applied Linguistics discipline, 13 participated in the discussion board (10 females and 3 males). All are native speakers of Brazilian Portuguese, and, at the time of the study, their ages varied from 18 to 22. Their participation in the forum was evaluated for quality: they could add up to 20 points to their total score in the discipline if they demonstrated knowledge of the concepts and reflexivity. To guarantee participants' anonymity, all names are fictitious.

Research Questions

This study investigated whether an online discussion board run within the Applied Linguistics to the Teaching of Foreign Languages discipline affords learning opportunities and, if so, how these learning opportunities are materialized in participants' language behaviors. It also addressed the constraints faced by participants, given the characteristics of the medium. The research questions undertaken were:

- What are the affordances and constraints of the discussion board case studied?
- How do learners both create and reflect on discourse?
- What patterns emerge, if any, of language use and collaboration?

Analysis

To answer the research questions, the messages posted by the participants were qualitatively analyzed for recurrent patterns that might throw light on the cognitive and social levels of meaning making. These patterns were further interpreted in the light of the literature review and the sociocultural approach to learning and the mind, pioneered by Vygotsky (1978). The central tenets of this view are mediation, the social origin of higher mental functions and their historical or developmental nature (Lantolf & Thorne, 2006). According to these authors, cultural artifacts (language, writing, the computer, the discussion board) mediate the relation of the human mind with the world. "These auxiliary means arise as a consequence of participation in cultural activities" (p. 59) in the case under study, participating in a Moodle mediated online discussion board. During these activities, the cultural artifacts interact with cultural concepts in complex ways, "shaping our perception of phenomena," how we relate to others, "the meanings we can make and the actions we can take" (Jones, 2013, pp. 2-5). Based on these premises, the unit of analysis was the "real-time, concrete mediated action" in the corpus.

Key findings: Affordances and Constraints in the Case Study

In their influential book on digital literacies, Jones and Hafner (2012, p. 5) have posited a five-fold classification for the different affordances and constraints introduced by any

media: affordances and constraints on what we can do; on what we can mean; on how we can relate to others; on how or what we can think; and, finally, on who we can be. In the sections below, these five categories will be applied to the data under study.

What Participants Could Do: Co-Construct Knowledge Discursively

In the case of the online discussion under study, participants invariably prefaced their claims by citing their colleagues' contributions. Thus, the forum may be argued as being instrumental in the co-construction of knowledge. Students' uptake of one another's ideas and the order in which each one contributed to the discussion illustrates this incremental construction, shown in Example 1. With the exception of Luis, Rogéria and Pepe (postings 12, 15 and 16 respectively), who did not retake previous ideas, the other participants advanced information from points made by their colleagues.

Example 1

	Posting	Translation into English
Posting 2	Joana: Aproveitando um fato marcante que a Maria comentou []	Taking advantage of a remarkable fact that Maria commented upon []
	Assim como a Maria apontou []	As Maria pointed out []
Posting 3	Pedrita : Concordo com as meninas, sobretudo com o que a Joana afirmou no trecho []	I agree with the 'girls', especially with what Joana stated in the excerpt []
Posting 4	Juliana: Como já mencionado de alguma maneira por todas []	As has already been mentioned by everybody []
Posting 5	Lúcia: Bom, partindo de coisas já mencionadas []	Well, starting from issues already mentioned []
Posting 6	Mariluce: Como já foi comentado anteriormente [] e aproveitando o que a Lúcia comentou[]	As commented previously, [] And taking advantage of what Lúcia (has commented []
Posting 9	Marcela: Gostaria de destacar dois pontos do filme (já mencionados) Juliana (<i>4th posting</i>) mencionou o primeiro ponto [] E Lúcia (<i>5th posting</i>) mencionou o outro momento []	I would like to highlight two points that have already been mentioned about the movie [] Juliana (<i>4th posting</i>) mentioned the first point [] And Lúcia (<i>5th posting</i>) mentioned the other moment []
Posting 17	Pedrita : Elaborando um pouquinho mais uma questão já abordada anteriormente por vários colegas	Elaborating a little bit more on an issue previously addressed by several colleagues []
Posting 18	Juliana: teoria da pidgnização ou aculturação, já citada pela Melissa, e também pela Pedrita e pelo Gabriel []	[] pidginization or acculturation theory, already cited by Melissa, and also by Pedrita and Luis []

Collective Construction of Knowledge

What Participants Could Mean: Appropriate and Apply Concepts

The newly acquired concepts and appropriate terminology were exchanged with peers in a secure and friendly asynchronous discussion. Students were able to read, reflect upon and check information before putting it down in words and posting. These processes arguably afford the appropriation of newly acquired concepts (mediation, scaffolding, ZPD and others), of academic discourse (learners cite their readings for the course, viz. Quaresma de Figueiredo), taking the role of teachers (viz. Alice in Example 2) or analysts who analyze the case of Viktor in the movie (the case of all participants). Example 2 shows two postings in which concept appropriation occurs.

Example 2

Appropriation of Newly Acquired Concepts

Posting 18	Juliana. Algo que também observei foi	Something that I have also noticed is
1 Osting 10	que Viktor recebe bastante input, mas não	that Viktor (gets lots of input , but is
	recebe instrução. Ele não possui mediação	not given any instruction. There is no
	do conhecimento como auxiliar no	mediation of knowledge to help him
	desenvolvimento do andaimento e da zona	create scaffolding and a zone of
	de desenvolvimento proximal (ZDP) ou	proximal development (ZPD) or
	mecanismos de atenção dirigida para a	direct his attention mechanisms in
	apresentação da sistematização.	order to systematize knowledge.
Posting 7	Alice: A aprendizagem da segunda língua	The learning of a second language by
1 0.000	feita por criança e por adultos é realmente	children and adults is really specific?
	distinta. Seguindo Quaresma de	According to Quaresma de
	Figueiredo, o fator idade se distingue	Figueiredo, the age factor
	pela velocidade. O adulto já tem	distinguishes the rate of acquisition.
	estratégias cognitivas para passar por	Adults already have cognitive
	uma língua []	strategies to use in a language []

Thematisation (Brown & Yule, 1983) is another way to examine how concepts have been appropriated by these participants. Thus, the thematic organization of the corpus was analysed, in addition to the number of times a theme was retaken (see Table 1). As some participants contributed ideas, others would retake and further develop the same ideas, foregrounding information, and/or showing alignment with a peer. For example, *Topic 1: Input in natural contexts of interaction is facilitative of learning,* the most frequent claim, was further developed into subtopics such as *the affective filter needs to be low* because *motivation increases* or *a low affective filter is not enough*.

Table 1

Topic 1: Input in natural contexts is facilitative		Topic 2: The age factor makes a difference	
Sub-Topics Mentions		Sub-Topics	Mentions
Low affective filter	11	Viktor is an adult	8
Contextual cues	6	Accent	10
Motivation	4	Learning strategies	5
Absence of formal study	3	Hypothesis testing	2
Topic 3: Errors		Topic 4: Reactions to survive	
Sub-Topics	Mentions	Sub-Topics	Mentions
Acquisition natural order	6	Signified/signifier	5
Everyday actions	6	Motivation	4
Local errors	4	Independent study	4

How Learners Explained Viktor's Learning of English: Main Sub-Topics

Topic 5: Use of mother tongue		Topic 6: Discourse Theory SLA	
Sub-Topics	Mentions	Sub-Topics	Mentions
Cognitive demands	5	Interaction=input	3
Emotional demands	5	Comprehension emerges from context	2
		Output affords the perception of gaps	2

The length of their postings also signals the quality of topic development. Some postings, such as Alice's in Example 2, added up to 626 words, posting 18, 371 words, posting 8, 364 words, posting 13, 354 words. The mean length of their contributions was 277 words, the shortest being João's (70 words). Most postings fell in the range of 250-370 words (n=12). That is, their topics and subtopics were well explained.

How or What Participants Think: The Discourse of a Discussion

Learners structured their discourse by making claims (the topics and sub-topics in Table 1 are examples of claims in the corpus), providing grounds (by means of examples and further development of the sub-topics) and warrants (citations of readings and expression of agreement with peers). This structure is shown in Example 3:

Example 3

Structure of Discourse

Postina	Marcela: [] Não entendo como Viktor	[] I don't understand how Viktor could
1 Usung	poderia entender a complexidade da	understand the complexity of the situation as
	situação enguanto fazia o papel de	he performed the role of a translator, how he
	tradutor, como ele conseguiu pensar e	could think and notice fast that if the
9	perceber rápido que se os remédios não	prescriptions were not for a given person
	fossem para uma pessoa ele poderiam não	they would not pass immigration; and when
	ser barrados; e quando o diretor lhe dá a	the director raises the possibility of giving
	chance de asilo político ele não entende[]	him political asylum, he does not understand
	Poderia ser um engano do filme ou	[] Could it be a mistake made by the
	poderia ter alguma explicação o seu	movie director or could his understanding be
	entendimento melhor em situações	explained in a better way in different
	diferentes?	situations?
Posting	Luis: Em vista dos tópicos que a Melissa	Given the topics that Melissa brought up, it
0	citou, é possível perceber que, devido a	is possible to notice that, because he was in
	estar em território americano, ele recebe	American territory, he receives lots of input
15	muitos inputs daquela língua o tempo	(s) in the target language all the time, from
15	todo, das pessoas ao seu redor, televisão,	people around him, TV, magazines, shops,
	revistas, lojas, enfim. Porém, faltam	etc. However, there is lack of formal
	instruções para que ele possa direcionar	instruction to direct his attention
	focos de atenção e transformar tais inputs	mechanisms and transform input in output;
	em outputs, devido a isso, ele precisa	because of this, he needs to develop learning
	desenvolver sozinho, mecanismos de	mechanisms by himself,, so that he can
	aprendizagem, para que possa assimilar	assimilate the inputs [] He begins thus to
	todos os inputs recebidos [] Ele começa	associate images when he sees the news on
	entao a fazer assimilações, como	IV, to compare a book in English to its
	associação de imagens, quando assiste ao	translation in his mother tongue []
	livro em inclês com outro versão em su	
	língue notive []]	
D (i	Inigua nauva []	Commenting briefly upon Marceles's
Posting	Juana. Comentando Dievemente o	commenting orienty upon marcelas s

	questionamento feito pela Marcela []	question, I believe that the movie wants to
	acredito que o filme quer justamente	show that as Viktor lives in an environment
14	mostrar que conforme Viktor convive no	where the target language is spoken he
14	meio linguístico da língua alvo ele começa	begins to have comprehensive input. And
	a ter input compreensível. E ele entra no	he begins to move from his L1 to the target
	período de transição de sua língua mãe	language and his comprehension improves
	para a língua alvo e sua compreensão tem	with strategies such as comparisons to learn
	uma melhora com os recursos de	vocabulary in English []
	comparação que ele utiliza na obtenção e	
	vocabulário da Língua Inglesa. []	

In brief, the participants' exchanges provide evidence of the way they see the task. The professor specifically says that they are to participate in a discussion. In Portuguese, *discussão* involves negotiation, arriving at a consensus, if possible. Theirs is a series of logically connected claim-ground-warrant sequences, showing that they can and are making contributions. However, there was no discordance between them, as it is clear in the examples (except for posting 15, in which Luis indirectly disagrees with Joana as she tries to respond to Marcela's question). Therefore, their exchanges within Moodle signal their idea of a discussion, a collaborative non-confrontational argumentation.

How Participants Relate to Others and Build Online Identities: The Social Level As discourse unfolds, it both creates relationships between participants and builds upon their identities, both as readers and producers of discourse. The online discourse of the undergraduates under study is no different: As it creates a way of being perceived by others, it also shows ways in which others are being perceived.

The first point under consideration is whether the undergraduates are indeed collaborating towards the completion of the task. An indispensable element for collaboration is that all those involved in a collaborative task are seen to contribute more or less equally (Ingram & Hathorn, 2009). All the undergraduates participated once, a few a second time, and none participated a third time. They also appear to have respected each other's contributions and even used peers' voices to warrant their own claims (Table 2).

Table 2

Learner	Postings	Date and time	Target	Retakes
Maria	1	13/06 12:01	Group	
Joana	2	13/06 19:31	Group	Maria (2 x)
		30/06 20:04	Group/Melissa	
Pedrita	2	14/06 09:01	Group / Joana & Maria	Joana & Maria
		01/07 17:30	Group	Several peers
Juliana	2	14/06 17:42	Group	Several peers
		02/07 13:00	Group	Rogéria, Pedrita,
				Melissa, Luis
Lucia	1	15/06 14:21	Group	Several peers
Mariluce		19/06 12:00	Group	Several peers, Lucia
Alice	1	19/06 15:03	Group	Juliana, Pedrita
Prof.	4	10/06 12:34	Group / Joana	
		20/06 13:00	Lucia /Group	
		20/06 13:15	Lucia/Group	

How Participants Relate to Others

		27/06	22:30	Rogeria /Group	
Rogeria	2	27/06	19:00	Group	Mariluce
		30/06	12:07	Group	
Marcela	1	27/06	20:15	Group	Juliana & Lucia
João	1	27/06	22:00	Group	Pedrita
Melissa	1	27/06	22:05	Group	Several peers
Luis	2	30/06	14:12	Group	Melissa, Mariluce,
					several peers
		01/07	09:30	Joana / Group	Melissa
Pepe	1	01/07	11:43	Group	

Although they acknowledge each other's contributions, the undergraduates do not ask questions with the exception of Marcela in posting 9. In addition, there is no direct disagreement. Luis (posting 15) was the only one to disagree, albeit indirectly, as he responded to Joana's attempt to respond to Marcela (postings 14 and 9 respectively). In addition, even though their discourse is mostly other directed, when the participants produce a self-directed discourse, the aim seems to be to promote a tentative non-confrontational mitigating image, the signals of which are "I think," "perhaps," and "I believe." Another element within their discursive construction that deserves analysis is the use of indirect evaluations, indexes of socio-affective support, the focus of the following section.

Socio-affective collaborative support. Albeit in a small scale, participants show support for each other by praising each other's contributions. To cite the contribution of a colleague may also be seen as a signal of affinity (Examples 1 and 4):

Example 4

Posting 2	Joana : Aproveitando um fato marcante que a Maria comentou []	Taking advantage of an impressive fact commented upon by Maria []
Posting 9	Marcela: Juliana mencionou o primeiro ponto que me chamou mais a atenção : []	Juliana mentioned the first aspect that called my attention the most []
Posting 10	Joao: Um acontecimento importante já citado pela Pedrita []	A remarkable event that has already been mentioned by Pedrita []

Citing to Build Trust

The same holds true for setting a friendly tone for the discussion with off topic comments such as "*as meninas*" (the girls), "*por coincidência, a sessão da tarde exibiu esse filme hoje* and *pude assitir de novo*: D" (by coincidence, the movie was on TV this afternoon and I was able see it again: D). The presence of an emoticon further strengthens the affective relation which is under construction by means of the expressions in bold.

All in all, the undergraduates' discourse foregrounded certain aspects of their identities: alignment with colleagues and ability to collaborate and complete the task. In this process, they took different identities for themselves. There are those who teach, those who analyze, those who simply retake what a colleague had said, but the know-it-all identity has not been found: knowledge in the forum is distributed.

Structure of participation. The structure of participation seems linear at a first glance, as Table 2 has already demonstrated: A participant initiates, and others develop topics; some cite each other's contributions and highlight what has already been mentioned. In general, participants address their group. However, a closer examination of the exchanges reveals a conversation-like atmosphere given the friendly tone, greetings, compliments to others and closures, in addition to discourse strategies (retakes; use of gerunds, qualifiers, first person pronoun, emotion and conversational markers such as "*bom*" /well/). These features project a conversation-like tone for a discourse that tends toward the academic pole of the continuum.

This atmosphere, however, is constrained by writing (a medium that led them to use language they would not choose when participating in face-to-face interactions), by technology (they had time to think, read and integrate information), and by the context (they know the professor is assessing their participation in the forum, and thus they are also speaking to her). The subsequent section further analyzes these constraints.

Constraints

It has been claimed that participants of online discussions act as constraints on each other (Dron, 2007). Each claim posed limits upon the choices of those who follow, thus shaping the exchanges. However, as Dron himself observes, this is simply "the nature of dialogue" (p. 163), and if it were not so, the exchanges would be a set of independent statements, rather than a discussion. Therefore, it is expected and desirable that a discussion becomes constraining in this sense. This was the case of this study.

Temporal sequence also limited the choices and breadth of the discussion. That is, messages that were posted early in the process were given a few or no responses/ comments. Maria, for example, was the first to post. Her posting was retaken once in Posting 2 and never again. Participants who posted last had no choice but to pull together much of what had already been said (Luis and Juliana). Their postings were very close to becoming a synthesis of previous postings. In other words, much of what seems linear is a consequence of the parallelism of threaded forums (Dron, 2007).

Summary and Final Remarks

This study focused on two levels of meaning construction: cognitive and social. Cognitively, participants were seen to construct knowledge by providing claims, grounds and warrants. A glance at the topic flow provides evidence of the variety of sub-topics developed throughout the discussion to complete the task, as well as participants' ability to integrate information from a variety of sources, i.e., signals of knowledge construction. Socially, participants' discourse reinforced and elaborated upon each other's contribution, yielding shared understandings. However, they hardly addressed, questioned or evaluated each other directly. Collaboration at this level of meaning construction is wanting. Structurally, the relation among postings is high, given the discourse strategy of retaking one another's contribution and citing colleagues to build trust. These retakes projected an interaction-like atmosphere and created cohesiveness, yielding a very high level of texture among the postings. This also allows us to say that subjectivity, intersubjectivity and reflexivity were high.

In sum, the affordances provided by the discussion board, as well as its constraints, impacted the way participants behaved socially and linguistically. Writing demands a

high level of digital literacy. To demonstrate this ability online demands reflection and the integration of several sources of knowledge (readings assigned by the course, in class discussions, peers' contributions in the discussion board, and the context itself, among others). If the communicative purpose was to reflect on the principles of foreign language teaching and learning, the discussion board was very successful. The medium appears ideal for the integration of knowledge and co-construction of meaning. However, in terms of interaction, there are constraints. Participants appear to treat the medium with a degree of reverence. Their choice of vocabulary reinforces this interpretation. In addition, they still need to adopt a critical stance and overcome constraints imposed by the medium for expanding the possibilities of online discussion boards as cultural artifacts. Ultimately, however, knowledge has been expanded and enhanced, and the medium has undoubtedly afforded reflection.

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ARTIFICIAL INTELLIGENCE, COMPUTATIONAL THINKING, AND MATHEMATICS EDUCATION

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Abstract

This paper examines the intersection of artificial intelligence (AI), computational thinking (CT), and mathematics education (ME) for young students (K-8). Specifically, I focus on three key elements that are common to AI, CT and ME: (a) agency, (b) modelling of phenomena, and (c) abstracting concepts beyond specific instances. Seeing ME through the lenses of other disciplines and recognizing that there is a significant overlap of key elements reinforces the importance of agency, modelling and abstraction in ME and provides new contexts and tools for incorporating them in classroom practice.

Introduction

In this paper I examine the intersection of artificial intelligence (AI), computational thinking (CT), and mathematics education (ME) for young students (K-8). Specifically, I focus on three key elements that are common to AI, CT and ME: (a) agency, (b) modelling of phenomena, and (c) abstracting concepts beyond specific instances (see Figure 1).



Figure 1. Three common elements of artificial intelligence, computational thinking, and mathematics education.

The theoretical framework of this paper adopts a sociocultural perspective where knowledge is constructed in interactions with others (Vygotsky, 1978). *Others* also refers to the multiplicity of technologies that surround us, including both the digital artefacts of our new media world, and the human methods and specialized processes

acting in the world. Technology is not simply a tool for human intention. It is an actor in the cognitive ecology of immersive humans-with-technology environments (Levy, 1993, 1998) that supports but also disrupts and reorganizes human thinking (Borba & Villareal, 2005). Actor-network theory (Latour, 2005) emphasizes the reciprocal relationship between the "actor" and technology, where we are both acting and acted upon (Thumlert, deCastell, & Jensen, 2014). In this examination of the overlap of AI, CT and ME, I identify and explore key elements of CT as actors we (can) think-with in the learning and teaching process.

The first two sections below briefly introduce AI and CT. The third section discusses how agency, modelling and abstraction may be seen as three common key elements of AI, CT and ME. The fourth section describes a proposed mathematics classroom project that integrates these elements and incorporates AI and CT.

Artificial Intelligence

AI is the intelligence evident in machines or software.

It is also the name of the academic field of study which studies how to create computers and computer software that are capable of intelligent behavior. Major AI researchers and textbooks define this field as "the study and design of intelligent agents," in which an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success. ("Artificial Intelligence," n. d., para. 1)

Today, AI is increasingly pursued in a variety of ways by industry, such as seen in the development of self-driving cars by Google and cognitive systems like Watson by IBM.

AI Singularity

Some experts estimate that we are 20-50 years away from an AI singularity, where machines capable of recursive self-learning surpass human intellectual capacity and control.

AI machines that match and surpass human intelligence may be seen as leading to positive technological advances, such as eliminating aging and disease or enhanced space travel (Bostrom & Yudkowsky, 2014). At the same time, an AI singularity may prove disastrous. Stephen Hawking told the BBC (Cellan-Jones, 2014),"The development of full artificial intelligence could spell the end of the human race." Hawking (2014, para. 7) wrote:

If a superior alien civilisation sent us a message saying, "We'll arrive in a few decades," would we just reply, "OK, call us when you get here – we'll leave the lights on"? Probably not – but this is more or less what is happening with AI. Although we are facing potentially the best or worst thing to happen to humanity in history, little serious research is devoted to these issues [...] All of us should ask ourselves what we can do now to improve the chances of reaping the benefits and avoiding the risks.

AI in Education

AI in education has historically focused on the design of digital tutors that not only provide exposition of concepts to be learned, but also have the intelligence to respond meaningfully to student behaviour, such as providing adaptive support (Gilbert, Blessing, & Guo, 2015), addressing student learning styles (Dorca, 2015), or providing

culturally appropriate communication (Blanchard, 2015). Historically, these tutors were embedded in software packages designed for specific content areas, such as mathematics.

Today, especially in higher grades and in post-secondary settings, with student learning increasingly occurring in online settings, there is a focus on web-based intelligent agents that may act as content tutors or as online discussion facilitators (Adamson, Dyke, Jang, & Rose, 2014; Tegos, Demetriadis, & Tsiatsos, 2014). AI support of online learning is especially important with the growth of Massive Open Online Courses (MOOCs), where enrollment in the most popular MOOC platforms averages over 40,000 students (Ferenstein, 2014). AI can play a role in organizing and supporting online collaboration and in assessing student learning.

Another form of educational AI, which most of us take for granted, is online search engines coupled with the tremendous amount of freely accessible online information. If we need a definition, the knowledge to complete a task, or help to understand a concept, a quick search of available online knowledge will identify a variety of text and multimedia resources to assist us.

Computational Thinking

CT in education has three instances: screen-based coding, digital tangibles (such as programmable robots and circuits), and off-screen algorithms or pseudocode. The term *computational thinking* was popularized by Wing's (2006) advocacy, "To reading, writing, and arithmetic, we should add computational thinking to every child's analytical ability" (p. 33).

Currently computational thinking in education is more as its own, isolated curriculum objective, rather than integrated with, and enriching, existing subject areas. However, there is a natural connection between computational thinking and mathematics—such as in the logical structure or in the ability to model mathematical relationships (Wing, 2008).

$\mathbf{AI} \cap \mathbf{CT} \cap \mathbf{ME}$

Let us now turn to the intersection of AI, CT and ME and explore their common focus on agency, modelling and abstraction.

Agency

AI. Agency and the associated features of self-regulation and self-learning are key aspects of AI. Let's take self-driving cars as an example, where a core problem is the analysis of sensor and image data. What kind of object is in front of the car, and how should the car respond?

It examines the images and guesses the kind of object in each image. Initially most of its guesses will be wrong. Therefore, the algorithm modifies internal parameters or parts of its structure somewhat and tries again. This process continues, discarding changes that reduce the algorithm's accuracy, keeping changes that increase the accuracy, until it correctly classifies all images. Afterward, when entirely new images are presented to the algorithm it will classify them with high accuracy. The algorithm has learned! ("Top misconceptions," 2015, para. 29)

The team of programmers designing the self-driving car could attempt to anticipate every obstacle or situation, but variations are too numerous. The car-in-action has to be able to learn from its experience and to make decisions based on that self-learning. What is also interesting is that once one car learns something from a situation, its knowledge can be immediately shared with all other cars, so that all cars learn.

CT. Student agency is a key feature of education-oriented CT environments. Building on Papert's (1980) work with Logo programming, several programming languages are available today (e.g., Scratch, available at <u>https://scratch.mit.edu/</u>), that offer a low floor, enabling even young children to engage with little prerequisite knowledge, and a high ceiling, providing opportunities to explore more complex relationships. As elaborated in greater detail in Gadanidis, Hughes, Minniti & White (in press) this environment offers students opportunities to abstract, automate and dynamically model concepts, to explore their relationships and to experience conceptual surprise and insight, not only by implementing pre-programmed simulations, but also by creating and editing their own, thus experiencing CT and mathematics as producers as well as consumers. For example, Figure 2 shows the Scratch code for drawing a set of circles, rotated about a point. Young students can drag and drop code blocks that snap together to model various of mathematical concepts. In such computer coding experiences, students are in control, writing personally meaningful code and exploring related problems and extensions.



Figure 2. Creating a circles pattern in Scratch.

ME. Students' agency is also a key feature of ME theory. Burton (1999) suggests that agentic control makes a substantial difference in mathematics attitude and achievement. Schoenfeld (1987) suggests, "Many students come to believe that school mathematics consists of mastering formal procedures that are completely divorced from real life, from discovery, and from problem solving" (p. 197). Papert (1993, p. 25) adds, "I am convinced that the best learning takes place when the learner takes charge."

Modelling

AI. Developing a self-driving car involves conceptualizing models of how other cars move and react and how pedestrians interact with vehicles, to give two examples. Similarly, designing intelligent agents in education contexts, such as tutoring or online learning facilitation, requires the development of models of the subject matter and of the learners. This model-creation and the associated model-testing and model-refinement is an integral component of AI development.

CT. CT is an approach to problem solving that focuses on the logic and design of computational algorithms, or sequences of steps that can be implemented using a computer (Aho, 2012; Wing, 2006, 2008, 2011). The power of CT modelling is its dynamic nature: making a change in the computer code shows the mathematical reaction immediately. For example, changing the values of parameters in Figure 2 can cause the program to draw fewer circles or different shapes.

ME. Dynamic modelling allows students to "play" with mathematics and helps bring to life the concepts students are studying (Sinclair & Jackiw, 2009). Play naturally engages children with creative problem solving (Ginsburg, 2006) and has historically been valued in early childhood learning (Perry & Dockett, 2002; Duncan & Lockwood, 2008).

Abstraction

AI. Abstraction "plays a key role in representing knowledge and in reasoning" (Saita & Zucker, 2013, p. 2), and is an integral component of AI development. For example, in the case of the self-driving car, creating a model of "pedestrian" abstracts key attributes.

CT. Yadav et al. (2014) note that abstraction is a key element of CT. Wing (2008, p. 3717) states, "In computing, we abstract notions beyond the physical dimensions of time and space. Our abstractions are extremely general because they are symbolic, where numeric abstractions are just a special case." This process of abstraction can be seen in Figure 1, where the code used represents a variety of related cases at once.

ME. Abstraction is at the heart of mathematics. Abstraction, in the everyday sense of the word, is also a natural human activity. For example, very young children easily abstract beyond specific instances of objects and develop mental models of classes of objects, such as "cat," despite the many different sizes, colours and behaviours of cat instances.

However, as I have argued in Gadanidis (2014, 2015) the idea of engaging young students with abstraction is not widely accepted in education, primarily due to the widespread acceptance of Piaget's stages of development. Egan (2002) notes that "Piaget's ideas and overall approach absolutely dominate in education" (p. 105). Papert (1980), Egan (1997), Fernandez-Armesto (1997) and Schmittau (2005) challenge Piaget's notion that young children are not capable of abstract thinking, which Egan identifies as integral to language development. Abstraction helps students conceptualize and engage with complex problems and relationships by reducing information and detail. Wing (2011) notes that we use abstraction to better manage complexity.

A Classroom Example: Artificial Intelligence Mathematician

Agency, modelling and abstraction are integral components of AI, CT, and ME. The following is the first draft of a plan to bring all of these into play in a K-8 mathematics learning environment, all at once, by engaging students in the design and development of a numeracy intelligent agent. We have tentatively called this AI agent Artificial Intelligence Mathematician or AIM, although in the end its name will be decided by the students themselves.

Students in K-8 develop numeracy skills, ranging from a sense of number to a variety of computational procedures. The goal is not simply for students to remember definitions or algorithms, but to develop robust conceptual models and thinking skills for analyzing problem situations and deciding which methods may be most appropriate for specific situations. For example, in multiplying 26 x 257, they might use a calculator or the standard paper-and-pencil algorithm, and in multiplying 26 x 19, they might mentally multiply 26 x 20 (520) and then subtract the extra 26 (520 - 26 = 494). The solution of 26 x 19 = 26(20 - 1) also uses a form of expanded notation, the distributive property, and models that expressions such as 3(x+1) and 3x+3 are the same, thus making important numeric and algebraic connections.

Students will use unplugged CT methods, such as flowcharts or pseudocode, to design the decision making that AIM will use in responding to computation questions posed. We also plan that students will create support material to enhance the learning experience offered by AIM, by adding where they deem appropriate, text, images, videos, art and even songs they write and perform.

Student designs of AIM will initially be programmed in Scratch by one of our graduate students in computer science. Scratch allows users to also access, copy and edit the code, and we foresee that some K-8 students (especially in the higher grades) will do some of the programming. AIM will be publicly available, so family and friends as well as the wider community may engage with AIM and perhaps even offer feedback.

Engaging students with AIM, we are at once engaging them with AI, CT and ME. We are also offering them opportunities to: (a) to use their agency in the design of AIM, (b) model their mathematical thinking using CT, and (3) abstract beyond specific instances by classifying problems and their solutions.

Concluding Remarks

This paper offers a nascent exploration of the intersection of AI, CT and ME, highlighting three of their common elements: agency, modelling and abstraction. Seeing ME through the lenses of other disciplines, and recognizing that there is a significant overlap of key elements, reinforces the importance of agency, modelling and abstraction in ME and provides new contexts and tools for incorporating them in classroom practice.

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COMPUTER ASSISTED SCIENCE INQUIRY IN THE SCIENCE CLUB

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Abstract

This paper examines the innovative teaching approach of computer assisted inquiry in science subjects. This approach is justified through research to promote effectively knowledge, skills and attitudes in science as well as computer subjects. When teachers implement it though, challenges arise. Most of these challenges are generated by factors of the school context where teachers work. In this research the approach was implemented in the Science Club, in a primary school in Greece. In this club, attempts were made to reduce these factors. Through a qualitative research it was concluded that the club was indeed a fruitful context, but several challenges remained.

Introduction

This research focuses on computer assisted science teaching through inquiry. It aims to identify the possibility to implement it effectively, in a context designed appropriately. Inquiry includes processes, such as asking questions about natural phenomena and the natural world, interacting, investigating and giving answers (Crawford, 2007). According to the National Research Council (2000, p. xii), "Inquiry is in part a state of mind...Students need to learn the principles and concepts of science, acquire the reasoning and procedural skills of scientists, and understand the nature of science as a particular form of human endeavor."

There are many benefits in teaching science through computer assisted inquiry. Mainly, the profound understanding of science knowledge and work, as well as the familiarization with ICT in science processes (Osborne & Hennessy, 2003; Ødegaard, Haug, Mork, & Sørvik, 2014). However, its implementation is often hindered by the school's context (Twidle, Sorensen, Childs, Godwin, & Dussart, 2006; Kellow, 2006). This research implements this approach in the context of the science club, which is composed of pupils interested in science subjects. Thanks to the flexibility of this context it is possible to reduce the presence of hindering factors (Law No. 3966/2011).

The conclusion on whether implementation was effective or not requires thorough exploration of this approach along with the research context and process (Cohen, Manion, & Morrison, 2011).

Implementing Teaching through Computer Assisted Science inquiry

In order to examine the implementation of computer assisted science inquiry in class, it is necessary to investigate the main points of science inquiry, the potential of ICT, evaluation and challenges arising.

Scientific inquiry

Inquiry is significant in scientific work. Recent approaches to science teaching, involve participation in science inquiry tasks, which enhance science learning through the engagement in authentic scientific problems and everyday experience, negotiated through inquiry (Ødegaard et al., 2014). During the teaching of scientific inquiry, learners ask questions, give answers and benchmark them to those the scientific community accepts as correct. It also involves selecting the appropriate method to gather, analyze data, represent them and apply them to explain concepts or phenomena. This is done though continuous group work to explain, justify and review every action. This approach treats science as a process and not as a sum of concepts and phenomena to memorize (NRC, 2000; Crawford, 2007).

Eastwell (2009) has identified four different levels of scientific inquiry. These can assist teachers in selecting dimensions or parts of the inquiry that can be included in a teaching intervention. The first level is confirmation research. As can be understood by the name, this kind of research aims to guide learners to confirm a principle or a theory of science through tasks such as hands-on activities or experimentation. Within such inquiry, learners are provided with a question. They are expected to work with a specific method, which is thoroughly described to them, as it is known and decided well in advance. The results that learners are expected to come across are also known.

The second level is structured research. At that stage, the question is still given to learners. There is also a pre-decided process of tasks and methodology that they will follow. Results and the answer are also studied and known in advance. However, flexibility is provided. Learners can comment on methods presented and can choose others. Overall, they will use data as basis to explain a scientific phenomenon and construct knowledge (Eastwell, 2009; Přinosilová, Mechlová, & Kubicová, 2013).

The next level is known as guided research. Learners, who are working on a scientific inquiry at that level, are guided solely by the research question, which is provided to them by the teacher as in previous levels. There are no predetermined approaches to answer it. Learners have the flexibility to choose method and means. Moreover, the results are not predetermined. In other words, learners should be able to plan an investigation in order to discover new knowledge that will give the desired answer. The teacher does not pre-describe a particular path for learners to follow anymore.

The ultimate level of scientific inquiry is open research. At that stage, it is up to learners to state and specify research question, as well as the plan they will use to answer it. Teaching inquiry should ideally aim at reaching this level. This can be achieved gradually after passing the previous three. In other words, for learners to be able to ask science-oriented research questions, they should initially become familiar with applying methodologies to justify or draw conclusions as well as planning research methods. This way, learners can understand that inquiry is the essence of science.

Teaching inquiry across the four levels is not a linear process. Teachers should provide contexts for learners to work with different levels during the same period and not move statically from one level to another. This allows further on-going deepening with the individual elements of the inquiry (Eastwell, 2009; Přinosilová et al., 2013).

Computer Assisted Scientific Inquiry

Computers and generally information and communication technologies (ICT) have been invading education research and teaching practices over the last decades, bringing on opportunities for innovation in teaching. In science teaching, computers and ICT are supported by research to assist in tasks of data collection, as they offer a wide range of up-to-date resources. Moreover, digital-recording equipment and software can help in gathering, categorizing, analyzing any kind of data, findings and information. Additionally, presenting, disseminating and publishing tools can help in exchanging information, conclusions and ideas about findings and results. Aside from that, ICT can help science teaching with other measures such as virtual experiments and simulations, data logging kits and hardware, which also focus on gathering and managing various types of data (Osborne & Hennessy, 2003; Bingimlas, 2009).

ICT helps promote science learning through inquiry. Stating questions, planning methods to answer the questions, implementing plans and evaluating approaches, which compose the process of science inquiry, depend highly on skills and tasks about data managing that can be promoted through ICT. Overall, thanks to ICT it is possible for science teachers to go beyond teaching science as sum of information and development of skills and attitudes. Learners are lead to the desired level where they continuously ask, plan, experiment, inquire and construct knowledge continuously (Kellow, 2006). The continuous emphasis on the role of ICT in inquiry learning has generated the approach of *computer assisted inquiry* or even more specifically *computer assisted science inquiry* (Osborne & Hennessy, 2003; Sun, Looi, & Xie, 2014).

Evaluating Teaching Through Inquiry

Evaluation of teaching through inquiry can be neither simple nor quick. It is an ongoing process, which examines if learners finally, started implementing inquiry, which means, asking questions, planning a methodology to answer them, experimenting, carrying out the plan, discussing findings (Ødegaard et al., 2014).

Harlen (2013) underlines that teaching through inquiry calls for both formative and summative evaluation. The former involves engaging learners to use knowledge, skills and other qualities to understand and express ideas, to take part in discussions about scientific topics. It is necessary to collect data during teaching, which can be benchmarked to initial goals of the teacher or curriculum. The teacher, based on this data, can conclude what has been gained, what the next step is and what the learners' strong and weak points are. Moreover, students by receiving continuous feedback, which is an important element of formative assessment, can have a better understanding of their achievement as well as the nature of science inquiry.

Evaluating peer work is a common activity of formative assessment. It gives useful insight of learners' understandings of the inquiry process, through comments they express about the work done (Ødegaard et al., 2014).

Summative assessment, though. is also necessary. It includes methods such as regular tasks, tests and revisionary exams. Although these means can distort the inquiry process, they provide significant records of learning. Perhaps, the most challenging factor in using summative assessment in inquiry teaching is to select the most appropriate techniques. These can be exercises, written essays, portfolio, artifacts,

learners' projects and other pieces of their work. Assessment criteria would be based on information, skills and evidence related to the inquiry process (Harlen, 2013). When it comes to integrating science with ICT, to promote inquiry, it is crucial to include activities that reveal the knowledge constructed by learners in both subjects. Formative and summative assessment overlap each other in this case, as through both learners demonstrate in many ways their understanding in science and ICT individually, as well as their relationship within inquiry (Jarvis, 2012).

Challenges in Teaching Science Through Inquiry

Although teaching science through inquiry is supported as a beneficial approach for learners, its implementation is often accompanied by challenges. Some are common to any case of an innovative teaching approach. Others however, can be attributed to the characteristics and demands of science inquiry (Ødegaard et al., 2014).

With regards to the former, teachers who teach innovative practices frequently come across time pressure. Data analysis, presentation of findings and ideas cannot happen fast and easily. Another barrier would be lack of the appropriate school equipment. This also applies in inquiry teaching, as it depends on experimentation. These challenges are linked to the school and the curriculum demands. With regards to the latter, research states that teachers and learners maintain several misconceptions about inquiry. For example, many learners tend to overemphasize the hands-on activities and experiments. They pay less attention to discussion and findings analysis. Another barrier would be incompatibility with practices that learners are used to. Learners are not by default familiar with planning processes, testing hypotheses and constructing knowledge (Crawford, 2007; Harris & Rooks, 2010).

In short, the challenges are relevant to the school context and working conditions of the teacher. Similar challenges apply in promoting computer assisted inquiry in teaching. It is very common for science curricula to takes no in-depth consideration of the teaching potentials of ICT. Therefore, the teacher has to adjust ICT use to the demands of the curriculum. The school equipment may be insufficient, also. Additionally, learners need to become familiar with the "pedagogy of the Internet" (Twidle et al., 2006, p. 219). Learners need to understand how ICT can assist in learning, generally and specifically with regards to science inquiry. This is another point where the curriculum may cause barriers, as it may not contemplate the relevant qualities, as knowledge, skills and attitudes that learners may need.

Unless these issues are dealt with, there is a great risk for the intervention to be less successful. The teacher risks may need to deal with time pressure in order to help learners understand how to use ICT resources to gather data, analyze and present them. Learners may fail to understand the exact reason why they use the computer and consider it only as means of amusement and not learning. This may lead to the computer assisted science inquiry teaching losing its focus (McMahon, Garner, Gray, & Mulhern, 1999; Kellow, 2006).

Planning the Research Study

The planning of the study was based on the literature about computer assisted science inquiry, research methodology and the characteristics of the context.

The Context of the Study

Computer assisted science inquiry teaching is therefore justified to help science teaching, but, during its implementation, challenges may arise, due to the characteristics of teaching through inquiry. Learners are not used to the inquiry processes, since this approach is rather new. Teachers have to spend time to engage learners with the knowledge, skills and processes of the inquiry. This sometimes is difficult, as there is no provision for that in the curriculum. There are also challenges attributed to demands and restrictions set for teachers. Teachers may lack time, equipment and working conditions to teach science through inquiry either computer assisted or not (McMahon et al., 1999; Kellow, 2006; Twidle et al., 2006).

Bearing that in mind, a research study was planned to investigate the potential to promote teaching through computer assisted science inquiry in a context free of such restrictions. A context like that was found to be the science club of an elementary school in Greece. The clubs are for learners who express interest in a subject. The teacher responsible for the club has the flexibility to arrange the to arrange the syllabus, the time, and to plan and select the teaching approach to use, without requirement from curriculum. Research findings with regards to the subject of the club, which in this case is science, should not be neglected. The science club included learners interested in science (Law No. 3966/2011). It has been working since 2012. Forty two participants of the fifth or sixth grades, which are the final two of the primary school, have attended the club for two years. They have carried out tasks focusing on inquiry through evaluating hypotheses, justifying findings, planning experimental and scientific investigations, and, finally, asking questions. This was done through continuous data collection, analysis and discussion (Eastwell, 2009; Přinosilová et al., 2013).

Learners were introduced to tasks focusing on computer assisted inquiry science teaching. They worked in groups of three or four. Approximately eight to ten such tasks were carried out each year. The duration was three to six weeks.

Learners were shown ICT applications for such activities. They saw how to search websites, use spreadsheets for data collection, management and analysis. They were shown virtual experiments to use for testing. They were also shown software for data presentation or communication. Software selection was based on availability and appropriateness for the learners' age (Kellow, 2006; Twidle et al., 2006; Jarvis, 2012). Tasks focusing on confirmation research included using websites and electronic resources mostly to collect information, about a known topic. Tasks focusing on structured research included search sites to collect information in order to confirm data and present them. Tasks focusing on guided research would include searching information online about experiments, simulations and possible equipment that can be used in order to plan scientific activities. They also included searching pages such as networking sites to see prepared materials of science inquiry, analyze them and understand how to plan them. Similar were the tasks focusing on open research, which however included less instruction by the teacher with regards to identifying the topic under study (Eastwell, 2009; Jarvis, 2012; Přinosilová et al., 2013).

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The Research Questions

In order to identify if computer assisted science inquiry teaching was effective, it is necessary to evaluate if learners understood the elements of scientific inquiry and the level achieved. It is important to identify whether they became able to evaluate hypotheses and confirm findings to prove achievement of the confirmation level. Learners need to prove they can draw conclusions and explain phenomena to prove achievement at the structured level. They also need to show they can plan scientific investigations to prove achievement of guided level. Lastly, they must show they can state research questions and trigger investigation to prove achievement of the final level of open research (Eastwell, 2009; Přinosilová et al., 2013). Aside from that, learners need to show ICT efficiency, with regards to knowing benefits and risks of involving ICT in science inquiry processes and applying them (Jarvis, 2012; Sun et al., 2014).

The research questions were:

- 1. Did the learners use ICT to evaluate hypotheses?
- 2. Did the learners use ICT to draw conclusions?
- 3. Did the learners use ICT to plan scientific investigations?
- 4. Did the learners use ICT to ask questions?

These questions have dual aspects. They focus on determining if learners consolidated, first, levels and processes of science inquiry and, second, the potential of ICT to contribute to these processes. By answering these questions, it is possible to see if within the clubs, computer assisted science inquiry was taught effectively, or if challenges emerged in this context as well (McMahon et al., 1999; Kellow, 2006).

Research Methodology

The study is qualitative. Strauss and Corbin, (1997, p. 17) describe that qualitative research is "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification." This study is an example of action research as there is the researchers' personal involvement as teachers in, the process. Action research involves reflection, collaboration and dialogue, as elements of empirical study to promote and evaluate teaching practices (Cohen et al., 2011). During each session, data were collected through documents, learners' projects and notes, observation of learners while working, reading and discussing and interviews with learners (Bell, 2001). This helps implementation of both formative and summative practices (Harlen, 2013).

The development of skills in all sessions was observed. At the same, time learners participated in group semi-structured interviews, which focused on themes relevant to inquiry such as data collection, data management and use, investigation planning and evaluating. Focus was also given on ICT use in such processes. In order to answer the first research question, learners' notes and projects were collected. Learners answered questions such as "What do you think will happen?" "Do you think this was correct or wrong?" "How will you prove it?" "Will you use the computer for that?" which gave insights of learners' ability to use ICT in order to confirm hypotheses.

To answer the second research questions data came from learners' notes and projects as well. By answering questions such as "Why do you think this happens?" "Would you

use the computer to find out if your conclusion is correct?" learners would prove whether they could use ICT to explain phenomena and justify their explanations.

To answer the third research question, apart from learners' notes and projects, their portfolio was checked. Emphasis was given on the way they planned methods to answer a scientific question. Learners would reply when asked "What would you do to answer the question?" "Would you use a simulation on the computer for that?" and show if they developed the skills to plan investigation, with the help of ICT.

Lastly, to answer the fourth research question, notes, projects and portfolio, were used. Learners asked questions like "What do you think about this subject?" "What have you found out?" They were also observed, in order to see if they would use ICT, in order to form a research question that would trigger further research.

The data were transcribed and analyzed. These methods aimed to identify the development of computer assisted science inquiry skills in learners (Osborne & Henessy, 2003; Eastwell, 2009; Harlen, 2013).

Findings

The findings were overall positive, but there were points that called for improvement.

Question 1.: "Did the Learners Use ICT to Evaluate Hypotheses?"

With regards to the first question, findings were encouraging. The results show that pupils learned to evaluate the hypotheses stated and they also managed to use ICT easily and effectively in such tasks. Firstly, as seen from the interviews, pupils understood what evaluating a hypothesis includes. They were able to test thoughts set to them and implement findings to explain phenomena. When the task they were working on required that, learners would immediately reply with comments like "We need to check if that [hypothesis] we made is right or wrong," or "I can show that this is correct." Even though in the beginning, hypothesizing would sometimes be omitted, as the study progressed, this was less frequent. Testing a hypothesis was therefore a skill satisfactorily developed by learners (Harlen, 2013; Ødegaard et al., 2014). Secondly, learners showed that they understood the assistance of ICT in evaluating a hypothesis. Searching sites and seeking data online was most used. It was common for learners to explain, "We can use the Internet to check if that idea is right." Apart from that, there were replies about use of spreadsheets. These prove adequate knowledge of ICT assisted inquiry (Osborne & Hennessy, 2003; Sun et al., 2014). So, learners got the qualities needed in order to carry out confirmatory research with the help of ICT, as seen from the findings gathered (Eastwell, 2009; Jarvis, 2012).

Question 2.: "Did the Learners Use ICT to Draw Conclusions?"

Findings were equally encouraging for the second question. Most learners gradually understood the process of drawing scientific conclusions with assistance of ICT and carry it out as part of the inquiry (Kellow, 2006; Twiddle et al, 2006). More specifically, learners had initially shown difficult in stating an explanation of a phenomenon. For example, in a process that linked color and heat absorption, when asked to explain what they conclude based from the temperature measurements on similar objects of different color, learners would possibly give no answer. This however, changed at later stages. As the study progressed, learners would easily give replies such as "Black color objects absorb more heat." This improvement was apparent in many tasks. This shows steady overcoming the barrier of limited experience in forming conclusions from data (Harlen, 2013). Additionally, learners understood the potential assistance of ICT in drawing conclusions. Pupils would frequently suggest loading websites or using virtual experiments and simulations to get more data that would help them form, generalize or justify conclusions. When examining the link between color and heat absorption, learners suggested "to use the experiment on the computer to do more measurements with more colors and see what happens." Similar answers were frequently given, especially with regards to simulations. Hence, learners gradually learned how to carry out ICT assisted structured research (Eastwell, 2009; Jarvis, 2012; Přinosilová et al., 2013).

Question 3.: "Did the Learners Use ICT to Plan Scientific Investigations?"

Findings regarding the learners' ability to plan scientific investigation were encouraging, though only to a certain extent, as challenges were observed in several essential parts of the planning process (Ødegaard et al., 2014). On one hand, the searching and investigating aspects of planning were carried out effectively. Learners would show ease in searching online in order to collect information about phenomena, or even to search for possible experiments that could be carried out to answer stated scientific questions. They would also frequently suggest carrying out virtual experiments relevant to the topic. So learners became able to use ICT as a means of deciding about experimentation and carrying it out. These are significant parts of computer assisted science inquiry (Harlen, 2013). On the other hand, when it came to presenting their investigation and explaining how, why and what they planned, learners faced challenges. Sometimes, they could not justify the decisions they got. When explaining what methodological process they would carry out, they would present experiments that would not directly relate to the question they had to answer. There was improvement by the end of the study, but not that significant. In other words, they would lose focus, a challenge commonly seen (Kellow, 2006). In short, learners conquered aspects of the guided research level, along with relevant ICT benefits, but not totally (Eastwell, 2009; Jarvis, 2012; Přinosilová et al., 2013).

Question 4.: "Did the Learners Use ICT to ask Questions?"

Learners' ability to ask questions and clarify problems or areas for experiments with the use of ICT improved after participating in five or six tasks, but this improvement was rather limited. When learners were presented a topic and asked to discuss about it, most of the times learners would either give no answer, or would answer based on previous experience. Replies such as "We don't know about it," show that they would treat it as a question to test knowledge instead of suggesting questions and plans. Even though this is necessary for investigation, there was lack of identifying a subject to discuss and search further. This attitude was probably due to missing experience with activities that were of such a nature (Harlen, 2013). In relation to that, the learners' use of ICT in order to specify topics that call for study was not very extensive either. Even though several learners explained they were aware of using software to present study ideas, or social network sites to communicate with others, they could not use this in relation to science topics to question. In cases where they were encouraged to use the software or sites, it was difficult for them to stay focused on the topic. The challenge of focus lack is apparent in asking questions, as with planning investigations (McMahon et al., 1999; Kellow, 2006; Harlen, 2013). Learners faced common challenges in identifying topics to investigate and ask questions with the use of ICT. The open research level was not significantly attained by them (Eastwell, 2009; Jarvis, 2012; Přinosilová et al., 2013).

Table 1

The	Findings
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Question 1. "Did the learners use ICT to evaluate hypotheses?"	Question 2. "Did the learners use ICT to draw conclusions?"	
 They understood what evaluating hypothesis includes. They were able to evaluate hypotheses. They used ICT for that purpose. 	 They were able to draw conclusion. They understood the potential of ICT, especially simulations. 	
Question 3. "Did the learners use ICT to plan scientific investigations?"	Question 4. "Did the learners use ICT to ask questions?"	

Conclusions

This research examined a case of implementation of computer-assisted science inquiry. This approach is known to be beneficial for learners as it promotes effective knowledge construction, skill development and attitude adoption about science, ICT and science learning. However, challenges arise as school culture and contexts are not ready to accommodate it. The reasons are lack of time, pressure of duties of teachers, and the fact that pupils are not used to learning through inquiry (McMahon et al., 1999; Kellow, 2006; Twidle et al., 2006; Harlen, 2013).

The aim of the research was to identify if these challenges could be alleviated when implementing teaching science through computer-assisted inquiry in a flexible context. The research took place in a primary school in Greece, where a science club is conducted. The teachers of clubs have no prescribed curriculum to follow. They have the opportunity to arrange the syllabus, to select what topics to teach, tasks to implement and teaching approach to use, and to manage time appropriately (Law No. 3966/2011). So the context of the clubs was flexible and appropriate for this research.

The classification of Eastwell (2009) about the four levels of science inquiry, in combination with the findings of Harlen (2013) about evaluating the effectiveness of computer assisted science inquiry teaching, was used. The findings showed that learners attained the level of confirmatory and structured research. This means they were capable of using ICT in science processes to collect data, test hypotheses and draw conclusions about phenomena and concepts. They did not completely attain the levels of guided and open research, as they gave limited proof of effective ICT use in, evaluating data, planning science investigations and forming questions.

There were encouraging results. It is possible to promote computer assisted science inquiry teaching in a flexible context although challenges that literature describes

emerged. Learners' lack of general experience with that practice and losing focus were perhaps the most prevalent. In conclusion a flexible context can assist promoting computer assisted science inquiry teaching to some extent (Osborne & Hennessy, 2003; Twidle et al., 2006; Crawford, 2007; Harris & Rooks, 2010; Harlen, 2013; Sun et al., 2014). Before generalizing these conclusions, though, it is important to point out the limitations of this study, which have to do with the specific context, period of time and number of learners involved (Bell, 2001; Cohen et al., 2011).

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THE USE OF SMARTPHONES AND SOCIAL MEDIA IN SCHOOLS OF KOTA SALATIGA, CENTRAL JAVA

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Abstract

Smartphones and social media are the source of entertainment and communication for many students, both inside and outside of school. This is the case in Indonesia where high numbers of students from Year 6 to senior schooling have access to a phone and social media. To investigate student use of smartphones and social media, it is therefore appropriate to collect data from students. Children know first-hand what they do, know and think about the environment created by smartphones and social media. This study will inform educational leaders about design learning of the future.

Introduction

The focus of this study is about knowing the learner and his/her context as the basis for designing learning. Historically, Ausubel (1968) and colleagues suggested this to mean building knowledge of the child's physical, emotional, social and cognitive environments. In the late twentieth and early twenty-first century, knowing the learner encompasses knowledge of the digital environment from and the digital experiences with which learners come to school, including where children have no access to digital processes or artifacts (Thrupp, 2008). Childhood has changed as a result of the introduction of information communication technologies. Thrupp claimed that ICTbased identities of students require greater responsiveness to an increased diversity in classrooms than in pre-ICT eras. Understanding the digital context of students and their ICT-based identities in a wider learning community enables schools to design a total learning environment, both physical and curriculum, in which students feel comfortable and learn in a way that meets their needs in the twenty-first century. In a recent study, Palekahelu, Hunt and Thrupp (2016) examined access to and use of ICT by school-age children in Central Java, Indonesia. This earlier report identified the prevalence of mobile technologies in this age group. As a general rule, mobile technologies are widely available and used in Indonesia. This is particularly the case in the schools and homes of the students surveyed. The data used for this report was a subset of the data gathered previously during an earlier study. In establishing an understanding of the use of smartphones and social media as mobile technologies, purposeful consideration can be

given to the extent of and nature of impact of this phenomenon on schools, classrooms and learning. This study confirms the wide availability and use of smartphones and social media and delves into the uses and social practices by students developing a picture of the contemporary learner in Indonesian schools. The study provides starting points for schools and education leaders to consider future approaches in learning.

Literature

The influence of the environment from which students come has long been recognised as a factor in improving schooling. The environment is constituted by background experiences from which knowledge and attitudes develop. Considerable theoretical work on prior knowledge (Ausubel, 1968) has influenced teachers as they work to know their learners. On this basis, curriculum is designed as a composite of content and strategy to create success in learning. The importance of background and experience are further extrapolated in the concept of inclusivity, enabling all students to achieve successful learning despite variables in their background. Given this, the digital context from which learners arrive at school daily needs to be visibly recognized and valued in the classroom (Thrupp, 2008). This study makes visible the digital context of learners in Indonesian schools.

The Context of Childhood in the Twenty-First Century

The social practices that constitute childhood, once dictated by geographic areas (Prensky, 2001), are no longer limited in this way. Childhood has changed for this generation. Childhood interactions occur with a variety of different groups in different geographical locations, breaching the limitations of distance, time and culture (Jukes & Dosaj, 2006). Both social and pedagogical activity (Hayes, Mills, Christie, & Lingard, 2006) in childhood has changed. For some children, personal lives have both virtual and physical components marking this generation apart from earlier generations (Sefton-Green, 2001). Key to these changes is the ICT-driven interactions. These changes in childhood social practices associated with digital technologies are associated with changed thinking about learning throughout childhood. Schools can no longer claim ownership of learning (Condie & Munro, 2007). Contemporary learners have increased opportunities to learn from others, have control of that learning (Somekh et al., 2002) and learn anywhere and anytime (Davies, Hayward & Lukman, 2005). ICT have provided this context. There is a need to understand prior learning and background experiences (Ausubel, 1968) as the "local reality" of teaching and learning (Wink & Putney, 2002, p. 30). Understanding "local reality" enables teachers to define their role to meet the challenges of working with contemporary learners. With this, teachers determine school organisation and classroom pedagogy to enable successful learning.

Social Media in Indonesia

Social media affords the opportunity for students with online access to contribute to the world in meaningful ways (Richardson, 2011). Social media allows students to create, share, discuss or exchange ideas and information online. Between 2004 and 2009, the amount of time that students aged 2 to 11 spent online increased by 63 per cent (Varlas, 2011). According to Asosiasi Penyelenggara Jasa Internet Indonesia (eMarketer, 2015), Internet use is synonymous with social media use in Indonesia (see Table 1).

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	N= 2000
Digital Activities Conducted by Internet Users in Indonesia, February 2015	aged 18-65

	% of respondents
Use social networks	87.4%
Look for information/search/browse	68.7%
Instant messaging	59.9%
Latest news	59.7%
Upload/download videos	27.3%
Email	25.4%

This same group, (eMarketer, 2015), reported that the vast majority of Internet users (85%) conducted online activities using their mobile phones. Fewer than one in three respondents went online using a laptop computer, desktop or tablet. In another online forum (Redwing-Asia, n. d.), the use of social media is well described in the following:

Indonesia is currently vying with Brazil for the title of social media capital of the world, and the stats show why. It is the world's 4th largest market for Facebook, 5th for Twitter, and 12th for LinkedIn. The reason for being at the top of the tables is twofold. Firstly, demand: Indonesia has an exceptionally social culture, and the statistics simply reflect the online expression of the real world in Indonesia. The second reason is supply: ingenious tweaking gets Facebook working on even the lowliest feature phone, so more than 80% of the mobile base of 278 million subscribers can potentially access social media services. (para.1)

The use of smartphones and social media are cause for investigation, and in the case of children the investigation must take place with the children, themselves.

Student Voice and Use of ICT

Much childhood activity with smartphone and social media is invisible to those in the immediate vicinity of the child. Much of the information that needs to be known about students and their interactions with smartphones and social media can only be learned from the student. A growing body of research in the area of ICT has produced findings from data provided by children. This approach to data collection is known as *giving voice to children and students, student voice* (Thrupp, 2008). Fromme (2003) argued for the need to hear children when childhood is being examined. After all, it is their social and cultural milieu. Effective data collected from children results from techniques that acknowledge that children provide relevant and valid information (Somekh et al., 2002; Appleton, Hunt, Heldsinger, & Thrupp, 2006; Thrupp, 2008; Mojica-Casey, 2014). These techniques acknowledge the distinctiveness of gathering consistent and clear data from children and the need to capture the "social, cultural, situational and contextual" reality of children (Stake, 2005, p. 452).

Research Questions

- 1. What use is made of smart phones in schools? What is the frequency of their use? How much time is given to using smart phones?
- 2. 2.What use is made of social media for learning? How much time is given to using social media?

Methodology

The research used a mixed methodology, where the survey collected data that was both closed response (quantitative, using Likert scales) and open response (qualitative). Trained enumerators administered the surveys in fifty-two schools including primary/elementary, lower secondary, senior secondary and vocational schools, with a requirement that sampling represented schools in urban and peri-urban areas. Students participating in the survey ranged from 10 to 18 (Year 6 to Year 12).

Table 2

Number of School Type in Sample

	Number of type	Number of female students	Number of male students
1. Primary/Elementary	33	481	456
2. Junior Secondary	10	218	201
3. Senior Secondary	6	151	105
4. Vocational High School	3	68	58

Data Analysis

From the total of 1738 respondents, 80.5% own mobile phones, while 19,5% do not own personal mobile phones. From the total of 1399 students that own mobile phones, 92.6% own one mobile, while the other 7.4% own one or more mobile phones.

Table 3

About Smartphones N=1738 80.49% of students reported ownership of a smartphone 29.40% of students reported using smartphones for learning either one or more times a day or two to three times a week 23.30% of students reported using their phones at school for social activity either one or more times a day or two to three times a week

As might be expected, there is an increase in ownership in the higher levels of schooling: 71.5% of upper primary students have a smartphone; 80.2% of lower secondary students have a smartphone; with the figures being 95.6% and 81.75% for senior secondary and vocational schools, respectively.

Table 4

Brand of Smartphone Commonly Used by Students			Not all students responded to this question
	No. of references		No. of references
Samsung	389	Evercoss	66
Advan	193	Oppo	66
Smartfren	171	Sony	41
Asus	121	Nokia	34
Lenovo	97	Blackberry	30

From the total of mobile phones used, the largest numbers by brand representation are Samsung (27.2%), Advan (13.6%), and Smartfren (12.0%). In the data available, 14.4% of primary/elementary students use smartphones in learning activities either one or more times a day or two to three times a week; for the other schools and the same frequency, the data are: 19.25% in lower secondary, 90.4% in senior secondary, and 58.9% (73) in vocational schools. Facebook, YouTube and SMS dominate social media use at home though a diverse range is reported.

The use of social media at home is twice the frequency of use reported at school (see Table 5 and Table 6). Other social media used by students included: BBM (cross platform), IMO, Instagram, WeChat, Path, Blogs, WattPad, Quipper, Google Hangout and assorted email packages.

Table 5

About Social Media at Home	N=1738
59.09% of students use Facebook	
21.28% of students use Twitter	
53.10% of students use YouTube	
85.78% of students use SMS	
39.29% of students use Line	
27.67% of students use WhatsApp	

Table 6

About Social Media: Frequency of Use Home Versus School

35.55% of students use social media at school either one or more times a day or two to three times a week

64.55% of students use Facebook or social media at home either one or more times a day or two to three times a week

These data were further analysed according to level of school. In all instances, greater use occurred at home with less of a difference between use at home and school evident in senior secondary and vocational levels. For the complete cohort, 35% use it at school either one or more times a day or two to three times a week, whilst at home this shifts markedly to 64.6%.

Table 7

Locational Use of Social Media by Students	Not all students responded to this question		
	At school	At home	
Primary/Elementary	20.6% (185)	54.3% (497)	
Junior Secondary	34.7% (141)	71.7% (295)	
Senior Secondary	80.8% (202)	90% (226)	
Vocational High School	72.6% (90)	83.2% (104)	

One question asked specifically about using social media at school for *learning*. Table 8 summarises students' use of Facebook and other social media either one or more times a day or two to three times a week *at school and for learning*.

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Soeiar meana ana Deanning ar Sentoor		Not un students responded to uns question
	No. of references	
YouTube	686	
SMS	352	
Facebook	351	
Line	137	
WhatsApp	92	
Twitter	76	

Social Media and Learning at School

Not all students responded to this question

The use of social media at school showed 98% use it to search for learning material, that is for enhancing knowledge, searching for information assigned by a teacher, finding the meaning of difficult words, translating English to Indonesian, and for communicating learning materials and assignments given by a teacher. A small number of students use social media at school for social activities such as: updating status, commenting friends' status, posting pictures, etc. Students were asked to describe some of the things they do with social media at home; this diverse use is shown in Table 9.

Table 9

•	0		
News	83	Video/YouTube	72
Chat	205	Jobs	48
Facebook	63		
Status	102		
Friend	195		
Games	122	Learn	47
SMS	47	Search	80
BBM	41	Information	211
Photos	25	Lesson	26

Student Activity Using Social Media at Home

The analysis here is of single words. However, they were often contextualized further in combination with other words, e.g., chat with friends, upload photos, find jobs (employment), download videos, contact friends and family. One particulate grouping demonstrated that social media was also used at home for the purpose of schooling (shaded text above). While social media outside school hours is significant, 76% utilized it for social activities such as communicating with friends, sharing pictures, looking for entertainment, as well as gaining information related to their learning. Students were asked to indicate approximately how many hours each day they used specific social media (see Table 10).

Table 10

Daily Hours of Use of Social Media

1702 students responded to this question

	-						
Social Media	0.199 hours	1-3 hours	4-6 hours	7-9 hours	>10 hours	Do Not Use	
SMS	328	704	96	22	49	446	
Twitter	129	203	12	0	4	1356	
YouTube	209	672	44	6	13	745	
Line	155	408	48	18	33	1043	
WhatsApp	114	266	20	6	19	1225	

SMS, Facebook and YouTube appear to be the social media most widely used. With reference to SMS and Facebook, a number of students suggested that they were connected 24/7. These students were mainly from the secondary and vocational phases of schooling suggesting the primary students may use a restricted set of social media.

Answering the Research Questions

RQ 1: What use is made of smartphones in schools? What is the frequency of their use? How much time is given to using smart phones?

The data suggest that as a mobile technology, smartphones live in pockets, in the hand and in the school bag. They provide instantaneous and endless access to a wide range of social media. Students make use of these diverse media in a way that matches their style and that of their friends. As a result, they are accessible at all times, enabling frequent use both in school and out of school. By the time students are in higher levels of schooling, use of social media could be said to be habitual. The diverse use of social media, both in frequency and nature, challenges school leaders and teachers to understand the variety of experiences students bring to school (Ausubel, 1968).

The answer to this question must be considered against the prevailing views of Indonesians who regard the Internet and social media as almost one and the same (eMarketer, 2015). Smartphone ownership in the schools surveyed is high (80.5%). More than 30% of students use these devices either one or more times a day or two to three times a week. At the same time, students have said that their use of social media at home is high, with 1122 students using Facebook or social media either one or more times a day or two to three times a week.

The broad list of social media used at school includes Facebook, Twitter, YouTube, SMS, Line and WhatsApp. The use made of these tools and the wide range of tools and apps connected to the Internet, is mostly about communication across social groups and searching for information for class work.

The difference in home/school use of social media using smartphones decreases across the years of schooling. It is clear that there is a strong difference in the use of social media by primary/elementary students at home and school. More than twice as much use occurs at home. The extent of difference in home/school use is similar for junior secondary students. In senior secondary and vocational schooling, the difference between home/school use decreases extensively.

RQ 2: What use is made of social media for learning? How much time is given to using social media?

The data suggest that school related learning occurs through the use of social media. It is evident that students no longer rely upon the teacher or the school to learn. Students are using social media and thereby learning different ways to learn and how to control their engagement with learning, engaging in pedagogical activity away from school (Hayes et al, 2005). It can be assumed that the diverse experiences with social media beyond the school are creating different types of learners, bringing to school different expectations of learning and curriculum. This could be a challenge for teachers to create new and different pedagogical frameworks. Students have been less clear about precisely how they use social media and the Internet for learning, although there are statements about capacity to complete tasks set by the teacher and to locate current information for presentations and assignments.

Social media is used at school by 98% of the students surveyed. They use it to search for learning material, for enhancing students' knowledge, for searching for information assigned by a teacher, finding the meaning of difficult words, translating English to Indonesian, and for communicating learning material and assignment given by teachers. The greatest time allocated to use of social media by students appears to be in the range of 1-3 hours per day, with some students being connected 24/7 (mainly from secondary and vocational schools). Table 10 clarifies these data more fully.

Where to from Here?

Smartphones, social media and the Internet are to a large extent the same thing in the Indonesian context. The smartphone creates the connectivity, and the Internet provides access to the social media. This is a cultural scenario that needs to be understood by those who bring distinctly Western and developed nation views to this research. There is a need to understand the local context and consider how this influences expectations and possible solutions to learning in a connected world. Indonesia does not rely on copper wire networks for telephony and Internet access, as say does Australia or the US. Therefore, arguments about the possible solutions surrounding how the Internet (including smartphones and social media) need to be explored from the prevailing cultural context. These 'wired and wireless' technologies are embedded in the Indonesian culture. The question is: How can this be value-added to grow learning opportunities in a safe and secure environment for learners?

School leaders and teachers are faced with a diversity of learners, strongly influenced by the learning afforded them through smartphone technology and social media. Strong use of social media opens a diversity of social practices, giving students freedom in an unsupervised social environment. Students learn to be independent and in control of their communication and learning, recognising that they do not need to depend on teachers and schools for learning. Learning is now available outside the school gates. Teachers need to recognise that students come to school having learned extensively, school-type learning in an out-of-school context in ways that match their learning styles. They have collaborated with friends and self-directed their use of time and engagement with topics. These learners may challenge a traditional teacher-directed pedagogy.

The Challenges

The horse has bolted one might say. The Internet and all it embraces is an established part of life for many Indonesians, including its school children. Personal beliefs around the Internet and the World Wide Web are well developed due to access to and use of social media through smartphones. The cultural aspects of how Indonesians perceive the connected world must be respected. The challenge is for education system authorities, school principals and teachers to elaborate upon this information to build a view of the contemporary Indonesian student. A comprehensive view built upon this meager start will serve to build curriculum and pedagogy that create a match with the contemporary student, the way they now learn and want to learn. Many schools will be responding, but the challenge for some systems and some teachers will be difficult. The solution must lie in exploring examples from around the globe that have harnessed mobile phones and social media to grow learning.

Moving Forward

To ensure the safety and security of schools and their students, rigorous policy should be developed and implemented in legislation to ensure that learning is maximized and safety is paramount. There are numerous Net Safety programs based on such policy that could be appropriately adapted to Bahasa Indonesia.

Schools will need to develop policy around the use of mobile technologies in schools, Again, there are many examples of how this can be achieved. Whilst there is considerable negativity around this notion, this is in a context alien to Indonesia that has established patterns of use.

Teachers will require training and development opportunities that illustrate how these technologies can be harnessed to serve their students for the future and their well-being. Think tanks of innovative teachers need to be created and encouraged to share their practice. Parents can be a school's best friend. Schools communicating with parents via social media should be explored and developed further.

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THE INTERNET: THE VIEWS OF YEAR SIX STUDENTS

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Abstract

As the Internet encroaches into our daily activities, and the Internet of Things (IoT) looms on the horizon, children's conceptualization of the Internet, its elements and functions, forms the basis of its use in teaching and learning. Only the children know what they know and think about the Internet. This research draws upon children's ideas of the Internet. Participating students were asked to *Draw a picture of what the Internet looks like, sounds like and feels like*, using pictures, words or both. What the researchers found was amazing!

Introduction

There is a paucity of research that has explored student beliefs about the Internet. While there is considerable research around student access to and use of and, more specifically, students' activities with the Internet (and ICT more generally) and many commentaries about students' interest in the Internet, there is a lack of clarity around what children know the Internet to be. Establishing some baseline understanding of the view of the Internet held by Year six students has the potential to inform teaching practices: this is based on the constructivist idea that it is necessary to know what students know as the basis of further learning. This research attempted to capture the beliefs of children about the Internet from children in Indonesia and Australia, using a methodology familiar to children, drawing.

Literature

Data and research tell us that access to and use of the Internet by children varies with age and in many countries use is extensive (Green, Olaffson, Brady, & Smahel, 2011). Morimoto and Friedland (2010) refer to this as *media saturation*. This use is determined by access and views of the Internet. Views of the Internet, its structure and function, form the basis for how children interact with it for learning, both independently and more formally in the classroom. Examining these views can form the basis of teacher planning for classroom usage. Many studies (Ofcom, 2014) conclude that children use the Internet for entertainment including gaming, social activities and communication.

In Livingstone (2003, p. 4), it is suggested,

Numerous commercial surveys chart children's favourite websites, showing that children value this new medium for information and entertainment, for relieving boredom and, their preferred activity, for communication (chat, email, instant message). BMRB's Youth TGI (2001) showed that the most common uses are studying/homework (73%), email (59%), playing games (38%), chat sites (32%) and hobbies and interests.

The suggestion in this paper is that an understanding of the Internet that includes these ideas has advantages for students in contemporary classrooms (Hunt, 2007; Linn, 2004). The Concept to Classroom website (Education Broadcasting Corporation, 2004) suggests,

The strength of the Net is in its ability to greatly increase the communication and collaboration among students and teacher, to increase the range of resources available to students, and to provide students with multiple ways of presenting their ideas and opinions. (para.1)

Prensky (2007) offers a different set of advantages including student engagement and increased motivation, collaboration with other students, flexible learning -- anywhere, anytime and anyhow. In White (2008), a definition of publishing on the Internet is proffered, "The WWW had moved towards becoming a read/write platform where users could engage with others, contribute and publish information in several formats including text, graphics, animation, audio and video" (p. 3). The fundamental ideas known and broadly agreed about student use of the Internet are clearly organic and the ways these ideas change is rapid, such is the growth of tools and devices available. Richardson (2011) suggested social media affords the opportunity for students with online access to contribute to the world in meaningful ways. It allows students to create, share, discuss or exchange ideas and information online. According to Asosiasi Penyelenggara Jasa Internet Indonesia (eMarketer, 2015), Internet use is synonymous with social media use in Indonesia.

Studies to date (with students) have used surveys to identify trends of use, access, and type of activity on the Internet. Few focus on what the Internet is from a technical perspective: a massive network of networks, a networking infrastructure. Children's views of the Internet create a different focus for research. This study examines these views and proffers ideas on the contribution of these views to Internet-enabled learning for a classroom context as a reference for teachers and education systems.

Research questions

- RQ 1: How do students describe the Internet?
- RQ 2: What are the dominant features of these descriptions

Methodology

This study used a qualitative methodology engaging children in an activity enjoyable to most children, namely drawing. Year six children were asked to show what they think and believe about the Internet using a combination of words and pictures: *Draw a picture of what the Internet looks like, sounds like and feels like*. This draws support in research by the works of Moreland and Cowie (2004), Appleton, Hunt, Heldsinger and Thrupp (2006), and Hunt (2015) and elaborates upon the idea of thinking with graphic organisers (Novak & Gowin, 1984).

Procedure Two mixed gender classes of Year six primary/elementary students participated in the study: one in Central Java, Indonesia and the other in Queensland, Australia. Students were encouraged to use drawings and annotations to show their

ideas. Data from each school were analysed manually by members of the research team and themes identified. Both data sets were analysed by an external moderator to ensure consistency of interpretation. Both sets of data are presented using the identified themes, followed by a comparison of the data sets.

Data Analysis

Themes identified in the data about the Internet included appearance, uses, evaluation/judgement and emotions. These themes were evident in both data sets. The data from each country is introduced using holistic statements from participants to forefront a more detailed comparison that follows with a discussion of data sets. Each data set had some unique attributes and these are discussed separate to the larger themes.

Indonesian Data

Indonesian participants show that Year six students are capable of presenting their ideas,

The point is that by using the Internet we can find many things and see anything. We can sell and buy things in the online shop. The weakness of the Internet is [that it is] sometimes slow and runs out of bandwidth. But, by using the Internet, homework can be done.

This statement demonstrates a critical view of the Internet, some of its uses (e.g., finding out, seeing, purchasing, and doing homework) and elements (e.g., bandwidth, connections). Use of the word *weakness* shows that the Internet is viewed as having strengths and weaknesses.

A second quote identifies a further category of responses, emotions,

Sometimes feel angry when I lose, especially when I am almost winning but because of the games lag and broken [Internet connection], I had to go back to the main menu. That can make me cry, angry and screaming.

The image of six asterisks (*****) that follows this statement elaborates on the extent of emotion related to the Internet.

A third quote forefronts uses, appearance and evaluation. "We can search for so much knowledge and other things that [are]useful. We can read comics. We can open social media such as Line, WhatsApp, and Blackberry Messenger (BBM)." Words such as *useful* identify the ability of Year six students to evaluate the Internet, identifying aspects of the Internet (e.g., Line) and its uses (e.g., searching).

Australian Data

The Australian data is presented in a different format to that used for Indonesia as it contained two student perspectives statements worthy of a closer analysis. Case Study 1 represents unique data from a single student. Case Study 2 is representative of the data of most participants.

Case Study 1. The participant described the Internet as a "world of knowledge. It is a big space of imagination that is intriguing." Though it appears to have "freedom and fun it feels like someone is watching or doing things we don't know of." This participant associates "addiction" with the Internet and a place where you need to "think before you click."

Case Study 2. The Internet "looks like videos, websites." It consists of "hard drives, computers, phone, mouse and TV, peoples' voices," and "beeps and bops."

A Comparison of Data

In analyzing the broader themes, it became evident that there were considerable similarities between the two student cohorts, whilst there were also some unique features. This section analyses and compares data from the two schools according to the themes identified: appearance, uses, judgment/evaluation and emotion.

Appearance

Views of the appearance of the Internet differ considerably. The appearance is defined for these students by the physical reality for them. In the case of the Indonesian students, it is the graphical user interface of the social media. Australian students more frequently refer to the hardware they use and home pages, e.g., Google, though there was also a sense of the graphical user interface as the Internet. Some sense of the size of the Internet is evident in the Australian data. Interestingly, the references to *connection* and *speed* are more evident to Indonesian students because of the constant problems they experienced. This reference to speed and connection is also reported in the: *Policy Brief: Evaluation of ICT in Education in Papua Province* (Analytical Capacity Development Partnership, 2015).

Table 1

Indonesia	Australia
 Indonesia Students described the Internet using words such as <i>connection, speed</i> and <i>modern</i>. References to <i>modern</i> were common. Three physical descriptions included <i>small</i> box, white colour, white and looks like a sewing machine when loading and thirdly, like a rotating ball. Other physical references indicated sounds that are obvious when connections are made, for example, Facebook and <i>when someone</i> wants to talk to us. Lists of software and applications suggested that the Internet looks like <i>Line, WhatsApp, Blackberry Messenger, Google, YouTube, Facebook,</i> and <i>Instagram.</i> Students described games including <i>Minecraft, Avatar skin, Angry Birds</i> and Star 	 Australia The Internet is described as <i>everything</i>, <i>listening to people</i> and <i>talking</i>, <i>different accents</i> and <i>noises</i>, <i>both loud and quiet</i>. A sense of size for the Internet was given by <i>huge</i> and <i>the world</i>. Others presented different physical views: the Internet is strongly associated with hardware used e.g. keyboards, screens, desktop computers and headphones Linguistically, students described it as: <i>It looks like a heap of little square shaped pixels</i>. Others described the screens as having <i>shapes, colours (red and black), letters</i> and <i>action</i>. The Internet appears associated with what is seen on the screen. <i>Home pages</i> and <i>Google</i>
Wars II.	 were frequently mentioned. Specific applications other than YouTube were not mentioned.

How the Internet Appears to Students

Uses

The Internet is a diverse environment of fun and entertainment for *avoiding boredom* and *filling leisure time* according to the data. In the Indonesian context, the entertainment is related to communication with friends. Australian students identify

music and videos for entertainment, predominantly. The Internet as a place of learning is more clearly enunciated by Indonesian students and less so in the Australian data. Communication is evident with less frequency in the Australian context. Unique to the Indonesian data were references to the Internet being *motivational*.

Table 2

Student Uses of the Internet

Indonesia	Australia
 Indonesia The Internet is: <i>diverse can be used for</i> <i>everything</i>, or <i>look for anything</i>. The Internet was viewed as: sharing and communicating. Described as <i>seeing updates</i> <i>about other people, contacting other people</i> <i>via social media, seeing other friends'</i> <i>postings, chatting to friends,</i> and <i>we can</i> <i>know people that we don't know.</i> NOTE: This latter might raise concerns amongst educators if not managed well through Internet Safety programs. The Internet was also related to learning: <i>lessons, learning materials, understand new</i> <i>things, search for so much knowledge and</i> <i>other things, getting knowledge,</i> and as a way of dealing with <i>difficult homework.</i> The Internet as entertainment was commonly referred to as: music, favourite songs, streaming video (e.g. Stand-up comedy) and 	 Australia The Internet is seen as a place of entertainment. The words <i>fun</i> and <i>entertaining</i> were common. Limited references were made to <i>sport</i>, communication, <i>learning</i> and <i>opportunities</i>. Entertainment included <i>listening to music</i>, accessing <i>different music</i> and <i>noises</i>, <i>recording</i>, <i>YouTube</i>, <i>video uploading</i>, and <i>Google</i>. <i>Music</i>, <i>videos and YouTube</i> were the forms of entertainment to which there were most frequent references. <i>Sport</i> was mentioned several times. Data such as <i>words</i> and <i>messages</i> attributed communication to the Internet. <i>The Internet</i> <i>is a great way to communicate to the people</i> <i>you want to talk to as well as see them</i>. Learning was evident for <i>searching places</i>. <i>You can learn and [it can] help you get</i>
online games.	

Judgements/Evaluations

The Internet is a place that is readily judged and evaluated. All students felt comfortable with rating the Internet as interesting. Importantly, students identified the Internet has having extremes. Attributes, both good and bad were identified. Australian students were more likely to discuss the trustworthiness of the Internet. Terms alluding to the Internet as noisy, ugly and rude appear less frequently in both data sets though are worthy of future study within the context of students being safe on the Internet.

Table 3

Indonesia	Australia
 The Internet is seen as: <i>helpful, useful, very useful, popular</i> and <i>interesting</i>. Others used words such as: <i>dazzling, weird, wasteful, noisy</i> and <i>ugly</i>. These descriptors not commonly found in the literature. The term <i>wasteful</i> was contextualized by <i>because we have to have quota/bandwidth</i> 	 The Internet is seen as <i>interesting</i> and <i>smart</i>. Other attributes included: <i>extraordinary</i>, <i>fantastic</i>, <i>fabulous and awesome</i> These judgments were balanced by: <i>good</i>, <i>bad</i>, <i>not good</i>, <i>boring</i> or at least, <i>not boring</i>. The attributes of <i>rude</i>, <i>mysterious</i> and <i>trustworthy/well-trusted</i> require further investigation.

Judgments/Evaluations Made About the Internet

Emotions

The Internet as an emotional environment was supported strongly in the data (Table 4). The majority of participants expressed their views with multiple adjectives, strengthening the conviction with which they expressed these views. Both negative and positive emotions are attributed to this environment, some students expressing the full spectrum in one statement, for example, *light, funny, sad, dark*. Other examples included *gives sounds like my heartbeat when he/she is in the BBM* balanced by *sometimes makes me scared and emotional*. Terms used such as *sorry, guilty,* and *hurt feelings* deserve future clarification within the context of safety.

Table 4

Emotive Ideas Expressed About the Internet

Indonesia	Australia		
 One participant stated <i>touches emotions</i>. Positive emotions described: <i>fun, enjoyable, nice, cool, exciting, sensitive, sweet, WOW, relax, interesting</i> and <i>surprised</i>. Negative emotions described included: <i>sad, scary, hurt feelings, angry,</i> and <i>insensitive</i>. Some participants contextualized the one-word emotions further: <i>Enjoyable when we play online game; Cool to hear music;</i> <i>Fun when we can see other friends' postings in Facebook;</i> <i>Fun because we can search for so much knowledge; and Exciting when chatting to friends.</i> The Internet is also viewed as <i>hurting feelings</i> and could be related to the term <i>insensitive</i> giving way to <i>sad for no reason.</i> 	 Many words to describe emotions included: enjoyable and funny. Funny was emphasized further by cool, relaxing, hilarious, joyful and happy. Positive emotions were frequently balanced by: confusing, sad, dark, sorry, guilty, creepy and shocked. The Internet appears to create a wide range of emotional type responses. Sorry, guilty, creepy and shocked may need further investigation. 		

The Research Questions

This research sought to explore the following research questions:

RQ 1: How do students describe the Internet?

RQ 2: What are the dominant features of these descriptions?

The discussion that follows is framed by these questions and asks in addition:

- 1. What is the effect of students not knowing the correct definition of the Internet?
- 2. What is the effect of students not being able to differentiate between World Wide Web and Internet?
- 3. What knowledge of the web and Internet should we expect students to have?

The uses of the Internet identified by students in many studies, including this work, dictate what students believe the Internet to be. The composite definition of each group relates to the uses of applications, though in the case of the Australian data, there was an identification of hardware as the Internet, rather than hardware being the device by which the Internet is accessed. Year six students from both countries provide little evidence of the technical structure of the Internet and, therefore, the definition supported by the technical community. The understanding of the Internet by Year six students is constructed from their experiences in using it. It is an environment that they

judge to be of worth for their enjoyment. In Table 5, a comparison of the broad ideas held by students is presented using the broad themes identified. Student data in this Table is italicized and uses are listed in order of frequency within each data set. Same order does not denote equal frequency.

Table 5

Summarv	Comparison	of Data	Organized in	Identified Themes
		- J		

Indonesian	Australian		
Appearance Connection, speed, modern Line, WhatsApp, Google, YouTube, Facebook, BBM, Instagram	Appearance Everything, listening to people and talking, different accents and noises, both loud and quiet keyboards, screens, desktop computers, and headphones represent the Internet Homenages, Google		
Uses Filling in leisure time, motivation, not being bored Sharing and communicating (e.g., know people we don't know) Finding things out (e.g., search for knowledge) Entertainment (e.g., songs, video, games)	Uses Fun, entertaining, sport, communication, learning opportunities		
Evaluation Helpful, useful, very useful, popular, interesting	Evaluation Interesting, extraordinary, fantastic, fabulous and awesome good, bad, not good, boring trustworthy		
Emotion Fun, enjoyable, nice, cool, exciting, sensitive, sweet, WOW, relax, and surprised Makes me annoyed when slow, sad when out of bandwidth.	Emotion Enjoyable and funny, confusing, sad, dark, sorry, guilty, creepy and shocked		

Comparable and common themes were evident in both sets of data. The emphasis or nature of individual themes varied. The appearance of the Internet is that of applications according to Indonesian students. This was less so with Australian students where the appearance was consistent with hardware with few applications listed. Both sets of participants identified the Internet as a place for entertainment, information and learning, and communication, consistent with findings by Ofcom (2014) and Livingstone (2003). While Australian students placed a strong emphasis on entertainment, they placed little to no emphasis on information and learning and communication as entertainment. This was strongly evident in their emphasis on social media. The nature of entertainment identified by both groups differed in other ways; one group placed a heavy emphasis on videos and gaming whilst the other group gave little specific attention to these activities. Dominant features of the Internet as *awesome*, *surprising* and *motivating* were agreed by both student groups.

Both groups use the Internet in different contexts on different devices. Substantially, it can be concluded that both groups have defined the Internet by basing their thinking on their personal use. As a group, clear comprehensive views with social and emotional dimensions were evident. Few participants enunciated a complete personal view. Only a few individuals mentioned any detail that associates with the technical definition of the Internet.
While a few students chose to make lengthy descriptions or explanations, others responded specifically to the sounds like, looks like, feels like structure. These responses were compiled to construct a cohesive response in defining the Internet. It appears that few Year six students are able to enunciate the complexity of the connections, which account for the vast size of the Internet and the technical definitions of the Internet. They understand it to be an environment of seamless links to others and information in a way that is worthwhile for personal satisfaction. Students define the Internet to be about connecting people rather than connecting computers. There is very little cognizance by Year six students of the underlying foundations that technically define the Internet, regardless of culture. Much of that which students consider the Internet to be is the World Wide Web.

The participating students, regardless of culture, view the Internet as an enjoyable place for their entertainment and less so, for communication. The Internet is social, emotional and endless in nature. It is an environment of many emotions, strongly divergent in nature and extent. It is recognized as having two sides, bright and dark. While some commentators and researchers (Richardson, 2011) perceive social media to be an environment of opportunity, this is only minimally recognized by Year six students.

Commentary (Prensky, 2007) in the last twenty years refers to the digital competencies of children. Many names have been applied to children born in the era of the Internet, for example, digital natives. These names accredit children with knowledge of the digital world from having lived in this era. The question remains, what knowledge do we expect children to have? In the instance of this study, is it expected that children know what the Internet is? This study has shown that children have developed partial views for themselves and can describe their views. How do these incomplete, partially formed or incorrect views influence effective use of the Internet in the future?

These questions create challenges for teachers and educators. Students know the Internet to be a diverse environment with some cognizance of the opportunities it offers. This knowledge is limited in many ways. Teachers and educators are now tasked with bringing together the requirements of curriculum that assumes an alternate knowledge of the Internet than that shown to exist for students in this study.

Conclusion

The Internet is a technical term that is defined in general commentary according to its uses or with how students interact with it. Year six students agree with this view. The concept of the Internet as a network of networks is overwritten by the public face of Facebook and Google and does not align with the technical definition. Obviously, there is some confusion between the terms Internet and World Wide Web. Furthermore, there exists some incompatibility between the views of the Internet held by students and student views of the Internet as perceived by educators as evidenced in national curriculum documents. While further research with larger groups of students (in other age groups) is necessary to confirm the findings of this study, this study highlights the need for reflection on perceptions of the knowledge of contemporary learners and of the concerns of students and educators for safety in the Internet environment. The notion of Internet safety appears to be at the fore-front of suggestions made by the Australian students, appropriate in a country with rigorous programs designed to keep students safe. There is no identifiable policy or practice in Indonesia, a position gleaned from

previous studies and conversations by the authors in Papua, West Papua and Central Java.

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MESSING WITH YOUR MIND: USING GAMIFICATION IN A FLIPPED CONSUMER BEHAVIOUR CLASS

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Abstract

With momentum gaining for flipped classrooms, in order to reach and engage millennial learners, it is essential that teaching pedagogy solidly underpin these changes. Yet even with solid pedagogy and reasoning, is flipping the classroom enough to engage students? This paper presents a case study of a gamified second-year undergraduate unit with a flipped classroom design. This study outlines the reasoning behind each of the elements in an effort to not only engage the students in the material, but to also encourage them to think deeply while learning new skills. This case outlines the scaffolding necessary for a constructivist approach to gamification within a business course in Australia. Recommendations are made for future practice.

Introduction

This paper presents a case study analysis of a second year undergraduate business course and the journey to introduce a gamified approach within a flipped classroom experience. Firstly, the paper will briefly present a discussion on flipped teaching and learning within a blended approach. Secondly will be a discussion of gamification in both industry and education. Finally, this study will present a description of a higher education Consumer Behaviour unit and a reflection on the transition from a typical lecture/tutorial to a flipped gamified unit. This paper adds to this emerging body of research by focusing particularly on gamification within a flipped classroom improve student engagement and results? Considering the question will provide insights into how gamification can be applied to higher education within a business school environment.

Flipped Learning

While there is some debate as to what exactly constitutes a flipped classroom, essentially it starts by taking what was traditionally content covered in the lecture and translates that into online materials for students to undertake in their own time, including pre-recorded lectures, podcasts/vodcasts, screencasts, and/or interactive videos (O'Flaherty & Phillips, 2015). However, a flipped classroom doesn't just move the lecture and content online. While the content is delivered online, the key learning comes from what happens in the classrooms when the content is already pre-learned. Flipped learning is the key outcome to the flipped classroom. The Flipped Learning Network defines flipped learning as:

A pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter. (FLN & Sophia, 2014) Yet it is not only classrooms that are seeing less face-to-face and more virtual interaction: "The rise of virtual workplaces and teams suggests that for professional development reasons, some course activities that historically have been conducted face to face should be conducted online" (Arbaugh, 2014, p. 786). Therefore flipping the classroom, or at least providing blended learning/online materials for students to work through and engage with, should progress them not only within the educational environment, but also prepare them for industry experience following graduation.

Also emerging in industry is the concept of gamification. Gamification has been hyped as a next generation method for marketing and customer engagement (Hamari, Koivisto, & Sarsa, 2014). Fortune magazine crowned gamification as the new business concept with a market projection of over \$1.5 billion in 2015 from \$97 million in 2011(Konrad, 2011). However, just because it is a hot marketing topic does not necessarily mean that it will be effective, or translate into student engagement. After all, students seem to be notoriously cynical about anything that is designed to promote their learning.

Gamification

Deterding, Dixon, Khaled and Nacke define *gamification* as "the use of game design elements in non-game contexts" (2011, p. 2). This distinguishes it from being a game in itself. When I was initially asked to describe *The Game* it was difficult to outline what I was doing in this context. I soon realised that it was because I was not creating a game as much as using game concepts to encourage and engage students in classroom activities. Therefore, while gamification can be used to design a game, having a fully designed game is not necessary to implement gamification concepts.

Pedagogy

Self-Determination Theory (SDT) reflects the motivation of students to participate in the gamified environment. SDT argues that competence, autonomy, and relatedness are basic cognitive needs (Abeysekera & Dawson, 2015; Deci & Ryan, 2008). Therefore, if students feel competent that they can understand, and even master, the behaviours required within the unit, feel in control of their ability to do well, and also feel they belong within the social workshop setting, this should increase their motivation. SDT breaks down motivation into intrinsic and extrinsic motivation. To influence intrinsic motivation, the student must find the workshop activities (and pre-workshop materials) fundamentally satisfying and engaging (Abeysekera & Dawson, 2015). Therefore, a context that allows the students to satisfy their basic cognitive needs should, in theory, increase their intrinsic motivation. The gamified environment has the potential to motivate the student extrinsically through rewards such as Points, Badges, Leaderboards (PBLs), and grades. These gamified elements are discussed in the next section.

Relatedness is an important concept within the flipped environment, and I would argue even more so within gamification. Hence my mantra to "let them teach each other." While this does not exclude me entirely from the learning process, it does recognise that by increasing the level of peer-to-peer relatedness, students will be more likely to exhibit game-like behaviours such as teamwork and competitiveness.

Finally, constructive alignment was a key focus of the gamified approach to ensure that good alignment was kept between the learning outcomes, the teaching and learning activities, and the assessments. While I do not teach to the exam, I wanted to create workshops to get students to work on the skills required both in the classroom and also

for their future careers. Constructive alignment of the assessments and the learning activities enables it so that they cannot avoid learning in the format that I want them to.

Building *The Game*

Scope and Aim

For most flipped classrooms, adoption tends to be on a lecturer or a departmental level, rather than as a strategy for an entire institution (Millard, 2012). However, Monash Business School has opened a new program, the Bachelor of International Business (BIB) and set it up as an entirely flipped program. Hence the students immersed into The Game had already experienced two full semesters of flipped mode teaching (up to eight units of study) so had already been exposed to this mode of teaching. Consequently, this paper does not seek to add to the literature justifying, or challenging, the flipped teaching mode. Instead, the aim of this paper is to investigate the introduction of gamification into the flipped mode environment and its perceived impact on engagement, motivation, and student results.

Gamification Framework

The game framework used the six steps of gamification framework (known as the 6D framework, see Werbach & Hunter, 2012) as a base for thinking about game design. These include the following: (a) define the objectives, (b) delineate target behaviours, (c) describe your players, (d) devise activity cycles, (e) don't forget the fun, and (f) deploy the appropriate tools.

Objectives

Within gamification, objectives are specific performance goals that should be performed by the gamers or, in this case, the students. The main goal was to get them to pass the unit. However, breaking this down into smaller goals seemed reasonable. Sub-goals were: to write using their own words using their own examples in application, to read journal articles and use them in written work to support their thinking, and to verbally communicate via presentations, an important skill not just in their degree, but also in their future careers.

Target Behaviours

Target behaviours are what I wanted the students to do; therefore, the main target behaviours were motivation and engagement. To measure this, I wanted them to complete the pre-class materials (essential for an effective flipped classroom), turn up for workshops on time (they have two two-hour workshops per week for a total of four hours of face-to-face time per week), apply the theory to real world examples, talk to each other about their examples, write for at least once a week, and correctly use a journal article for support in their writing.

Players

For this setting, the players were all students undertaking the second trimester course of consumer behaviour. Some of them were previous students, and others were international students transferring into the degree in their second year. While Werbach and Hunter (2012) suggest player modelling when designing any gamified system, this was not something that could easily be done before The Game began: how students would react, what their behaviours would be in the new situation, what their motivations

were, these were not questions that could easily be answered beforehand. However, teaching experience suggested that even within a small group of players, there would be those that fit the classic gamer profiles as defined by Bartle (1996): *achievers* (those who love gaining badges and awards), *explorers* (want to find new content or information), *socialisers* (those who like engaging with others) and *killers* (those who want to impose their will on others). Therefore the design could be set up to accommodate those types of profiles.

Activity Cycles

As The Game ran across a trimester, the activity cycle was fairly set: It would begin in Week 1 and end in Week 12. The Game design was basically linear: students would progress from week to week without deviations (unless they chose to go backwards to review previous theory). The model used in most games is that the players complete an activity (sometimes of increasing difficulty) then followed by a challenge at the end of each segment. Each segment could be considered each week's material, so each activity cycle would be consistent in design. Werbach and Hunter (2012) note "in a gamified system, of course, there probably won't be a 'boss' villain waiting at the end of the line" (p. 275). However, due to the nature of the unit, there would in fact be an opportunity for a boss: the final exam. This would also signal the end of the activity cycle and the end of The Game.

Don't Forget the Fun

Before implementing the game, Werbach and Hunter (2012) strongly urge designers to consider if their gamified system is fun. After all, without the fun, why would the game continue to take place week after week? They question whether you would still play the game if there were not an extrinsic reward. One might wonder if students would sign up for a course without the award of course credit, regardless of whether it was gamified or not. However, thinking about how the game would run, while difficult and time consuming, did make for an enjoyable experience for the game designer. Therefore, it was assumed that if the designer had fun designing the game, students might have fun playing it.

Appropriate Tools

In this last step we implement the gamification elements into the system. For some, considering gamification starts at this stage, with Points, Badges, and Leaderboards (otherwise known as PBL). However, in a well-designed game, these PBL are the mechanics and components of the design: they compliment the objectives, motivate the target audience, and work within the activity cycle. In other words, they serve a purpose rather than being the 'shiny and cool' core focus of the game (Werbach & Hunter, 2012).

Components (and weight of	tuon components and mechanics Description	Used	Mechanics _ Driving Action
assessment if relevant)	HOULDER	where	MECHALINCS – DITVING ACHOR
Quests	The lesson plans each week. Each Quest consisted of two videos, a series of interactive content, and questions to check for understanding. Quests were delivered using a template that matched the template of the Moodle environment to provide visual consistency.	VLE	Challenge – each Quest contained an intro video that set out the objectives of the Quest (the learning objectives for that week) and involved 30-50 minutes of time for students to work through and 'solve' the questions/objectives posed by the Game Master in the introduction video to each Quest.
Boss Fight – Mini- Bosses	A set of multiple-choice questions with a deadline and a 15- minute timer for completion. Completed individually. The mini-boss was portrayed as a character icon on the Moodle site	VLE	Feedback – this allowed the students to test themselves on the knowledge of the quest material. It also set them up for the quiz in workshops.
Immediate Feedback Activities (10%)	A set of multiple-choice questions answered in the Workshop in groups. Conducted on scratch cards that allowed the student to continue to answer until they received the correct mark. Score decreased the more scratches they had to do.	Workshop	Feedback, Reward – Mark given each week. As well, a 100% score earned the group Tokens.
Boss Fight – Big Bosses (70%)	The assignment and the exam. Each Big Boss had its own character icon on the Moodle site, and an accompanying walk-through icon for help with the Boss Battle.	VLE	Feedback- the student was given feedback on the assignment. Reward – rewarded with a graded mark.
Challenges	The homework for the week. Each week I issued their homework via a 15-second video posted to the @consumerbehaviour Instagram page. Students were asked to find an example that matched the theory and post it to their own Instagram site.	Instagram	Challenge – students had to watch the challenge and then post back to the Instagram site with their answer.
Partics	The allocated groups for that week's workshop tasks. At the end of the final workshop each week the Parties were set for the following week.	Workshop	Chance – Each week the students were randomised into different groups. This allowed different combinations of students and strengths to work together
Party Battles (20%)	The 3-minute group presentations conducted on a weekly basis. The Party Battles were the student answers to the Challenge posted on Instagram that week. Each Battle was given a 3- minute countdown timer and had to be completed within that time frame. Each battle was assessed, and feedback given to the Parties within the workshop.	Workshop	Cooperation, Competition – the students had to work in groups to fit their presentation within the time frame. Following all Party Battles each student was asked to vote on the winning Party for that week (they could not vote for themselves).

Table 1 Gamification Components and Mechanics

	Mechanics – Driving Action	Challenge, Cooperation – students worked in their Parties to address the question posed. It allowed them to review the theory from the Quest and improve their writing and referencing skills. Following the end of the 30-minute timer, the Parties exchanged scrolls and a marking rubric was given. Each Party then needed to review, mark, and justify their mark on each Scroll. This writing period allowed them to not only improve their writing skills, but also practice exam-like questions within a time- constrained environment. Marking each other's work also improved their ability to break down an exam question into its component parts in order to address the entire question.	Chance, Cooperation, Competition, Reward – some Badges were released ahead of time so students knew what they had to work towards. Badges for Party Battles needed cooperation for achievement, whereas badges for Mini-Bosses were individual challenges. Other Badges were only released and given after a given behaviour was exhibited (for example, missing a Party Battle without notification) thereby introducing an element of chance into the Badges.	Chance, Cooperation, Resource Acquisition – They were given for exhibiting behaviours such as turning up to workshops on time, completing a presentation, applying the theory correctly during a presentation, and achieving 100% on an immediate feedback activity.	Chance, Cooperation, Competition, Transaction – at the beginning of the game only a few Spells were released. As The Game progressed, more spells were released for purchase. This added an element of chance and risk for some students who began to hoard their Tokens in hopes of a large payout towards the end of the game. Students could cast Spells on their group (encouraging cooperation and gaining ground) or against other groups (encouraging competition and engagement in the game). The driving action of Spells was more fun than for any specific reward or outcome, and added an opportunity to improve student engagement with each other in the workshop.
	Used where	Workshop	VLE	Workshop	Workshop
nification Components and Mechanics Continued	Description	A written piece of work given following the Party Battles that was relevant to the material covered that week in the Quest as well as the Challenge posted on Instagram. Following the Party Battles a question was given to the students. The answer had to be written in 30 minutes and needed to include a referenced journal article. Journal articles were printed and placed in the library, so one student from each party (the "Researcher") had to physically leave the classroom and work in the library to find a quote/paraphrase from one article, complete with the correct reference, to return to their party in the workshop.	Each badge represented a behaviour or outcome that the student had achieved. These included Badges for completing the Quests, Mini-Bosses, Challenges, and Party Battles.	Tokens were a transaction unit given in the game. Tokens were used to purchase spells (see below) and could be collected and traded with other students.	Spells were another transaction unit in the game. They could only be purchased with tokens, and could not be traded with another student. The cost of each Spell (number of Tokens required for purchase) varied between spells, as did the amount of spells available. Spells were limited in number and contained specific rules about when they could be used. A full list of the Spells available and the rules was posted on the Moodle site. An example Spell was the Summoner. This spell can "summon" another Party member from another team to assist for one week
Table 1 Ga	Components	Scroll	Badges	Tokens	Spells

Continu	
nents and Mechanics	
Compo	
Gamification (
Table 1	

While it would be ideal to assume that all students, if given the opportunity to develop using their basic cognitive needs, would embrace the game and be motivated, it is more realistic that many behaviours exhibited by students are as a result of ingrained habits. Therefore, I needed to also consider what behaviours I wanted them to exhibit, and consider how to reinforce positive behaviours to lead them to creating effective habits within the learning environment, therefore using operant conditioning (Bagozzi & Dholakia, 1999). The in-workshop assessments can reinforce the pre-workshop behaviour in a positive way (I studied therefore I achieved a good mark) or a negative way (I did not achieve a mark that I wanted therefore I need to study). As well, because the workshop activities are largely conducted in a group environment, peer-pressure and group dynamics also added to the positive and negative reinforcement.

Scaffolding Learning in The Game

Table 1, on the previous pages, describes the components of the game, where they were used, and their overall purpose (the driving action, or mechanics, behind the component). Scaffolding of the learning process was done through two main mechanisms: myself as the cognitive coach, and other students as peer tutors to scaffold thinking and learning to progressively higher levels. The sequencing of events provided a clear structure to the students in which to build their knowledge. The initial events of Quest/Mini-Boss Battles established the base of their knowledge before entering workshops. Within the workshops, the IFAs allowed students to tutor each other, with each student taking on the role of tutor/tutee depending on their grasp of that week's material. During the first workshop I also was able to coach them through a series of sequenced questions in order to solidity their own learning by using questions to guide their thinking. Once solidified, I was able to present them with that week's Challenge. Challenge and Party Battles continued to scaffold their knowledge construction by developing application skills and using guided inquiry to find and present their own applied examples. Following from this task, the final elements of Scroll writing and peer marking allowed students to both construct and retain the knowledge for that week's material. It also allowed them a sense of personal ownership of written work, and, after peer marking, a sense of accomplishment each week.

Filling the Gap: Why Consumer Behaviour?

While there has been little research done within marketing education on flipped mode and gamification, this is not reason enough to argue that research should be done in this area. Instead, this particular unit in consumer behaviour was chosen because many game elements draw on psychology of student learning. Therefore, in gamifying a course that has psychology elements, such as consumer behaviour, the real 'fun' is in seeing the students recognise that many of the elements they are learning in the unit have been incorporated in *The Game* (for example: operational conditioning as a form of learning where Tokens are used to reward positive behaviour). This epiphany for the students was also a moment of confirmation for me as the lecturer to see that the students could apply their learning outside of the workshop to a wider context.

Keys to Success: Reflections and Recommendations

This paper set out to address one simple question: if gamifying a flipped classroom can improve student engagement and results. The ad hoc feedback from the students so far has been extremely positive, and the pass rate has improved for this unit. Students seemed to find the workshop activities (and pre-workshop materials) fundamentally satisfying and engaging, therefore their intrinsic motivation seemed to increase (Abeysekera & Dawson, 2015). This was demonstrated through increased attendance, participation, and stronger presentation marks as the trimester went along. Therefore, gamification of the consumer behaviour unit would seem to increase both engagement in the materials, as well as the overall student results, which is positive and satisfying to me as the game designer and lecturer. That being said, there are a number of challenges that either need to be addressed, or perhaps just acknowledged for future development.

From my perspective, the Tokens (see Table 1 for details) increased students turning up on time to workshops, and also provided an incentive for their activities within the workshops. However, the use of the Tokens beyond just collecting them (i.e., for Spell purchase) did not take place as early or as often as I had anticipated. Most students tended to hoard their Tokens and did not end up spending them on Spells until the last two weeks of the trimester. While this made for a very exciting last two weeks, I did question if perhaps the incentive of Tokens was enough, and that the Spells were not required. Some students were known to visibly carry their tokens around, so perhaps the incentive of collection and display of Tokens was more important than the purchased Spell reward.

The scroll writing each week also had its pros and cons. While I perceived this was a very effective way for them to learn and practice the materials, once they had written for five to six weeks this seemed to become too routine and less of a challenge. As well, once their written assignment was completed, having students work on references seemed redundant as their focus was shifting more to the exam. Initially, I perceived that creating a consistent, structured environment would allow the students to have a clear purpose and outline of the gamification of their unit. However, introducing more elements of chance in the game would appear to be important in order to both capture and maintain engagement in the materials. Therefore, creating a clear framework with a consistent approach from the start is important, but then allowing for some changes within that framework to create new or chance elements may keep students' attention focused and stop the game from becoming mundane.

What was encouraging is even though the students professed to dislike both presentations (Challenges and Party Battles) and written work (Scrolls), their informal feedback to me indicated that they understood at least why these elements were important in terms of their personal and professional development. They did make huge improvements in both their writing and presentation styles, suggesting that The Game improved both their skills and their confidence about their communication skills. This indicated to me that not all game elements need to be fun for all students all of the time. Practical work that has a clear purpose would seem to be key for gamification in a higher education environment.

Though it seems daunting to gamify an entire course, the students need time to understand and recognise the gaming language and elements, then even more time to integrate them into their habits of study. While every element of the course does not need to be simultaneously gamified, the elements that are chosen should be consistent for the entire semester of study so that the students are not second-guessing what needs to be done for achievement in the course. Creating a consistent framework would seem to be key, though elements of chance still should be introduced in order to maintain a level of engagement and interest in the entire unit of study. Gamification on this scale does take an enormous amount of time, planning, and set up for operationalising, so appropriate measures should be taken by the lecturer/game designer before undertaking gamification of their unit.

Note: This study was undertaken as a pilot study with 12 students and ad hoc discussions and observations to obtain feedback and insights. Future research should be undertaken with a larger class size, with structured survey questions to measure motivation, satisfaction, and engagement.

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NEW LOCALS: OVERCOMING INTEGRATION BARRIERS WITH MOBILE INFORMAL AND GAMIFIED LEARNING

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Abstract

The article describes a study focused on integration of refugee and migrant teenagers to a German society. The research was done in 2015-2016 by a group of students from the University of Bremen, Digital Media Department. The central issue in this research is the migration crisis in Europe that reveals many challenges one of which is the question of newcomers' adaptation to the local society and culture. The paper contains results of a literature analysis, state of the art projects and qualitative interviews. The research was used to complete the requirements for a gamified digital communication application.

Keywords: Informal learning, non-formal learning, gamification, gamification in education, integration, refugees, migrants

Introduction

During the Syria crisis, Germany overall, and each of the Federal States, such as Bremen, helped over 8,000 migrants by accommodating them for humanitarian reasons in 2015 (Schlee, 2015). These migrants came with different characteristics such as different age, gender and educational backgrounds as well as working experiences. Despite these differences, all of the migrants to whom we spoke over the course of our fieldwork discussed the same goal: living a "normal life" in the new country (Personal interviews, 2015). According to a study from the Office of the United Nations High Commissioner for Refugees (UNHCR), 86 percent of young refugees own a mobile handset, and more than 50 percent are using the Internet either once or multiple times per day (Maitland, 2015). This resource creates an opportunity to develop a mobile application that could help migrants to get into contact with locals and by that to adapt in Germany.

The research via personal interviews, literature analysis and exploring existing projects provides a basis for the development of a gamified mobile application. Social norms, behavioral rules, local traditions as well as unfamiliar language, stay in the way of integration of newcomers to a local society and create many inconveniences to both local citizens and migrants. The aim of the application is to support face-to-face communication and social contact to same age locals and thereby learn the new language indirectly in organized leisure time activities by a mobile gamified communication application. The term *gamification* describes the use of game mechanics and experience designed to digitally engage and motivate people to achieve their goals (Burke, 2014). Instead of underlining the difficult situation of migrants, the main aspect is to underline the benefit of learning new languages and making cultural exchange.

Literature Review

Local integration is the process of becoming an accepted part of society. It consists of three dimensions: social, cultural and political (Penninx, 2005). According to the German Nationality Act for naturalisation, a combined language and citizenship test for migrants is employed to prove that they possess an adequate knowledge of German and knowledge of the legal system, society and living conditions in Germany. Acquiring the local language enables the migrant to have the possibility to interact with locals, understand the culture, gain access to a position in the local society and establish a sense of belonging. Therefore, language learning can be seen as a key component to both legal and social integration.

From the interviews conducted for this research, two main problems for integration of migrants surfaced: language barriers and a lack of contacts to local people. From the perspectives of cross-cultural communication studies, communication helps individuals with developing relationships with people (Liu & Gallois, 2014). However, the main obstacle for integration arises in communication. It is not only related to language barriers, but also to cultural differences. To avoid misunderstanding related to various cultural differences, one of the solutions is to introduce cultural specifics to each cultural group. Matthews and Thakkar (2012) report that individuals who have experienced different cultures, are more cognizant of how to alter their communication style so that others understand the information they are trying to transfer. A vicious cycle begins when migrants have low understanding of local language. First, it is harder for them to establish communication with locals; then, the contact frequency for both parties declines respectively.

By considering language barriers, what are the potential tools to help migrants to integrate into a new culture? According to a study of the Office of the United Nations High Commissioner for Refugees (UNHCR), 86 percent of young people in their sample owned a mobile handset. More than a half used the Internet either once or multiple times per day. There is also a high level of interest in a wide variety of Internet based services, particularly social media and news (Maitland, 2015). This statistic shows that using mobile application is not unfamiliar to the migrants. It also provides a potential to develop a mobile application that could help migrants to get into contact with locals and, by so doing to adapt in Germany.

In a study from Clough, Jones, McAndrew and Scanlon (2009), it is shown that smartphone users use their devices to support a wide range of informal learning activities. Throughout all of the interviews from our research, people, especially those refugees who did not visit a school, learned German by themselves from books or mobile applications. Livingstone (1999) states that, *informal learning* is any activity involving the pursuit of understanding, knowledge or skill which occurs outside the curricula of educational institutions. Although migrants have the learning tools on their mobile phones, they still have to communicate with the locals in order to be socially integrated.

Social integration refers to the quantity of social relationships and the frequency of contact with those people (Schwarzer, Hahn, & Schröder, 1994). Siddiquee and Kagan (2006) suggest that *community* and *participation* are intrinsically linked and that frequent contact may be established by doing or sharing the same goal or interest.

Attending events, participating in hobby clubs or other things could be examples here. It might only be seen as the concern of the migrants; however, the interaction between both parties determines the direction and intermediate and final outcomes of the integration process (Penninx, 2005). Thus, this is also a challenge for local society to responds to migrants' needs.

A lot of applications that help migrants to adapt to a new living environment can be easily found on mobile devices (see: Review of existing projects for migrants). However, most of them only provide information in text, and none of them include gamified mechanics. What happens if a mobile application could engage and motivate migrants in order to have a better understanding of their new living place?

Gamification is a term that uses different elements of games in non-game aspects to improve user experience (Deterding, Sicart, Nacke, O'Hara, Dixon, 2011). It makes learners become more dedicated and concentrated on their learning progress (Dicheva, Dichev, Agre, & Angelova, 2015). Based on the idea that players of all types seek to satisfy psychological needs in the context of play, the *pull* effect motivates the player for further play (Ryan, Rigby, & Przybylski, 2006). Therefore, in the context of the use of gamification elements, it is not only enhancing the learning experience, but also immersing users into the learning environment. Specifically, we ask the question: Can gamified digital communication support local integration of refugees with language barriers? If so, how?

Gamification in education has a ubiquitous presence nowadays in different areas. Yet the research between gamification in education and integration is limited. There is no empirical research revealing its potential for informal learning regarding local integration of migrants. In the remainder of the paper, the research gap between gamification in education and integration will be closed by the following research project on a gamified mobile application – "MOIN."

Review of Existing Projects for Migrants

Before starting work on the project, the research of existing projects fulfilling the needs of migrant teenagers and refugees as well as of miscellaneous target groups, is required. Therefore, main criteria for a revision were set. The system should use a widespread mobile platform to ensure high availability. The location for which the project is done must be relevant to Germany, especially to Bremen. Offered functions must provide relevant content or activities to migrants. In addition, the system should provide educational elements, as well as include game and communication elements. The focus should be on teenagers.

The projects done specifically for refugees and migrants are: Welcome App Germany, Refugermany, Refoodgee, helphelp2, Das WillkommensABC, "Zeig mal!" – Neues Bildwörterbuch für Flüchtlinge, InfoCompass Berlin, Workeer, "Deutsch für Flüchtlinge," and Ankommen. These applications are analysed according to the use of the mobile platform, location and their functionality.

Mobile Platform, Location and Functionality - Refugees and Migrant Related Projects

Seven out of ten applications for refugees and migrants are done for iOS and Android platforms: Welcome App Germany, Refugermany, Refoodgee, helphelp2, Das WillkommensABC, Deutsch für Flüchtlinge, and Ankommen. One project is also available on Windows Phone: Welcome App Germany.

Eight applications are adjusted for migrants living in Germany: Welcome App Germany, Refugermany, Das WillkommensABC, "Zeig mal!" – Neues Bildwörterbuch für Flüchtlinge, InfoCompass Berlin, Workeer, Deutsch für Flüchtlinge, and Ankommen. Two applications are focused on the whole of Europe: Refoodgee, helphelp2. The applications Welcome App Germany, Refugermany, helphelp2, InfoCompass Berlin represent static information for newcomers. The language support is represented mostly as a pure language dictionary: Das WillkommensABC, "Zeig mal!" – Neues Bildwörterbuch für Flüchtlinge, Deutsch für Flüchtlinge, and Ankommen. None of the ten analyzed applications contain game elements. Two of them (Refoodgee, Workeer) contain communication elements which represent registration for refugee events, and a registration for a job search. There are no communication elements found explicitly for refugees and local populations. Three applications contain educational elements: Deutsch für Flüchtlinge, Ankommen, Das WillkommensABC. They provide functions of learning basic vocabulary via pictures, audio and video. None of the applications are focused on teenagers or young people.

To find more opportunities for the research target group the study on other related projects was done. Among them: phase 6 "Hallo Deutsch," Healthcare App Communication, ImageIt, Speakfree, Real-time translation apps, Babbel, and Duolingo. These applications were also analyzed according the use of mobile platform, location and their functionality.

Mobile Platform, Location and Functionality - Mobile Devices Applications in General

All applications are done for iOS and Android platforms. One project is available on Windows Phone: Duolingo. Two applications are adjusted for Germany: phase 6 "Hallo Deutsch," and Babbel. All other applications have an international focus e.g., Healthcare App Communication, ImageIt, Speakfree, Real-time translation apps, and Duolingo.

Seven applications provide language support: phase 6 "Hallo Deutsch," Healthcare App Communication, ImageIt, Speakfree, Real-time translation apps, Babbel, and Duolingo. Three applications contain game elements: phase 6 "Hallo Deutsch," Babbel, Duolingo. Gamification is represented by scoring systems with points, levels, progress bars, badges, vocabulary quests, avatars, levels and gamified tasks. Three applications contain communication elements via images or chat: Healthcare App Communication, ImageIt, and Speakfree.

Six programs contain educational elements for language learning: phase 6 "Hallo Deutsch," Babbel, Duolingo, Speakfree, and Real-time translation apps. In the case of Real-time translation applications, it is usually represented by audio pronunciation of words. Only one application - phase 6 "Hallo Deutsch" - has a young target group. Research on existing projects and further summaries revealed several gaps in current mobile applications.

Lack of multilingual elements. There are applications done explicitly for migrants and refugees, but there are only several options with multilingual support. Many refugees are not able to speak English or German and translation into Arabic, Persian, Pashto, French and other languages is needed.

Static information and no interaction elements. Most of the applications providing first important information about Germany --local rules and registration procedures -- do not provide any elements for further integration to a local environment or assistance in communication with local people. They cover only limited amounts of topics and do not answer further questions. On the other side - most of the applications providing communicational elements are very specific (for instance, Healthcare apps) and not targeted for refugees. They also do not provide any help in getting in touch with local people in order to communicate.

Language support does not connect people with real life. Most of the applications providing language assistance or language lessons do not support real-time language practicing situations. And none of them provide real-life feedback.

No focus on young target group. Among the studied examples, there are no programs for young refugees and migrants.

No game elements. Applications done explicitly for refugees and migrants do not contain any game elements.

No learning elements about local culture, rules and society. All educational elements are focused on the language learning and there is no application focused on learning local environment, culture, traditions and behavioral norms.

No projects for Bremen region. There are many applications done specifically for migrants and refugees in Germany, but there are no applications specifically for Bremen.

Hypothesis

The hypothesis was formulated based on the research question: How can gamified digital communication support local integration of refugees considering language barriers?

Hypothesis: Gamified digital communication leads to more efficient integration into a local culture and environment.

Methods

A variety of methods were applied in order to accomplish this research and to deliver the requirements for the final product. For a deeper understanding of integration problems of young refugees and migrants in Bremen, 33 qualitative interviews with 9 target groups and field observations were conducted in refugee camps and the local school. Analysis of existing mobile projects targeted on migrants and language learning problem showed several gaps in the area. Analysis of scientific literature was done on topics of cultural integration, migration, refugee crisis in Europe, indirect learning and gamification. The research showed various perspectives on the solving of integrational problems. Prototyping and usability testing methods were conducted to create the first version of the product and try it with a target audience to reveal further directions for research and development.

For further project development, information about needs of refugee, migrant teenagers and local teenagers was needed. Interview guidelines were designed, and semistructured interviews with various related target groups were conducted.

Data Collection and Results

Data was collected from refugee and migrant teenagers:

- Going to school and living with families (5)
- Going to school and living without families (2)
- Not going to school and living with families (8)
- Not going to school and living without families (6)

Also interviewed were: German students (2), refugee camp social workers (2), refugee camp volunteers (3), teachers working with migrant teenagers (3), and communication experts (2).

Interview results provided the ground for elaboration of project requirements. Teenagers going to school and living with family are more involved with local life. They experience fewer problems with obtaining acquaintances, communicating with locals, on finding activities in leisure time. They also express better German language skills. The situation for teenagers going to school but having no family is almost equal in terms of communication – they are open to new contacts and motivated to meet local people and learn German. In the case of teenagers who do not visit a school but live with families, contacts with local people are more seldom. They state that they have too much free time and unstructured daily rhythm. Those teenagers mostly communicate with peers from refugee camps, and they have not many connections with local citizens and, as a result, they have a weaker level of German language or no German language skills. Teenagers who are not going to school and have no family expressed having even more difficulties with communication and integration to a local society due to the lack of family support and psychological circumstances. Most of the teenagers are open for new contacts with local people and would like to go to school and join various activities. Most of the refugee and migrant teenagers use smartphones. The most popular platform is Android. Reasons for using digital media are mostly related to assistance with German language, communication via various social media, entertainment and looking for information about Germany. German students also expressed the interest in communicating with migrant students, spending time in shared activities and providing some help.

Interviewed experts like volunteers and social workers from refugee camps showed that daily rhythms of teenagers depend on the presence of school and family. They also stated that the language barrier is the main problem that prevents refugee teenagers from integrating into local society despite the fact that most of the young people expressed the desire to communicate with Bremen citizens. Communication experts state little difference in communication styles of teenagers from various cultural

backgrounds. These differences mostly related to gestures, mimics or other expression but do not affect general needs and interests of young people from different cultures. Teachers supported ideas of communication experts by adding that overcoming language barriers is the most important step to adapt to a local society.

Product Prototype

Information collected from the interviews provided a basis for further development of the project concept. The objective of the final product is to offer help to refugee and migrant teenagers to adapt to local society and to local young people to enrich their leisure time and social life with events and activities in intercultural social groups based on shared interests.

The final product prototype (see Figure 1) represents an Android-based mobile application that provides the following functionality:

- There is the possibility to create or participate in local informal learning events in Bremen that are organized in categories: Sport, Cinema, Food, Music, Culture, Games, Education, Time Out, Excursion, Help and Language Practice.
- The application is designed in a way to bring young people to a face-to-face communication in order to create situations of indirect language practice.
- The application is offered multilingually in order to be used by people with poor German skills.
- The mobile application contains educational elements providing language support: visualised vocabulary with specifics of the Bremen region and language tests.
- The system has gamification elements (progress bars, leaderboards) that are used to increase the motivation of usage and the interest of young people to the product.
- The application is developed with technical requirements for offline data usage and less data volume in order to be used by people with limited high-speed Internet.



Figure 1. Overview of MOIN-application functions.

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Usability Test

After the development of the first application prototype, the development group conducted a usability test using System Usability Scale (SUS) method (System Usability Scale (SUS) & Rauer, M. (2011)). The test was conducted in March 2016 with two user target groups: 5 German people aged from 19 to 23 and 5 migrants (3 from Afghanistan and 2 from Syria) of same age group. The test was held in English; all the participants were required to have at least an intermediate English language level. During the test, participants were asked to accomplish tasks using the application "MOIN" on Sony Xperia Z smartphone, Android version 5.1. The tasks were: to register in the application, to sign in, to create an event, to join an event and, in case of migrant group, to pass a German language task.

Table 1

Task	Justification	Change	Severity
Register and log in	3 participants had problems with this task. Observers found out that users try logging in instead of registering.	Size and position of the "sign in" and "register" buttons	Moderate
Create an event	Participants do not understand clearly that they have to fill in all the data they are asked.	Add data validation	Moderate
Join an event	9 participants completed this task successfully. One participant could not find the joining event section. Observers state that the button "join" should be more visible.	Change "join an event" button	Low
Accomplish language task (migrant group)	Participants found it difficult to find the language learning part. The navigation inside the application is not clear.	Revise the navigation, add additional navigational elements	High

Findings from the Usability Test

The usability test revealed some difficulties for further investigation and improvement. First, it seems that the navigation inside the app is intuitive for German users but less intuitive for users from the migrant group. This issue requires further research and improvement. Additionally, main buttons and their sizes inside of the application need to be revised, changed in size and replaced. Some of the participants suggested extending the age group from 23 to an older age. Nevertheless, quantitative analysis of the usability test also pointed out the acceptability of the product and a positive assessment from both target groups.

Further Research Directions

The conducted research revealed main problems existing in the field of integration of migrants into German society. As one of the steps for overcoming challenges arose due to the migration crisis it suggests a solution based on digital technology. It also opened

another point of view on the issue with the suggestion of looking at the difficulties not being problematic, but from a more sustainable perspective. What if we look at the things that enrich the quality of life of both migrants and local citizens? What if we use the potential of a multicultural young society to grow people able to improve crosscultural communication skill, in order to stimulate their creativity by the diverse social environments, and let them exchange ideas? Here technology provides extra support and makes opportunities for such communication inside one city more affordable to various groups. First, it offers a choice of activities as a means for further communication. Then, it helps with overcoming language barriers by providing help with unfamiliar vocabulary and learning elements. And it increases chances for finding people with common interests by providing technology used anytime and anywhere. These points state new questions for further research. For instance, a deeper study in the area of informal face-to-face communication supported by digital devices is needed. It will open new ways and techniques for stimulating people for such a communication and test its outcomes. What is more, there are challenges from experienced designers to find out more ways for overcoming language and cultural barriers using technology. And, at the end, the longer study of informal learning results under new cultural condition can be conducted. As a result, such studies open new prospects on migration challenges in terms of cultural exchange and acculturation in combination with the help of technology. The research reveals new questions that form the basis for further research. For instance, a deeper testing of informal learning results must be done, which requires longer periods of time for checking the progress.

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DIGITAL MAKING WITH "AT-RISK" YOUTH

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Abstract

This paper explores how a small group of adolescents in an alternative care and treatment program develop digital literacy skills over time while immersed in a rich media setting. It also explores how the students use new media tools and affordances to "perform" their identities and to present themselves within their classroom community. The author shares how these students used inquiry-based learning and multiple modes of expression, facilitated by the multimodal, multimedia nature of digital media, including both screen-based and tangibles as essential components of knowing and communicating.

Introduction

At-Risk or At-Promise?

To be literate in the 21st century, students need to both read critically and to write functionally across a range of media forms and formats. Literacy in the digital age has developed into a "repertoire of changing practices for communicating purposely in multiple social and cultural contexts" (Mills, 2010, p. 247). It does not only involve reading and writing anymore but also meaning-making with images, sound and movement. This is an important development for "at-risk" youth and struggling learners, as now more than ever, there exists an opportunity to engage and include these students who may have previously remained on the periphery of the classroom learning community, due to a deficit in traditional reading and writing skills. If we want to engage and support struggling learners, we need to: (a) reframe our thinking about what it means to be "at risk" and (b) provide them with equal opportunities to learn, to develop positive literacy identities and skills; thus, we need to draw heavily on digital and multimodal tools.

Following Swadener (2010), we agree that the term *at-risk* has been overused and tends to suggest a deficit model, positioning these youths as *other* in "dominant education and policy discourses" (p. 8). While we recognize that the students we worked with in our study do, by the nature of their unfortunate circumstances, "inhabit the 'margins' of contemporary society and are systematically excluded from many of its benefits" (p. 8), we choose to think of them as *at promise* for success, rather than at risk of failure (p. 9). Rather than focusing on the abilities of the students, we have directed our attention to assuring access to opportunities to promote digital literacy across the digital divide.

Uses of digital technologies—mobile devices, social media, apps and games, 3D printing, and robotics—are ubiquitous; in order to benefit from, integrate, and adapt to these technologies effectively, new approaches are required to meet the challenge of educating a growing young population with the knowledge and skills essential to a democratic knowledge economy. It is particularly important to foster digital literacy to help mitigate the digital divide in Canada and the world.

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Makerspaces in Education

One of the primary objectives of this research is to explore whether and how constructionist *production pedagogies* work to build students' *performative* competencies in digital literacies (where students demonstrate understanding and represent learning through a multimodal digital performance that is shared with a wider audience) and whether and how they promote personal and community identity awareness and development. Community makerspaces are becoming a widespread phenomenon; however, these do-it-yourself (DIY) models for encouraging teachers and students to become designers and producers of the materials and resources upon which they depend (de Castell, Droumeva, & Jenson, 2014) have not yet moved into the realm of formal education. Makerspaces are creative, educational, collaborative spaces that capitalize on current technology and help prepare students with the kinds of skills required for active participation in modern society - politically, socially and economically. The 2015 Horizon report indicates that "Makerspaces are places where anyone, regardless of age or experience, can exercise their ingenuity to construct tangible products. For this reason, many schools are seeing their potential to engage learners in hands-on learning activities" (Johnson, Adams-Becker, Estrada, & Freeman, p. 38). Makerspaces tend to include tools such as Arduinos, soft circuits, wearable tech, 3D printers, programmable robotics and more. These technologies position the users as creators and require participants to draw on a variety of skills including interpersonal skills, coding skills, troubleshooting skills and more. The educational benefits of makerspaces reflect a pressing need to incorporate makerspaces into schools to keep pace with society and students' out-of-school literacy practices. To avoid the "dangers of trivialization" or keychain syndrome of making "stuff" that will end up in landfill sites, Blikstein (2013, p. 8) cautions educators to shy away from the kind of quick demonstration projects typically associated with makerspaces and move toward learning that is more meaningful and contextualized.

Critical Making

The research activities undertaken here draw on the concept of digital making as a vehicle for deep learning through technology and community interaction. Situated within a constructionist approach to education, critical making assumes that learning is most effective when learners are actively *making* in the real world and drawing their own conclusions through experimentation across multiple media, where learners construct new relationships with knowledge in the process (Kafai, 2006; Ratto, 2011). Unlike more traditional instructionist approaches to learning (where the knowledge to be received by students is already embedded in objects delivered by teachers), constructionist learning encourages learners to learn from their own active engagement with raw materials. In this project, *raw materials* include both tangible and virtual materials. Creating interactive stories, simulations, games, and both physical and wearable technologies entails using digital tools to identify, access, manage, integrate, evaluate, critically analyze, synthesize, create, communicate and collaborate.

Beyond simply creating objects for the sake of creating objects (e.g., creating 3D keychains), critical making concerns itself with the relationship between technologies and social life, with emphasis on their liberatory and emancipatory potential. Thus, it connects two practices that are often considered separate: critical thinking and creative expression (Ratto, 2011). The term *critical making*, associated with the DIY movement, emphasizes critique and expression over technical sophistication: shared acts of making are more important than the resultant object. In the context of this research, students

worked in our university based makerspace, which was established to promote, observe and evaluate the impact of this kind of critical making using a variety of digital tools. For the past three years, we have been working with students enrolled in a Canadian alternative school that provides educational programming for students from government approved Care, Treatment, Custody and Correctional facilities. The primary purpose of this alternative program is to provide students with effective instruction that leads to the re-integration of students into community schools, post-secondary institutions or employment. For the purposes of this paper, we focus on a specific program intervention that took place over the course of five months, in which grade six to eight students (aged 11-14) engaged in a variety of digital making activities. We refer to the coupling of digital making with curricular goals as *serious digital making*, in the same way serious games refers to games whose main purpose is to train or educate. We are especially interested in serious digital making as a form of *computational participation* (Kafai & Burke, 2014), whereby students create digital artefacts to transport and perform their learning beyond the classroom, and in the case of these students, to explore individual and community identity. A focus on production or *maker* pedagogies can give students voice and agency in the context of their learning communities, and thus provide opportunities for them not only to learn subject matter, but also to explore issues of identity and their places in the world around them. This research investigates the relationship between production pedagogies and the development of adolescent digital literacy and identity. More specifically, it explores (a) how adolescents' digital literacy skills develop over time while immersed in a rich media setting and (b) how adolescents' identities are shaped and performed, as they use new media tools and affordances to present themselves to the world. In this paper, we will share how these students used inquiry-based learning and multiple modes of expression, facilitated by the multimodal, multimedia nature of digital media, including both screen-based and tangibles (Kafai & Burke, 2014), as essential components of knowing and communicating.

Methodology

Since this research focused on the transformation in teaching practices and student learning, an ethnographic case study approach was suitable. The researchers were immersed in the case, leading classroom activities and discussions, and thereby accumulated local knowledge. The case study method is also appropriate for studying a 'bounded system' (that is, the thoughts and actions of participating students or the learning-community connection of a particular education setting) so as to understand it as it functions under natural conditions (Stake, 2000).

This study involved seven students (3 female, 4 male) from a Canadian alternative school that provides educational programming for students from government approved Care, Treatment, Custody and Correctional facilities. The students were identified with a variety of cognitive, behavioural, emotional and developmental exceptionalities, which included fetal alcohol syndrome, oppositional defiant disorder, various learning disabilities, anxiety, and post-traumatic stress disorder. The students had a range of experience with, and access to, technology and different digital tools both at home and in school from previous grades. The students' digital literacy skills also ranged significantly. None of them had worked in a makerspace prior to this project.

Through an integrated arts-based curriculum, with a thematic focus on community and identity, the students used a variety of digital tools and media to create an "All About Me" book. The classroom teacher collaborated on lesson plans with members of the

research team. Each week for twelve weeks, the students came to the university's makerspace, for two hours each session.

Data Sources and Analysis

At the start of the project, the students, classroom teacher and child and youth care worker in the classroom completed a questionnaire about their experiences *making* and their expertise with digital tools and media in general. Throughout the project, the researchers recorded detailed field notes, collected students' planning notes and rough work, the digital texts they produced, still images/video recordings of the students' authoring/making activities and classroom conversations. The researchers also engaged in informal discussions with the students and teacher, of which noteworthy points, themes, ideas or feedback were recorded through text or voice recorder. We also conducted a set of open-ended interviews asking questions related to the texts and tangibles they were making. Analysis of the data took place over the duration of the study and attempted to capture the multiple layers of production practices and where and how those change over time. Thematic coding (Miles, 1994) and cross-case analysis were used when examining the data sources.

Digital Making Activities

The idea behind the "All About Me" book was to provide students with the opportunity to make discoveries about themselves, their likes and dislikes, and to uncover who they are, explore how they feel, what they think, and to express these answers through a variety of activities and technologies. Students were given a weekly question, and, during the course of the assigned activities and learning new technologies (using the Evernote app), students would spend time reflecting on what they had created, what they had learned about themselves, and their experiences with the technologies they were learning about and using. Over the course of three months, the students designed and created a series of 8 pages, with their reflections based on the following questions:

- 1. What is your favourite season? Why? (PicCollage)
- 2. What is your favourite sport to play/watch? (Lino)
- 3. What is your favourite colour? How does it make you feel? (Chibitronics)
- 4. If you could go anywhere, where would you go? Why and with whom? (WordSwag)
- 5. If you could have dinner with a famous person, who would it be? What would you talk about? (Popplet/Piktochart)
- 6. Ask someone to define your greatest strength. What is it? Do you agree? Why or why not? (MangaMaker)
- 7. What advice would you give to your future self? (Tool of their own choice)

For each of these pages, students used a different digital tool (noted in parentheses above) to represent their responses to the question. Each question required students to justify their choices and explain their reasoning (i.e., why is green your favourite colour?). The reflection process afforded students the opportunity to delve deeper into why and how they felt about something (e.g., like or dislike) and to practice their communication skills. It is beyond the scope of this paper to discuss all seven of the activities. The questions became gradually more complex, and we focus our discussion on the final three questions, which elicited the most interesting, introspective responses from the students.

Sample Questions and Student Responses.

In this section, we share activities and student responses to Questions 5, 6 and 7.

Question 5: "If you could have dinner with a famous person, who would it be; what would you talk about?"

Students were advised that they had won a contest and that the prize was for them to take a famous person of their choice to dinner. So as not to waste their time on asking trivial questions (i.e., where were you born?), students were required to complete a short biography, to ensure the questions asked were more meaningful. Students then chose a restaurant, anywhere in the world. Students' choices were varied – one student chose Cleopatra as she already had some knowledge from previous research completed at school, but was surprised at all the information she didn't know (i.e., that Cleopatra had married her brother). This generated a lot of



Figure 1. Cleopatra Popplet.

conversation about how what was acceptable historically would no longer be tolerated. Students used Popplet to organize the information collected so it was easily accessible and visually appealing – students used text and pictures, and retrieved pictures of their restaurant and copies of menus (see Figure 1). They also used PicktoChart to create an infographic based on the person they chose.

Question 6: "Ask someone to define your greatest strength; what is it; do you agree; why or why not?"

This prompt provided the students the opportunity to see how others view them. A list of personal strengths was handed out to each student, and individually they chose a strength that best represented each classmate. Then in pairs, they chose a strength that best described their partner. A discussion followed to determine if the strength really exemplified the students themselves. Using this strength, students then wrote a story in which they were a hero, and then using a storyboard template, they outlined the story in

rough format. At the end of the activity, using MangaMaker, students would write their story using text and pictures available with that program (see Figure 2). Most students had a clear vision of how they wanted their story to appear – the backgrounds, and the appearance of the characters. The MangaMaker program has set character choices that did not jive with the students' vision. Some students found it difficult to adapt and change their stories or characters within their stories, and as a result rewrote the original version. This particular session generated a lot of frustration for the students, and it afforded the facilitator and teacher an opportunity to reflect that giving students an opportunity to familiarize themselves and play with technology



Figure 2. Manga Maker autobiography.

prior to planning their stories was extremely important.

Question 7: "If you could give future-self one important message, what would that be?"



Figure 2. WordSwag advice.

This question provoked important discussion for this particular group of students. They talked about the fact that the future is not written; every new day is unwritten. There are times when as individuals we look at our past and think if we could only change something that has occurred, perhaps send a message back in time that would prevent something from happening. We cannot change the past, and everything that has occurred has contributed in some way to who we are today. However, what if we could send a message to our future selves? This is what the students did and messages included: don't let people's words change who you are inside; if you don't make it the first time, don't give up – keep persevering; don't let the words of others stop you from doing what you love;

choose your friends wisely. Students wanted to ensure that their future selves would direct their own path, and not allow others to deter them from achieving their goals. Students were encouraged to represent this message using the technology of their choice – all of them chose WordSwag, and all of them indicated that this app allowed them to choose both the message and a picture that best represented the feeling behind the message. Students' reflections on their WordSwags demonstrated an ability to articulate their thoughts visually and in words. The student who wrote the message depicted in Figure 3 stated, "I chose this message because once I start learning more about myself in life, I have to take time to think about what I'm going to do – stuff like a job, where I am going to live, am I going to have a family, how long do I want to work before I retire, etc. In my final design I chose red because it means stop before you do anything stupid." Given the need to address both the educational and emotional needs of students in this program, an emphasis was placed on discussion and debriefing in all of the sessions and students wrote reflections on their learning each week.

In the final week of the project, students received the printed documents and the hard copy pieces that they worked on over the semester and organized them as per a table of contents that they created. They were given creative license in the way the documents were organized and whether they wanted to include their reflections in their books. When they had completed their organization, they used a template to mark holes on every page of their book, which they then used as guides when creating holes with a needle or an awl. Lastly, they used the holes to sew the books together using ribbon or embroidery thread. They returned to the school with their finished books. The students were incredibly and understandably proud of their books. We had hoped to keep the best examples to use as exemplars in the next iteration of the research; however, none of the students was willing to part with their book so we had to scan all of their work to keep in digital form only.

Discussion

Directing Their Own Learning

In addition to contemplating important topics related to their future goals and developing intrapersonal skills, the students also developed in other ways. The inquiry-

based approach, set in a makerspace environment where many materials were available

to them, helped the students to direct their own learning. Throughout the creation of their book, students were encouraged to take increased responsibility for their learning with each successive question, and to explore their learning process through reflection questions. Students who struggle in traditional learning environments often find expressing themselves easier when they use multimodal tools and technologies (Hughes, 2009). The students in this program had ubiquitous access to iPads, which they used to research information and create digital texts through apps like WordSwag, Popplet, Picktochart, PicCollage, and Evernote. Combining text, recording, and picture options conveys student meaning more effectively, and in turn provides opportunities for academic successes previously not experienced. One of the strategies we used to help them develop autonomy was creating and providing them with visual "walk-through guides" that they could access on the iPads when they weren't sure what to do next. The guides were consistently written



Figure 4: Walk-through guide for PicCollage.

in a way that facilitated the transfer of skills from one tool to the next. Indeed, we found that the guides (and the tools as a result) became much easier to use as they progressed through the weekly activities (see Figure 4). We also directed students to online tutorials for each of the tools and insisted that they access and view these prior to asking the teacher(s) for assistance.

Developing Perseverance

Assessment of the students changed significantly as the emphasis shifted from creating an "end product" to focusing on the process of learning. Students are not just producing a conventional assignment, but also are learning specific and significant skills as they acquire knowledge through the process of creating their digital texts. This allows the teacher to observe in greater depth the growth a student undergoes while exploring the technology. Students also spent much more time throughout the process reflecting on their learning than previously. They learned to trouble-shoot and problem solve, as well as to determine what they could do to improve their work. Previously, when the students struggled with something they found difficult, they would give up and refuse to keep trying. At the beginning, we needed to constantly reassure the students that making mistakes was an opportunity to learn. When they felt frustrated and exhibited negative behaviours as a result (tossing the work aside, crumpling it up, saving 'this is too hard'), we challenged them to rethink their responses with more positive questions, such as "how can I deal with this setback?" Encouraging this kind of growth mindset that praises effort rather than results (Dweck, 2007) has helped the students develop perseverance.

Developing Confidence

As the students became more comfortable with the concept that making mistakes and learning from them or *failing forward* (Maxwell, 2014) is an important part of the design/creation process, they became more flexible and relaxed about the modifications

they had to make from the planning stage of their activities to the execution, adapting to constraints of the soft/hardware.

Using iPad apps removed a great deal of pressure from the students, allowing them to develop their abilities to interact to:

- build trust, commitment, self-confidence;
- develop a feeling of self-worth;
- develop an ability to effectively communicate thoughts and feelings;
- develop listening and cooperation skills and, the ability to compromise; and
- participate in a safe, secure, comfortable, non-judgemental learning environment.

Students spend a great deal of their day in the school environment, and in the 21st century it seems to be that a blurring of the lines between work and play would be a positive thing. As technology is such an integral part of our culture, the distinction between work and play has not remained defined, and in fact the lines are blurred. Allowing students the opportunity to explore a technology, to play and become adept at the capabilities of a given technology, only serves to increase both their comfort level and ability to apply their knowledge to a given task. In many work environments individuals are required to have knowledge of emerging technologies, and to employ this expertise in their work. Teaching students how to navigate their way through unfamiliar technology, to reflect on the process, and to communicate effectively, are important in both academics and future work environments. We continue to work with this group of students in our STEAM-3D Maker Lab and emphasize learning through discovery, design and the development of important skills such as perseverance, trouble-shooting, resilience, and collaboration. All of the students are making gains in their academic work, and, perhaps even more importantly, in the development of some of the so-called "soft skills," such as perseverance and collaboration. Although the scope of this paper does not facilitate detailed elaboration regarding these gains for each student, one case in particular stands out. One of the grade eight boys identified with a learning disability in the group was reading at a grade one level at the outset of this program. He would not participate in any class discussions, and, when academic work was assigned, he characteristically put his head on his desk. His teacher commented that the "transformation that this student underwent was so amazing. Providing him with alternative way of expressing himself, lots of support and encouragement, served to increase his confidence. He went from never raising his hand, to being one of the first to having a contribution." We are expanding this program to work with students in other contexts, including at a high-needs, underachieving group of 21 grade six students in a local school.

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STUDENTS' PERCEPTIONS OF GAME-BASED LEARNING USING CODINGAME

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Abstract

Game-based learning incorporates educational content into computer games. It is a trend with many advocates and one which has experienced rapid growth in recent years. This paper discusses the potential of this approach and presents the results of the author's pilot study of the perceptions of students towards game-based learning in introductory computer programming. Data was collected from 33 first-year undergraduate students using a survey consisting of 16 Likert data items and using a 5 point Likert rating scale. The findings indicate that the students found this particular approach to learning enjoyable and in some cases preferable to conventional approaches.

Keywords: Game-based learning, serious games, CodinGame, student engagement

Introduction

General purpose computers in their modern manifestation entered classrooms in the early 1980s with educators keen to explore their potential in supporting part of the curriculum. In a short space time they gained many advocates who were quick to recognise their significance in promoting the development of higher order thinking skills and independent learning. Papert (1980), for example, was influential in arguing that students should learn computer programming as a means of developing such skills. He observed, "Children who had learned to program computers could use very concrete computer models to think about thinking and to learn about learning" (Papert, 1980, p. 11). While many researchers claimed that computer programming could support the development of problem-solving skills, Mayer (1988) argued that these claims were not strongly supported by research. On the contrary, research suggested that students struggled with understanding the fundamentals of computer programming, impacting their motivation for learning.

To address these challenges, educators began exploring alternative approaches to motivating and engaging students. By the 1990s, computer gaming technology had grown rapidly, and educators began to recognise its ability to motivate and engage players and were keen to tap into this potential. They began adopting the use of off-the-shelf games into their teaching practice, leading some to coin the term *edutainment*. Despite some success, it quickly became apparent that simply utilising games in teaching did not necessarily result in a more engaging learning experience. Where too much emphasis was placed on the game, the learning outcomes became obfuscated, and where too much focus was placed on the learning content, the motivational benefits of the game were reduced. By the end of the 1990s, researchers had recognised that whilst games have the potential to be effective pedagogical devices, those often used for educational purposes were not based on solid educational principles and practices

(Gunter, Kenny, & Vick, 2006). This led researchers to explore how to design games based on well-established educational principles with numerous frameworks developed in past decade dedicated to the design of such (serious) educational games (Garris, Ahlers, & Driskell, 2002; de Freitas, S. & Jarvis, 2007; Butt & Wills, 2015). This game-based approach to learning has been popular in recent years particularly at the primary and secondary level of school education. Whilst a majority of the students have had experience of playing computer games, the utilisation of games-based learning in higher education remains under explored. For instance, introductory computer programming courses remain a challenge for students in higher education (Woodley & Kamin, 2007). They have for some time been identified as suitable candidates for games-based learning yet the adoption of games in this area remains limited. Various reasons have been suggested by previous studies including the effect of students' perceptions of the game on their learning experience. Thus, investigating students' perceptions of game-based learning is a necessary precursor to adopting such an approach in introductory computer programming courses.

Methodology

The study utilised an existing web-based serious game known as CodinGame. This is a recent challenge-based learning platform created in 2015 that supports multiple programming languages including Java, Python and C++. The CodinGame graphical user interface presents learners with a traditional code editor integrated with a game-like visualisation as shown in Figure 1. The learner attempts to complete code challenges, and the system responds by executing the actions in the game.



Figure 1. The CodinGame Graphical User Interface.

The study was conducted at Southampton Solent University during the academic 2015-2016, and a total of 33 participants took part in the study. All of the participants were first-year undergraduate students who had completed at least one term of a computing or software engineering course. The participants were mainly young male UK students and native English speakers as summarised in Table 1.

Table 1

Demographic	nographic Variables		
Age	Age 18-20		
	21-29		
	30-39	2 (6.06)	
Gender	Male	32 (96.97)	
	Female	1 (3.03)	
Ethnicity	Ethnicity White / White British		
	Mixed / Multiple Ethnic Groups	2 (6.06)	
	Asian / Asian British	2 (6.06)	
	Black / African / Caribbean / Black British	5 (15.15)	
	Other	2 (6.06)	
Student Status	Student Status UK Student		
	European Student	6 (18.18)	
	Other International Student	1 (3.03)	
English Native	English Native Yes		
Speaker	No	11 (33.33)	
Degree	Computing	23 (69.70)	
	Software Engineering	10 (30.30)	

Demographics of Participants

Each participant first completed a tutorial that helped familiarise the participant with the CodinGame graphical user interface. The participants were then asked to solve between 3-5 challenges depending on their progress in the CodinGame within a period of 90 minutes. Following the activity, an instrument in the form of an online survey was utilised to capture the responses of the participants. The survey consisted of 16 Likert data items and 3 constructs, namely, attitudes, experience and expectations. The questions were based on the work of Ibrahim, Yusoff, Mohamed, and Jaafar (2011). Each participant was asked to complete the survey by rating each item on a five-point rating scale ranging from 1 = strongly disagree to 5 = strongly agree. The survey also included a single open-ended question to elicit a qualitative response. To prevent incomplete responses, the survey questionnaire required a participant to fully complete all the questions before being able to submit their responses.

Results and Interpretation

Table 2 shows the responses of the participants to items organised under the construct *attitudes*. A key finding for this construct is that a majority (67%) of the participants enjoy studying, and (60%) do not find the course boring, suggesting that the participants are generally motivated students.

Table 2

	Number of Participants						
Item	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
I like studying	0	1	10	12	10		
I get good marks at University	0	1	14	14	4		
I often find my course boring	8	12	11	2	0		
I learn better by myself	3	11	10	8	1		
I like to play video games	1	0	6	5	21		
I am good at playing video games	0	0	7	12	14		
I think video games are educational	1	3	9	12	8		

However, a fewer number of students (55%) felt that they got good marks at university, suggesting some disparity (9%) between the motivation and performance of the participants. Interestingly, a majority (79%) of the participants like playing video games, (79%) believe that they are good at playing video games, and (61%) perceive video games to be educational. This suggests that the participants are generally receptive to the idea of a games-based approach to learning.

Table 3 shows the responses of the participants to items categorised under the construct *experience*. The responses indicate the perceptions of the participants on their experience of using CodinGame. The majority (76%) of the participants found the games-based approach to learning to be helpful, (73%) interesting as well as (82%) challenging. Only 3% of the participants indicated that they found it unhelpful or not challenging. It can therefore be inferred from these results that the participants generally had a challenging but positive experience of a games-based approach to learning as provided by CodinGame.

Table 3

Item		Number	of Partici	pants	
I found solving the given problems really interesting	1	1	7	12	12
The games helped me to think critically	2	2	11	13	5
The games challenged my understanding of the subject	2	0	4	14	13
I think that video games based learning is helpful to me	1	2	5	17	8

Participants' Experience of CodinGame

Table 4 indicates the expectations of the participants after experiencing a games-based

approach to learning using CodinGame. Whilst a large majority (76%) of the participants felt it was worth using games for learning, and a similar number (73%) would like more opportunities to learn using games, fewer participants (58%) showed a preference for games-based learning in comparison to more traditional methods in class.

Table 4

Item		Number of Participants					
I prefer completing exercises in video games to multiple choice questions in class	1	1	13	8	10		
I prefer using games to learn compared to traditional methods in class	3	1	10	11	8		
It is worth using games for learning in the future	1	2	5	13	12		
I would like more opportunities to learn using games	0	2	7	13	11		
I would like to learn all computer subjects using educational games	5	7	9	7	5		

Expectations of Participants

Furthermore, the participants were split as to whether or not they would like to use a games-based learning approach in all their computer subjects, with 36% indicating they would and as many indicating they would not. Despite perceiving games-based learning as a worthy endeavour the participants are not entirely convinced that it can substitute traditional approaches in class or should be used in all computer subjects.

Table 5 provides a qualitative summary of some of the responses of the participants to the open-ended question: *overall what do you think about game-based learning*? The responses indicate that a variety of factors influence the participants' perceptions towards game-based learning. Amongst the 33 comments, 25 of the comments indicated a preference for game-based learning, 3 indicated a preference for traditional methods whilst the remaining 5 indicated no preference.

Table 5

Participant	Comment
1, 2	Good
3	Great for skills such as logic and problem solving
6	fun factor is important to me, just because it's a game doesn't mean its enjoyable
7	I prefer other methods
12	It is really useful and a lot of fun, but it is not applicable for every lesson. Sometimes it needs to be taught in traditional way
15	Fun and can see code in action instead of output text
20	It's a fun approach towards coding and programming which can seem quite plain, however bringing games into it adds color into it which can stimulate the mind a bit

Sample Set of Responses to Open-ended Question
Participant	Comment
	more than usual.
33	Good to add another perspective of learning, although I feel it couldn't replace a well- educated, passionate lecturer.

Table 6 shows the outcome of a thematic analysis of the responses.

Table 6

Thematic Analysis of Responses to Open-ended Question

Theme	Sub-theme	Participant
Critical thinking	Critical thinking Problem solving	8, 25 3, 22, 23, 25
Gameplay	Challenge Feedback Support Fun Progression	29, 31 10, 15, 32 21, 26, 33 6, 11, 12, 14, 15, 17, 18, 20, 23, 24, 27, 30 26, 32
Game-world presentation	Visualisation Interaction	4, 5, 10, 15, 20, 28, 32 16

A total of 27 of the 33 responses showed interesting features that resulted in 3 themes and 9 sub-themes. Amongst the responses, 15% of participants commented on how the game-based approach to learning helped develop critical thinking and problem solving skills whilst a majority (58%) of the participants commented on some aspect of the gameplay. Fun was a particularly important facet of the gameplay for 36% of the participants as was the visualisation for 21% of the participants.

Discussion

This paper detailed the results of a pilot study investigating the perceptions of students towards game-based learning. Prior to this study each participant had completed the *Introduction to Programming and Problem Solving* unit using Python. CodinGame was utilised as the platform for game-based learning. This was selected over designing a bespoke game due to time constraints. Furthermore, it was preferred to other existing games such as Scratch and CodeCombat, which are mainly used in schools and hide away code complexity and other useful details.

The perceptions of first-year undergraduate software engineering and computing students were captured using a survey designed with 16 Likert data items with a 5 point Likert rating scale and 1 open-ended question to elicit qualitative responses.

The results of this pilot study indicate that most of the students found a game-based approach to learning worth exploring and were interested in further opportunities to use this approach. This suggests that the students are receptive to such an approach to learning. However, fewer students were convinced that this approach could substitute

other more conventional approaches. Perhaps a combination of a game-based approach supported by conventional techniques may provide a better learning experience for the students. Whilst the results are encouraging, a larger study over a longer duration with an extended question pool and perhaps supported with a bespoke game could strengthen the understanding for the adoption of this approach.

Some limitations of this study include the small sample size which has implications for the statistically reliability of the conclusions that can be drawn. Additionally, the survey relies solely on the students' perceptions of their performance using the game-based approach to learning. An empirical approach would provide greater insight on the impact of game-based learning on the students.

Conclusion

This paper investigated the perceptions of students on game-based learning. This study found that students were receptive to such an approach and favoured greater opportunities to experience it when learning computer programming. Most of the students found the experience enjoyable whilst some students found it preferable to conventional approaches. The overall results suggest that perhaps a game-based approach complemented with conventional techniques may be worth exploring.

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ATTITUDES TOWARDS, AND UTILISATION OF, VIRTUAL LEARNING ENVIRONMENTS AMONG POSTGRADUATE UNIVERSITY TEACHING STAFF

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Abstract

Skill retention within a virtual learning environment (VLE) is dependent upon the complexity inherent in skill use (Cahillane, MacLean, & Smy, 2015) and the frequency of skill use (Arthur, Bennett, Stanush, & McNally, 1998). A questionnaire was used to capture demographics and perceptions/attitudes concerning VLE usefulness, VLE ease of use and self-reported VLE use among postgraduate level teachers. Results indicate that self-reported teaching workloads were negatively associated with attitudinal positivity. Further results indicated that the attitudinal concept of *Perceived usefulness* explained a significant amount of unique variance in *VLE Use*. However, perceptions concerning the *Ease of VLE use* did not.

Introduction

The knowledge and skills of those generating and maintaining e-learning content is pivotal to successful e-learning provision (Rogers, 2003). Skill retention within a virtual learning environment (VLE) is a multi-faceted construct. Cahillane, MacLean, and Smy (2015) advocate a link between skill retention and skill complexity and highlight a set of predictive criteria for assessing skill complexity. Criteria include, but are not limited to: the number of steps required to perform the skill; the availability of feedback; the availability of support tools; the mental processing requirements; the variety of facts that must be recalled. Another pivotal factor in determining skill maintenance is skill use. Cognitive factors predictive of skill maintenance involve temporal aspects such as the amount of time that has passed since the skill was last used effectively (Cahillane et al., 2015), and the overall frequency of skill use (e.g., Arthur, Bennett, Stanush, & McNally, 1998). Another important determinant of skill use involves socio-cognitive, attitudinal factors.

Socio-cognitive factors known to influence the uptake, use, and frequency of engagement with VLEs include attitudes and perceptions concerning ease of use and the perceived utility of the VLE (Collis, Peters, & Pals, 2001; Mahdizadeh, Biemens, & Mulder, 2008; Samarwickrema & Stacey, 2007; Wang & Wang, 2009). Attitudinal positivity and frequency of use may further vary depending upon the differing features and functionalities afforded by the VLE (Mahdizadeh et al., 2008; Rogers, 2003) and the degree of choice or autonomy when designing and implementing e-learning provision for work purposes (e.g., Gagné & Deci, 2005; Locke & Latham, 1990, 2002; Patrick, Smy, Tombs, & Shelton, 2012).

Cranfield University's VLE(s) enables various features and functions for enabling and delivering e-learning content (See Cahillane, Smy & MacLean, 2016). The present paper reports on current findings in an ongoing investigation into VLE attitudes. Existing theoretical models outline both the perceived ease of use, and perceived utility of VLE platforms as having an impact on VLE use (e.g., Wang & Wang, 2009). We

hope to extend the conceptual space by exploring these attitudes, along with selfreported VLE use within a postgraduate teaching context. In addition, an exploration of the frequency in use of differing VLE functions is considered. The following section now outlines the methodological design.

Method

Research Context

All participants were recruited from Cranfield Defence and Security (CDS), one of the four research schools within Cranfield University. Cranfield University caters to postgraduate students only, with CDS acting as a satellite campus based upon a military site (The Defence Academy of the United Kingdom). CDS is unique in that it provides teaching provision closely aligned to the academic needs of the military. As such specialised defence, business, engineering, management leadership, and forensic courses are offered to a mixture of military, civil service and civilian students. Formal teaching provision is primarily focussed around the provision of part-time and full-time MSc courses. However, a number of short courses are also hosted, and PhD students can access core research skills modules in support of their development. Teaching partnerships are in place such that CDS staff may also teach on courses provided to other Governments which may require the delivery of teaching content to students abroad (e.g., Ethiopia) either in person, or via VLEs. Some of the teaching conducted at CDS is of a sensitive nature. As such, restrictions regarding the dissemination of commercially/defence sensitive content may act to constraint the use of VLE for some teaching staff.

Participants

Twenty-nine teaching staff at CDS volunteered to take part in the research. Of those beginning the survey, 27 answered a reasonable amount of relevant questions and were included in the final sample. Three participants did not disclose their age. Of the participants who did, reported ages ranged between 30 and 67 years (Mean 48.7, SD 9.66). Twenty-one of the sample were male, six females. Teaching disciplines were varied, including (but not limited to) Management, Engineering, Behavioural science, Computing, and Forensics. Participants' teaching experience ranged from one to 34 years (Mean 14.04, SD 10.11). The amount of work time reported to be devoted to teaching provision (included design, delivery, assessment and supervision) ranged from 20% to 90% (Mean 57.04, SD 20.53). Of those responding, all but one used virtual learning environments in their teaching provision. All VLE users (n = 26) reported using the CDS virtual Moodle platform, with seven participants also reporting some use of the Blackboard virtual platform. VLE users had, on average, 6.91 years' VLE experience (SD = 3.99). Participants were recruited via an introductory email and were assured that the information they provided would be treated confidentially.

Materials and Design

An e-survey was designed using Qualtrics software. The survey consisted of a number of blocks of questions, preceded by project recruitment details, research aims, and ethical consent statements. The first block of questions captured participant demographics, as well as their teaching and VLE experience, the details of which are reflected in the previous section.

The second block of questions assessed VLE use and attitudes towards VLEs in general. Participants were required to capture their responses using a five-point Likert scales

ranging from "strongly disagree" through to "strongly agree" with the midpoint of the Likert scale representing "neither agree or disagree." As such, the Likert scale enabled responses to be scored in such a way that higher scores represented greater attitudinal positivity (with the exception of one reverse-scored item). Three separate attitudinal scales were administered. The first, a three-item scale was developed to assess participants' perceptions of their personal needs and responsibilities in regards to using VLEs within their teaching provision. We labelled this scale *VLE Use* ($\alpha = .57$; whilst Cronbach's alphas of .70 or above are typically recommended, lower coefficients can be deemed acceptable for scales consisting of a small number of items: e.g., Anastasi, 1990; Sijtsma, 2009). Items include, "I use the VLE frequently," "VLE use is optional in my teaching role" (reverse scored), and "VLE use is essential for my teaching role." A second scale assessed participants *Perceived ease of VLE use* (Davis et al., 1989, cited by Wang & Wang, 2009). This incorporated five items: an example is, "I find it easy to get the VLE to do what I want it to do corresponding to the ways I teach" ($\alpha =$.92). The third scale assessed *Perceived usefulness* of engaging with VLEs for teaching purposes (Davis et al., 1989, cited by Wang & Wang, 2009). Eight items were used: an example is, "Using the VLE gives me greater control over my work" ($\alpha = .86$).

A third, exploratory block of open questions was included to investigate how frequently teaching staff used Cranfield VLEs in order to fulfil different teaching functions. Functions were identified and developed using the inputs of four members of CDS teaching staff in a focus group setting. Whilst an exhaustive description of focus group methodology is not included in the present paper, interested readers are referred to the ICICTE16 paper, "A Case Study of the Barriers and Enablers Affecting Teaching Staff E-Learning Provision" (Cahillane et al., 2016). Sixteen VLE functions, covering typical pedagogical practices, administration, assessment, policy, and teaching management practices were identified. Whilst the list developed is not expected to exhaust every teaching possibility afforded by VLEs within educational contexts, we believe the list reflects the bulk of teaching-oriented VLE activity undertaken by teaching staff within the present research context. The full list of VLE functions is as follows:

- Conducting course administration
- Delivering introductory course materials
- Promoting student self-directed learning
- Promoting participation and interaction in learning discussions
- Archiving/curating course materials
- Developing practice and revision opportunities for students
- Assessing student engagement with course content
- Conducting formative assessment
- Conducting summative assessment
- Providing feedback to students
- Co-ordinating learning activities for part-time/distance students
- Generating course evaluation and feedback from learners
- Delivering blended learning
- Tailoring content to student ability and understanding
- Meeting student and institutional expectations
- Fulfilling contractual requirements for course management purposes

The frequency with which participants conducted each teaching function, where applicable, was measured using a further five-point Likert scale ("never," "rarely," "sometimes," "often," & "always," scored 1-5 respectively).

Procedure

Upon receiving an invitation to participate, volunteers clicked a hyperlink redirecting them to the Qualtrics webpage where the e-survey could be found. Participants first read about the research aims and the ethical handling of their data. Once informed consent had been obtained, participants proceeded to work through the questions at their own pace, according to the relevant skip logic. On average, participation took 10mins 35s, (SD 6mins, 57s).

Results

For the sake of simplicity, results are presented in two sections. The first section presents the results pertaining VLE attitudes. The second section examines the frequency with which various VLE functions are carried out.

VLE attitudes

The item scores of each of the three attitudinal scales were summed to produce on overall score. Table 1 presents descriptive results and intercorrelations reflecting VLE attitudes. Also presented is demographical information reflecting teaching workload, teaching experience, and VLE experience, all of which may impact upon attitudes towards the use of technology within teaching provision. As might be expected, a significant association was evident between teaching experience and VLE experience (r = .47, p < .05). Both teaching and VLE experience were not significantly associated with attitudes towards the VLE. Interestingly, reported teaching workload was found to be negatively associated with all attitudinal scales (*Perceived Usefulness*, r = -.46, p < .05; Perceived *ease of use*, r = -.50, p < .01; *VLE Use*, r = -.41, p < .05). Surprisingly, VLE experience was not significantly associated with the attitudes towards VLE environments measured within the present study.

All attitudinal scales were significantly and positively correlated. Of note is the high correlation between *Perceived usefulness* and *Perceived ease of use* (r = .86, p < .01). Whilst a correlation between these variables was expected, the magnitude of the correlation is indicative of a considerable degree of conceptual overlap between the two measures and statistical multicollinearity (Pallant, 2007). Hierarchical multiple regression was used to assess the ability of *Perceived usefulness* and *Perceived ease of use* to predict *VLE Use whilst controlling for the effects of reported teaching workload.* Results indicated a significant, unique contribution of *Perceived usefulness* but not *Perceived ease of use* (*part rs* = .37, -.07, *ps* .02, .64 respectively).

Variable	Mean	SD	1	2	3	4	5
1. Teaching experience (years)	14.04	10.11	-				
2. Teaching workload (%)	57.04	20.53	.26	-			
3. VLE experience (years)	6.91	3.99	.47*	.12	-		
4. Perceived usefulness	23.44	7.60	28	46*	09	-	
5. Perceived ease of use	14.23	5.57	11	50**	.16	.86**	-
6. VLE use	11.81	2.91	14	41*	.09	.69**	.52*
* = <i>p</i> < .05, ** = <i>p</i> < .01							

Table 1

Descriptives and Intercorrelations

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VLE functions

Table 2 presents the mean frequency of use of various differing teaching functions that could feasibly be carried out via a virtual learning platform, ordered according to the most frequently used VLE functions. Whilst the average reported use of all functions fell around the midpoint of the frequency scale, individual scores ranged from 2.17 - 4.25 (out of 5).

Paired-sample *t*-tests were used to compare the frequency of use of each individual function against the overall mean reported use of all functions. *Bonferroni* corrections were applied. Results indicated that two functions were conducted more frequently than average. These were *Conducting summative assessment* and *Meeting student and institutional expectations* (ts(23) = 6.35, 3.51, ps < .01, < .05 respectively). On the opposite end of the scale, *Assessing student engagement with course content* and *Generating course evaluation and feedback from learners* were reportedly used at a significantly lower frequency (ts(23) = -3.72, -4.34, ps < .05 respectively).

Table 2

Functions	Mean	SD	t
Conducting summative assessment	4.25	1.07	6.35**
Meeting student & institutional expectations	3.97	1.52	3.51*
Tailoring content to student ability & understanding	3.57	1.27	2.80
Fulfilling contractual requirements for course	3.32	1.62	1.13
management purposes			
Promoting student self-directed learning	3.26	1.29	1.71
Delivering introductory course materials	3.08	1.38	.83
Archiving/curating course materials	2.92	1.59	.11
ALL FUNCTIONS	2.88	.68	n/a
Co-ordinating learning activities for part-	2.88	1.48	03
time/distance students			
Conducting course administration	2.44	1.34	66
Developing practice & revision opportunities for	2.42	1.10	24
students			
Delivering blended learning	2.35	1.40	-2.72
Promoting participation & interaction in learning	2.29	1.12	-2.77
discussions			
Conducting formative assessment	2.38	1.38	-2.37
Assessing student engagement with course content	2.17	1.27	-3.72**
Generating course evaluation & feedback from	2.17	1.31	-4.34**
laamara			

* = p < .05, ** = p < .01 (*βonferroni* corrections applied), df = 23 in all instances

Discussion

The present research found that higher reported teaching workloads were associated with greater negativity in attitudes towards VLEs. High teaching workloads may be evidenced through greater variation in teaching content, a larger number of students (and therefore a greater assessment burden), and a greater need to standardise teaching processes (or a reduced ability to utilise some desirable VLE features such as tailoring content to student understanding). Whilst nothing can be concluded as to the criteria teachers used when estimating their teaching workload, it is apparent that within the

CDS research context, more teaching resulted in greater perceptions that VLEs were cumbersome to engage with and not of additional benefit to teaching quality.

Surprisingly, and contrary to expectations, the level of experience in using VLEs was unrelated to VLE utility attitudes. As such, a greater level of familiarity with VLEs did not result in perceptions that the VLE was useful or easy to use. Amongst VLE utility attitudes, *Perceived usefulness* explained a significant, unique amount of variance in *VLE Use. Perceived ease of VLE use* was positively associated with both *Perceived usefulness* and *VLE Use*. Such findings converge with theoretical models of VLE use (e.g., Davis et al., 1989, cited by Wang & Wang, 2009). However, overlap in the statistical measurement of *Perceived ease of use* and *Perceived usefulness* was indicated, and regression analysis indicated that *Perceived ease of use* did not account for unique variance in *VLE Use, but Perceived usefulness* did.

An exploration of various VLE functions indicated that the VLE was used most frequently to *conduct summative assessment*, and to *meet perceived student and institutional expectations*. Other functions, specifically *assessing student engagement with content*, and *generating evaluation and feedback from learners* were reported to be used less frequently. Whilst no further examination of VLE function use is reported in the present paper, it may be the case that various demographic distinctions such as teaching role (e.g., module contributor/lead, course director) may impact upon the frequency of use of the differing VLE functions explored. For instance, it seems likely that those functions mentioning course content or course evaluation would be of greater relevance to course directors as opposed to module contributors. Additionally, given the impact of teaching workload upon perceptions of VLE utility, the level of self-reported teaching workload may also differentially impact upon the VLE teaching practices that are used more frequently. For instance, those with light teaching workloads may only require two or three functions to carry out their teaching, whereas those with high workloads may need to use a wider range of functions on a frequent basis.

What is clear from the present results is that the use of information technologies for instructional/teaching purposes is a complex, multi-directional issue (Wang & Wang, 2009). Whilst technical knowledge (Rogers, 2003), task complexity and skill fade can impact upon the cognitive skills required to optimise VLE use (Cahillane et al., 2015: Rogers, 2003), attitudinal factors (Collis et al., 2001; Mahdizadeh et al., 2008; Samarwickrema & Stacey, 2007; Wang & Wang, 2009) and the nature of teaching workloads play a pivotal role in motivating teachers to interact with technology, and therefore need to be factored into models of VLE use.

Limitations

There are a number of methodological considerations that should be acknowledged. Firstly, the small sample size may affect the strength of conclusions that could be drawn. The 29 respondents documented presently represent a small percentage of the overall number of teaching staff at CDS who received an invitation to take part in the research. Secondly, the three-item scale developed to assess participants' perceptions of their personal needs and responsibilities in regards to using VLEs within their teaching provision (*VLE use*) had suboptimal internal consistency. Whilst a small sample size may have contributed to this result, further refinement and validation of a measure of teaching staffs' personal (i.e., not mandated) investment in VLE use would be desirable. Thirdly, with the exception of one reverse-scored item, no control measures were built

into the questionnaire in order to mitigate the impact of common method variance that can be introduced through use of self-report measures and common response formats (i.e., Likert scales). Future development of the questioning methodology will seek to intersperse scale items, develop more reverse-scored items, and visibly remove previous responses in order to reduce the likelihood of response sets. A further methodological improvement would be to reduce the reliance on self-reported data by using observable measures such as actual VLE engagement. Another limitation is the use of crosssectional data. Whilst there are theoretical justifications for predicting that some attitudinal variables are antecedents of VLE use (based on the weight of the evidence within the VLE literature base), a longitudinal design and data collection plan would be required to infer cause and effect.

A final consideration regarding the present results is the nature of CDS as a research context. In addition to the contextual nuances outlined within the Method section, restrictions regarding the dissemination of commercially and/or defence sensitive teaching content may act to constraint the use of VLE for some teaching staff within the present research context. Indeed, some Masters level courses are not available to civilian students, a factor not captured in the present research design. Further contextual concerns emerge from preliminary inspection of the comments left by questionnaire respondents. Whilst a full qualitative exploration of teacher's comments regarding current VLE provision is beyond the scope of the present paper, some reoccurring themes merit mention. These include the practical and applied nature of lots of CDS teaching disciplines. Terms such as "inflexible," "demonstration," and "hands-on work" indicate that some respondents did not feel like some teaching content could be best delivered via a VLE.

Future Research

Whilst the results reported presently reflect an interim snapshot of VLE attitudinal positivity within CDS, future research phases are planned. Such activity will involve collecting data within Cranfield University's other research Schools (School of Energy, Environmental Technology and Agrifood; School of Aerospace, Transport and Manufacturing; School of Management). This will enable comparison of the CDS environment against the VLE teaching practices of those on a more typical campus, whilst maintaining a focus on postgraduate education.

A further fruitful avenue for research development involves assessing the criteria (actual metrics and perceived components along with their relative weightings) considered when reporting teaching workload. Of high priority given the present impact of teaching workload on attitudinal factors, is to investigate whether self-reported workload coincides with contractual obligations. Where discrepancies arise, an examination of the factors at play in skewing workload estimations could highlight contextual factors that affect attitudes towards VLE utility.

It is envisioned that the long-term output of the research avenues outlined may have multiple applications. Firstly, the research may identify areas of underuse/disuse within Cranfield's VLE provision which could inform policy as to future functionality provision. Secondly, results could be used to determine whether VLE training or support may be of benefit. Here, frequently used functions that are perceived to add value to teaching provision should be prioritised.

Conclusions

VLE use is a multi-faceted construct dependent on knowledge, skills, and attitudes. Cahillane et al. (2015) suggest that skill fade is dependent upon the inherent complexity of enacting a teaching task within a VLE, coupled with consideration of when the knowledge and skills underpinning task performance were last used effectively. The present research builds upon this by highlighting some attitudinal factors that affect the use of technical skills used to achieve differing teaching functions. Future efforts should aim to merge these two research streams to establish a model of the socio-cognitive factors affecting the development and maintenance of VLE teaching skills. Such a model might have implications for assessing VLE teaching capability at an organisational level.

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A CASE STUDY OF THE BARRIERS AND ENABLERS AFFECTING TEACHING STAFF E-LEARNING PROVISION

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Abstract

The present paper reports the outputs of a focus group examining the perceived uses, enablers and barriers of utilising virtual learning environments (VLEs), amongst a small group of postgraduate teachers. Sixteen pedagogical/teaching functions were identified and were mapped to MacLean and Scott's (2011) model of VLE elements. Whilst a number of enablers of VLE use were apparent, participants' insights and inputs indicated a larger number of VLE barriers. It appears that the biggest barrier to overcome in using VLEs is finding the time to develop the materials and navigate the technology.

Introduction

The knowledge and skills of those generating and maintaining e-learning content is pivotal to successful e-learning provision (Rogers, 2003). Skill retention within a virtual learning environment (VLE) is a multifaceted construct, dependent upon the arduousness of the procedural steps involved in skill use (e.g., the number of steps required to perform the skill and the availability of feedback and support tools; Cahillane, MacLean, & Smy, 2015) and, of present importance, the frequency of skill use (e.g., Arthur, Bennett, Stanush, & McNally, 1998). Previous research by Cahillane et al. (2015) applied a predictive skills retention model that indicated variability in retention rates for VLE content organisation activities. A clear distinction was found between those tasks whose underpinning knowledge and skills are indicated to fade rapidly (11 activities) versus activities that were indicated to fade very quickly (5 activities). These technical activities, ranging from setting up a quiz through to adding files to a page, enable core teaching functionalities. In particular, tasks representing components of formative and summative assessment (e.g., quiz design), which support learning through interaction and feedback, were predicted to be highly susceptible to skills fade where no practice occurs over a period of 12 months.

Since the frequency of skill use (e.g., Arthur et al., 1998) is a known strong moderator of skill retention, the extent to which teaching staff use VLE and the factors which influence use need to be considered. Socio-cognitive factors are known to moderate the frequency of use of VLEs. Such factors include attitudes and perceptions concerning ease of use and the perceived utility of the VLE (Collis, Peters, & Pals, 2001; Mahdizadeh, Biemens, & Mulder, 2008; Samarawickrema & Stacey, 2007; Wang & Wang, 2009). Enablers of positive attitudes and perceptions here may include the relative advantage afforded by VLEs, perceived compatibility with teachers' existing values and practices, and institutional policies mandating or promoting e-learning capability (Rogers, 2003; Samarawickrema & Stacey, 2007). Barriers might include scepticism towards e-learning outcomes, time concerns, and workload (Mahdizadeh et al., 2008; Njenga & Fourie, 2010). This paper presents an exploratory case study that investigated academic staff perceptions regarding the functions supported by VLEs along with perceptions concerning the barriers and enablers which moderate perceived ease of use. The perceptions and experiences of Cranfield University teaching staff were sought in a focus group setting. Both individual opinion and group consensus were collected through a variety of open and closed questioning techniques, outputting both quantitative and qualitative data. It is envisioned that the outcomes of the research can be used to determine how best to support effective e-learning provision through VLEs and to recommend methods of assessing the teacher capability component of the university's e-learning provision.

Method

Participants

Four Cranfield University teaching staff took part in the research on a voluntary basis. All participants were from Cranfield Defence and Security (CDS), one of the four research schools catering to postgraduate students only. CDS is unique in that it provides teaching provision closely aligned to the academic needs of the military

Materials and Design

Qualitative and quantitative data outputs were collected. Flip charts and post-it notes were used to record and organise responses. Two targeted activities were conducted with corresponding probes. A survey at the individual level was conducted. The first half collected demographic information including: age, gender, teaching discipline, teaching experience, teaching workload, current VLE involvement related to role (e.g., course lead/course contributor/course administrator/module lead/module contributor/module administrator. The second half asked participants to identify: (a) different functional ways in which they use the VLE and, given their experience, (b) what they felt were enablers and barriers to the use of the VLE. The second half of the survey therefore acted as an introductory exercise to engage participants in thinking about their experience of using the VLE.

Upon completion of the individual surveys a focus group was conducted. At the beginning of the focus group, each participant was invited to describe his or her experience of using VLEs for teaching provision, including length of experience and use of differing VLE platforms. The latter probe enabled the research team to establish whether there was diversity in VLE platform use amongst participants or if participants had experience of all using a particular platform. The focus group then progressed to discussing the collective impressions of the differing features and functionalities afforded by Cranfield University's Moodle-based VLE. The final part of the focus group captured and facilitated discussion of the perceived enablers and barriers associated with the use of VLEs as part of teaching practice.

Procedure

Participants were welcomed and the research context, objectives and workshop agenda (as indicated above) was outlined. After first completing an informed consent form, participants were given 10 minutes to complete the pre-survey. For the open-ended questions within the pre-survey participants were informed that whilst they did not need to provide great levels of detail, these topics were going to be revisited during the focus group. Upon completion of the pre-survey, participants were invited to briefly outline their teaching role, responsibilities and their experience of using VLEs. Building upon

the individual survey data, participants were then asked to describe aspects of their teaching practice that are carried out online and to identify which VLE they use (Moodle or Blackboard). Whether they felt any elements of teaching provision are not supported by the current VLE platform was also ascertained. The barriers and enablers of using the Moodle VLE platform were then considered.

Throughout the focus group the research team used probes to facilitate focus group discussion. At the end of the focus group, the participants were debriefed on the full nature of the study and provided with the opportunity to ask any questions.

Results

Demographics

The length of time participants had been teaching ranged from six months to 21 years. Two of the four participants had taught for a relatively significant number of years (19 and 21 years). Only three of the four participants reported their teaching discipline which represented a diverse range, including applied maths and computing, engineering and information systems, and the social sciences. On average, 45% of work time was dedicated to teaching. Teaching here referred to all aspects of preparation, delivery, assessment, administration and supervisory contact. All participants (100%) reported the use of the Cranfield VLE. Figure 1 shows that all participants were module leaders and the majority also contributed to modules led by other academic staff.



Figure 1. Frequency of teaching roles undertaken.

VLE Functionalities

The results of this focus group activity were analysed by taking an interpretative approach, indicated in Figure 2. The focus group items captured were firstly organised into the teaching and pedagogical functionalities perceived by participants as supported by the VLE. These teaching functionalities were further explored through discussion of the various ways in which each teaching function could be translated into appropriate VLE content. This approach enabled the identification of pertinent technical VLE skills (such as those identified by Cahillane et al., 2015) along with discussion of other VLE components such as the type of media and presentational affordances, providing a richer descriptive explanation of the differing teaching functionalities. Subsequently, the teaching/ pedagogical functionalities, their subcategories and corresponding focus

group items were mapped to three major components of academic teaching activity derived from a published model (Maclean & Scott, 2011). The model is outlined below.

MacLean and Scott (2011) Model

MacLean and Scott identified three high-level VLE functionalities generic to many different e-learning platforms: (a) teaching and learning, (b) assessment, and (c) administration. Appropriately designed teaching and learning activities aim to promote student learning, whilst formative assessment shapes student learning through the provision of constructive performance-related feedback. Assessment refers to summative assessment, which enables academic teaching staff to check learning goals are being achieved and informs the award of academic qualifications. Administration can include a range of activities which together form the structure supporting the organisation and provision of the taught component of courses. Administrative activities can include, but are not limited to, course timetabling, student tracking, and archiving course materials. Administration also includes the collection of data regarding student satisfaction and experience, which helps higher education institutions identify where changes are required.

The results of the interpretivist analysis with respects to the teaching functionalities identified and their superordinate pedagogical categories are captured in Table 1. Each superordinate category is further unpacked in the following sections. Overall, 16 teaching functionalities became apparent through participant discussion.

Table 1

Learning and teaching	Assessment	Administration
Formative assessment Participation and interaction in learning discussions Provision/delivery of pre- course materials Promoting student self- directed learning	Summative assessment Grademark (Feedback)	General administration Archiving/curating course materials Co-ordinating part-time and full-time students Course evaluation Meeting course teaching expectations and
Delivery of blended learning options Optimisation of face-to- face contact time Providing feedback to students		contractual requirements Assessing student engagement with course content
Developing practice and revision opportunities Tailoring content to student ability and understanding		

Alignment Between MacLean and Scott's (2011) Pedagogical Categories and CDS Staff Perceived Functionalities Learning and teaching. For learning and teaching the focus group items were organised into nine subcategories. The conduction of formative assessment was reflected through the reported use of the VLE in the development of quizzes and questions, for example mathematics by multiple-choice. The promotion of participation and interaction in learning discussions was evidenced through the perceived use of the VLE for peer-to-peer discussion, teacher-to-learner interaction, online content, and discussion contributions through implementation of forums and blogs. The VLE was perceived to be useful for the provision of pre-course reading, papers, technical basic concepts, sound files, podcasts, presentations, and content for VLE only modules. These functions were categorised as representative of promoting student self-directed learning.

The perceived utility of the VLE for the delivery of blended learning options was categorised as promoting flexible access for and coordinating part-time/distance students. However, the extent of the perceived utility of the VLE for blended learning was limited to the provision of basic content and optimisation of face-to-face contact time. The Grademark feature of the VLE (a digital environment/tool for grading and commenting on student work) was viewed as useful for the provision of feedback to students. However, Grademark, which is used to provide feedback on summative assessments, was the only feature of the VLE reported as supportive of the provision of feedback.

Feedback refers to knowledge of performance or results. It is thought to have a beneficial effect on learning, especially if it is immediate and detailed such as, providing the correct answer or explanation straight after an incorrect answer is given (Pashler, Rohrer, Cepeda, & Carpenter, 2007). Also, combining immediate feedback with the opportunity to answer until the right answer is provided has been found to support retention (Dihoff, Brosvic, & Epstein, 2003). Feedback not only emphasizes successful performance; it highlights performance deficits that need correcting. Given this is a key teaching functionality found to drive learning, more examples of supportive features would be expected.

Within disciplines that are highly technical and require a lot of practical activity, the focus group indicated that it may be a challenge to develop practice and revision opportunities for students. It was suggested that in some contexts only technologically savvy teaching staff are able to generate practice/revision content. These technical *work-arounds* may not be directly hosted within the VLE. Instead they may require the generation of separate webpages that could then be linked to VLE courses through hyperlinks.

A final functionality linked to learning and teaching was the ability to tailor content to individual ability. Perceived as being achieved via a VLE affordance (and not necessarily the deliberate output of course design), hosting teaching content within the VLE provides students with the option of skipping over content that they already understand and indicates the VLE has utility in tailoring content to student ability and understanding.

Assessment. Two VLE assessment functionalities were identified through focus group discussions, with several features of the VLE supporting different aspects of teaching practice in respects to summative assessment. Learner engagement, student task completion metrics, and time tracking logs enable the capture of contributions to

summatively assess group project work. As discussed under the learning and teaching 'super category' of teaching practice, feedback is a key driver of learning. However, in respect to summative assessment, Grademark may be the sole feature within the VLE that can be used by Cranfield teaching staff for the provision of feedback to learners.

Administration. Five administrative teaching functions were identified. Teaching staff felt a number of features within the VLE, including completion and time tracking logs, Turnitin, and repository functionality supported the tracking of learner engagement. Teaching staff also reported using the Internal Evaluation (INVAL) link, Qualtrix, and the Moodle spreadsheet features. These were seen as supportive of course evaluation, and therefore collectively these features were categorised as generating course evaluation and feedback from learners. Many of the courses and modules taught at CDS are delivered as part of the Academic Provider (AP) contract Cranfield has with the Ministry of Defence (MoD). This function is therefore representative of the fulfilment of contractual requirements. Furthermore, given that VLEs are today widely implemented across higher education institutions, the reported competitiveness with other universities its use provides is arguably representative of the fulfilment of student and institutional expectations.

Barriers and Enablers of VLE Use

Table 2 clearly shows that, in general, participants viewed the VLE as enabling easy access to teaching and learning content and activities for part-time and distance learners. Good technical and flexible support for use of the VLE on courses was also reported. The standardised template formats available within the VLE platform were also seen as key to standardising the look and feel of teaching materials and supporting documentation across courses.

Analysis of the barriers displayed in Table 2 indicates that time to develop and organise content and generate the tools to check student understanding is a major barrier to the use of VLEs in teaching practice. In addition, use of the Grademark feature was viewed as lengthening the assessment and marking processes, and to mitigate this negative feature teaching staff reported setting shorter essays in order to ensure the marking process was completed and feedback provided to the students within the period of time mandated by the university. Platform specific limitations for technical content, for example, inputting symbolic mathematics, were also reported as restrictive to the effective use of the VLE for technical subjects. Teaching staff resistance to the use of the VLE for teaching activities was reported as due to limited technical literacy of many staff. The lack of face-face physical presence associated with the use of VLEs was seen as reducing student engagement.

Development of a shared understanding of a given topic in a reasonable amount of time was also seen as problematic as was the fact the VLE cannot adapt to individual learner knowledge states. The latter is particularly problematic for whole module delivery within the VLE. Finally, accessibility in VLEs was perceived as a barrier. For example, the compatibility with screen reading software presents accessibility issues for blind students. This barrier is widely recognised in the wider e-learning literature (e.g., Kelly, Phipps, & Swift, 2004; Nganji & Brayshaw, 2015).

Table 2

Perceived Barriers and Enablers

Enablers	Barriers
 Access to students Students can study at their own pace Good for part- time/distance learners Good for distance learners in different time zones Good technical support. Good level of flexibility Environmentally friendly (paper-free reduced admin, costs, environmentally friendly) Auditability Shared communication Can host student- generated resources Appropriate course/teaching standardisation 	 Platform specific limitations for technical content More time is required to develop content No additional time is available to develop content Resourcing Longer assessment/marking process Essays need to be shortened to maintain marking process/workload Difficulty in maintaining consistency across all teachers/content aligned to each course Teacher resistance to adopting new technology, technical literacy Lack of face-face physical presence reduces student engagement Difficult to develop a shared understanding in a reasonable amount of time (asynchronous communication theories of for supporting learning0 Usual cues that students are engaged not available (gestures, visual cues) Takes time to develop the tools required to check student understanding (e.g. formative quizzes) Not adaptive to individual knowledge states of learning Accessibility problematic in VLEs for some students (e.g. blind students and compatibility with screen reading software)

Discussion

Although the flexible and technical support offered to teaching staff was reported as an enabler to using the VLE, several barriers to its efficient and effective use were reported. Time to develop and organise content and configure the tools that drive learning emerged as a major barrier. The effective organisation of content within VLEs requires teaching staff with relevant technical knowledge and skills (Rogers, 2003). It is therefore likely that the reported resistance to the use of the VLE due to poor technical literacy in many staff, may further compound the perceived barriers related to the time required to develop teaching materials. That platform specific limitations for the input of technical content (e.g., symbolic mathematics) were also perceived as a barrier to teaching practice, suggests that certain platforms do not provide a standardised capability supportive of teaching practice across all academic subjects. The finding that

technically knowledgeable teaching staff can create work-arounds further exemplifies the need for foundational technical skills to support use. The reported technical literacy issues are mirrored by the fact that little consideration has been given to the impact of technology on the technical knowledge and skills requirements and teaching experience of academic staff (Attwell & Hughes, 2010; Cahillane et al. 2015). The barriers of time and technical literacy thus indicate the need for staff training in the efficient and effective use of VLEs.

Given time has a perceived impact on use, it is important to acknowledge that frequency of use is an important moderator of skill retention. Through the application of a predictive skills retention algorithm, Cahillane et al. (2015) indicated that less than 10% of tutors will be able to perform rapid fade VLE activities successfully (i.e., without errors or further training) after 12 months of no practice. This indicates that the use of training alone to support the acquisition of VLE content design, development and organisation skills would not support the retention of such skills. Therefore, mandated refresher training for those staff with little or no practice should be considered by higher education institutions.

Teaching staff felt the VLE was not adaptive to individual knowledge states of learning. VLEs by their nature are not equivalent to adaptive systems such as Intelligent Tutoring Systems (ITS). The latter facilitate learning through their ability to assess and adapt to individual learner knowledge states during progression towards proficiency (Sottilare & Goldberg, 2012). Developing an ITS is much more of a time consuming task compared to developing self-paced learning materials within the VLE. Moreover, providing staff with the skills to develop an ITS is unlikely within a conventional higher education institution. The more efficient approach would be to train staff in the development of tools and also ensure that learners are equipped with the appropriate skill set for learning within the VLE.

Conclusions

Given the very small sample size used for this focus group, only tenuous conclusions can be drawn regarding VLE use in teaching practice. This exploratory study, small scale and qualitative as it is constituting an important first step towards the more quantitative and generalizable in-house research that will provide strategic direction to the university exceptive and may be exploitable beyond the organisation.

Future Research

Time to develop and organise content and configure the tools required to support learning emerged as a major barrier, as indicated by the number of references to time. Future research would do well to rank the barriers and enablers according to their perceived impact and influence on teaching practice and the learner experience. It is only then that it will be possible to understand those factors that are perceived to have the most impact (negative and positive) so that mitigation strategies can be better targeted and prioritised against resource limitations. It would also be wise to develop metrics to capture how well the implementation of these strategies is contributing to the development of institutional e-learning capability.

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COMMUNICATION AND META-COMMUNICATION IN SOFTWARE ENGINEERING

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Abstract

This paper examines and focuses on some issues and questions relating to the use of the meta-communication concept in the software engineering process. Also investigated are the role of IT project communication and the project management tools that can be regarded as vital for software engineering, primarily the Internet, email, printed materials and the categories by which development teams interact. In the field of Software Engineering the perception of the role of socio-cognitive engineering (SCE) is continuously increasing. Today, the focus is especially on the identification of human and organizational decision errors caused by software developers and managers under high-risk conditions, as evident by analyzing reports on failed IP projects.

In this paper, more detailed aspects of cognitive decision-making and its possible human errors and organizational vulnerability are presented. The formal TOGA-based network model for cognitive decision-making enables us to indicate and analyze nodes and arcs in which software developers' and managers' errors may appear. As the nature of human errors depends on the specific properties of the decision-maker and the decision context of IT project processes, a classification of decision-making is suggested. Several types of initial situations of decision-making useful for the diagnosis of software developers' errors are considered. The developed models can be used for training the IT project management executive staff.

Keywords: Engineering Science, knowledge building, communications systems, expressing, formulas, defect prevention, socio-cognitive modeling, software engineering, IT, IT project processes TOGA meta-theory, socio-cognitive engineering, project communications management.

Introduction

Meta-communication. Bateson (1972) is typically said to have invented the term, but in fact, he credits Benjamin Lee Whorf. Bateson suggested the term's significance in 1951, and then elaborated upon one particular variation, the message "this is play," in 1956. A critical fact for Bateson was that every message could have a meta-communicative element, and typically, each message held meta-communicative information about how to interpret other messages. He saw no distinction in type of message, only a distinction in function; most of meta-communicative signals are nonverbal. From 1952-1962, Bateson directed a research project on communication.

This paid particular attention to logical paradoxes including Russell's paradox and to Bertrand Russll's Theory of Types, Russell's solution to it. Bateson (1972) and his associates here pioneered the concept of meta-communication, something that means different (often contradictory) things at different levels. *Meta-communication* is thought

to be a characteristic feature of complex systems (see <u>http://www.meta-</u> <u>communication.readwithhelp.com</u>). Russell's 1902 solution to his logical paradox comes in large part from the so-called *vicious circle principle*, that no propositional function can be defined prior to specifying the function's scope of application. In other words, before a function can be defined, one must first specify exactly those objects to which the function will apply (the function's domain). For example, before defining that the predicate "is a prime number," one first needs to define the collection of objects that might possibly satisfy the predicate, namely the set, N, of natural numbers. It functions as a formal definition of the function of meta-communication in communication.

In the early 1970s, Gregory Bateson coined the term to describe the underlying messages in what we say and do. *Meta-communication* is all the nonverbal cues (tone of voice, body language, gestures, facial expression, etc.) that carry meaning that either enhance or disallow what we say in words. (There's a whole conversation going on beneath the surface!) The term's root comes from the Greek word "meta," meaning "beyond" or "in addition to." *Meta-communication* is, therefore, something "in addition to the communication," and we must always be aware of its existence.

It is essential to remember that the meta-communication that accompanies any message is very powerful. Receivers will use these clues to help interpret what you mean, but, more importantly, they will often take the meaning from the meta-communication rather than from the words themselves, particularly when what you are saying conflicts with what you are doing. If, for example, you are angry but trying to hide your anger, you must be aware of your body posture, the way you use your eyes, gestures and facial expressions, and the tone of your voice, which may well give you away. Similarly, in writing, the 'tone of your voice' may show (Istifci & Demiray, 2011).



Other examples are useful to clarify understanding of the metacommunication concept and its function in the lifelong learning process and with our daily life. For example, Demiray (2010) points to signs concerning disabled persons, which we may find anywhere, and which result in each of us understanding the same meaning: e.g., parking for disabled person, toilet for disabled person, meal for disabled person, path for disabled person, reserved for disabled person, line for disabled person, etc.. The truth is that people communicate all the time. It's not

possible to avoid it (Vygotsky, 1978).



understanding being developed, by providing a separate channel for the support communication, and to do it in an easy, focused, and context aware manner. This may be particularly useful when the opportunity for face-to-face meta-communication is missing, as in much distance teaching (McLean, 1999).

Although nonverbal communication gives clues to what speakers are thinking about or enhances what they are saying, cultural differences may also interfere with understanding a message (Pennycook, 1985). The rules are brought to our attention only in formal discussions of nonverbal communication, such as this one, or when rules are violated and the violations are called to our attention-either directly by some tactless snob or indirectly through the examples of others.

While linguists are attempting to formulate the rules for verbal messages, nonverbal researches are attempting to formulate the rules for nonverbal messages-rules that native communicators know and use every day, but cannot necessarily verbalize. It must be mentioned that nonverbal behavior is highly believable. For some reason we are quick to believe nonverbal behaviors even when these behaviors contradict verbal messages. Nonverbal reports on research demonstrate that compared to verbal cues, nonverbal cues are four times as effective in their impact on interpersonal impressions and ten times more important in expressing confidence. From a different perspective, Albert Mehrabian (1976) argues that the total impact of a message is a function of the following formula: total impact = 7% verbal + non-verbal 38% + 55% facial. In using the meta-communication concept for models of interactivity, collaboration, and communication in a distance learning environment, technology is the tool that both delivers content and allows the learner to interact and communicate with others in the learning environment. Modes of communication can be either asynchronous or synchronous. Appropriate technologies can help encourage peer-to-peer interactions and learner-instructor interaction with content (Cooper & Robinson, 1998).

The meaning of the thumb and index finger forming a circle representing "OK" is spreading just as fast as English technical and scientific terms. Emblems are often used to supplement the verbal message or as a kind of reinforcement. At times they are used in place of verbalization, when there is a considerable distance between the individuals and shouting would be inappropriate, or when we wish to communicate something behind someone's back. Illustrators are nonverbal behaviors that accompany language In saying "Let's go up," for example, there will be movements of the head and perhaps hands going in an upward direction. In describing a circle or a square, you are more than likely going to make circular or square movements with your hands (Veliyeva, 2011).

Is Scientific Language a Perfect Spot for Meta-Communication?

In Education

Given that scientific inquiry is grounded in the previously discussed models for the learning of science concepts -- situated cognition and constructivism -- there are four elements about inquiry in the science classroom that are generally accepted (Anderson, 2007). These four elements as described by Anderson are:

- Learning is an active process of individuals constructing meaning for them; significant understandings are not just received.
- The meanings each individual constructs are dependent upon the prior conceptions this individual already has. In the process, these prior conceptions may be modified.

- The understandings each individual develops are dependent upon the contexts in which these meanings are engaged. The more abundant and varied these contexts are, the richer are the understandings acquired.
- Meanings are socially constructed; understanding is enriched by engagement of ideas in concert with other people. (Anderson, 2007, p. 809)

Given these four elements as necessary for inquiry in the science classroom, it is clear that the environment for learning science is not limited to the face-to-face classroom, but can be other environments such as online or informal education environments. In the teaching of scientific inquiry, it is also generally accepted that students need to participate in activities that promote the active role of the student. Activities need to provide opportunities for students to: ask their own questions, design their own activities, interpret, explain, hypothesize, and share authority for answers. The work that students do needs to emphasize reasoning, reading and writing for meaning, solving problems, build from existing cognitive structures, and explain complex problems (Anderson, 2007). How these characteristics of science inquiry look in practice in both the face-to-face and online classrooms has been discussed elsewhere by the authors (Baptiste, Neakrase & Ryan, 2011).

In Software Development

Software processes are specified for a number of reasons: to facilitate human understanding, communication, and coordination; to aid management of software projects; to measure and improve the quality of software products in an efficient manner; to support process improvement; and to provide a basis for automated support of process execution (Bourque & Fairley, 2014, p. 148). Modeling employs the application domain vocabulary of the software, a modeling language, and semantic expression (in other words, meaning within context). When used rigorously and systematically, this modeling results in a reporting approach that facilitates effective communication of software information to project stakeholders (Bourque & Fairley, 2014, p. 164).

Management sponsorship supports process and product evaluations and the resulting findings. Then an improvement program is developed identifying detailed actions and improvement projects to be addressed in a feasible time frame. Management support implies that each improvement project has enough resources to achieve the goal defined for it. Management sponsorship is solicited frequently by implementing proactive communication activities (Bourque & Fairley, 2014, p. 177). Different types of reviews and audits are distinguished by their purpose, levels of independence, tools and techniques, roles, and by the subject of the activity (see Figure 1). It is easy to get overwhelmed with our personal and professional tasks. We often forget that there is only one of us and a million things we need to get done. We can't possibly do it all or be everywhere we need to be. In order to get things done, we have to learn to let go and let others assist us.



Figure 1. Communication by roles in software engineering project (1-means one, * - many).

Success of a software engineering endeavor depends upon positive interactions with stakeholders. They should provide support, information, and feedback at all stages of the software life cycle process. Therefore, it is vital to maintain open and productive communication with stakeholders for the duration of the software product's lifetime. (Bourque & Fairley, 2014, p. 200).

In Airport Communications

Tam and Duly (2005) highlight that differences exist between western and non-western crews in attitudes, working practices, behavior, responsibilities and roles. They note that these differences will have global implications for training, safety and communications in aviation operations. It was found that current research of human factors in the flight deck generally used participants from Europe or America, suggesting it did not take into consideration human factor issues in non-westernized countries and flight decks with a mixture of both.

Effective communication is vital for the safe operation of an aircraft. This means that all information needs to be shared amongst the crew. If a co-pilot comes from a country with high power distance, for example, Malaysia (Clearly Cultural, 2009), then they are less likely to share information with their captain. If the captain comes from a culture of low power distance, then he or she would be expecting better information sharing. This lack of communication and understanding can lead to poor team work (Anderson,

Embrey, Hodgkinson, Hunt, Kinchin, Morris, & Rose, 2001) which is not an ideal situation on the flight deck. The Flight Safety Foundation (2003) claims that without friendly chatter amongst flight crew, boredom can become a problem; this boredom can then lead to undesired flight states. If the crew is made up of different cultures, then they may be uncomfortable or even unable to engage in friendly conversation to deter boredom.

Moreover, there has been a strong correlation found between countries with high power distance and the occurrence of plane crashes (Woessner, 2009). This could be due to a severe lack of effective communication between the flight crews. The power distance in the cockpit needs to be understood and recognised by not only the flight crew but also management. Where multi-cultural crews are concerned, efforts need to be made to reduce the power gradient so, for example, while the captain still retains authority, the first officers feel comfortable, are willing and able to communicate with their captains. If people are from different cultures or different nationalities, success in achieving the objectives of a message requires that in their communication there should be exact matching of verbal, non-verbal and contextual meanings.



Source: Retrieved on 16.10.2015 http://aviationsafety.net (please visit for detail).

More frequent communication, including face-to-face meetings, can help to mitigate geographical and cultural divisions, promote cohesiveness, and raise productivity. Also, being able to communicate with teammates in their native language could be very beneficial. It is vital that a software engineer communicate well, both orally and in reading and writing. Successful attainment of software requirements and deadlines depends on developing clear understanding between the software engineer and customers, supervisors, coworkers, and suppliers.

Let's look deeper at examples from the math course world. Usually 2x2 is 4; 2+2=4 in every corner of the world as, the formula for calculating the area of a square also remains the same (Demiray, 2010). If the formula is shown, it means computing the area of a square, in any language, even changing the length of the sides, does not change the way of computing the area. Only numbers change. When we view the formula, we think and animate in our mind that square of an area is equal to one side's square. These formulas bring a picture to our mind automatically.

Illustrators make our communications more vivid and more forceful and help to maintain the attention of the listener. They also help to clarify and make more intense verbal messages.

for circle
$$\mathbf{r} = \pi_{\mathbf{r}}$$
 triangle = $\frac{1}{2}(bh)$ $\mathbf{r} = \frac{\mathbf{r}}{\mathbf{r}}$ one half times the base length times the height of the triangle

For area of square = a^2 , **a** for area of rectangle = ab

We learned these formulas in math course in around 4th primary level education. We still remember these formulas as certain concepts in picture form. It is just like for traffic signs. Some formulas are important for life so we do not forget them any time. We use them automatically as a reflex. Similarly, some graphs tell us very briefly what is happening in the diagram: on some, increasing success, increasing production, increasing population or, on others, decreasing success, decreasing production, decreasing death rate, increasing birth rate, etc.

As seen in these examples, we do not need to talk or tell much. Concepts such as asymptotes or colors for graphs of rational, logarithmic and exponential functions are explored numerically. They give the main ideas in general info at initial scanning. They help us to share very complex results in basic and brief explanations. Asymptotes, colors, legends and charts have their own meanings, which are decoded in our mind immediately. This decoding tells us correlations and differentiations with each other.

Reading, Understanding, and Summarizing

Software engineers are able to read and understand technical material. Technical material includes reference books, manuals, research papers, and program source code. Reading is not only a primary way of improving skills, but also a way of gathering information necessary for the completion of engineering goals. A software engineer sifts through accumulated information, filtering out the pieces that will be most helpful. Customers may request that a software engineer summarize the results of such information gathering for them, simplifying or explaining it so that they may make the final choice between competing solutions. Reading and comprehending source code is also a component of information gathering and problem solving.

Writing

Software engineers are able to produce written products as required by customer requests or generally accepted practice. These written products may include source code, software project plans, software requirement documents, risk analyses, software design documents, software test plans, user manuals, technical reports and evaluations, justifications, diagrams and charts, and so forth. The software engineer's ability to convey concepts effectively in a presentation therefore influences product acceptance, management, and customer support; it also influences the ability of stakeholders to comprehend and assist in the product effort. This knowledge needs to be archived in the form of slides, knowledge write-ups, technical whitepapers, and any other material utilized for knowledge creation (Bourque & Fairley, 2014, p. 201-202).

Team and Group Communication

Effective communication among team and group members is essential to a collaborative software engineering effort. Stakeholders must be consulted, decisions must be made, and plans must be generated. The greater the number of team and group members, the greater the need to communicate. The number of communication paths, however, grows quadratically with the addition of each team member. Further, team members are unlikely to communicate with anyone perceived to be removed from them by more than two degrees (levels). Organizational aspects describe how to identify which organization and/or function will be responsible for the maintenance of software. The team that develops the software is not necessarily assigned to maintain the software once it is operational. Communication management is also often mentioned as an overlooked but important aspect of the performance of individuals in a field where precise understanding of user needs, software requirements, and software designs is necessary (Bourque & Fairley, 2014, p. 134).

Literature Review

Meta-communication studies in computer science mostly are related to human computer interaction (HCI) and semiotic engineering. Semiotic perspectives on HCI take humancomputer interaction as a special case of computer-mediated human communication. See "Meta-communication and Semiotic Engineering: Insights from a Study with Mediated HCI" (Monteiro, de Souza, & Leitão, 2013), which reports on empirical research about meta-communication in HCI and discusses how and why semiotically inspired research can contribute to and advance knowledge in this field.

Another area related to meta-communication is values and culture in interactive systems design. Depending on the way the technologist designed, it will afford behaviors that are intrinsically related to individuals and the complex cultural context in which they are using it (Neakrase, Baptiste, Ryan, & Villa, 2013). It is argued that metacommunication, i.e., communication about communication rules, is a general integration methodology that is applicable to the integration of architectures, protocols, and systems. Efforts towards the development of an automated methodology for metacommunication are discussed. The authors view meta-communication as a design problem. Meta-communicating entities exchange partially specified communication rules. Each entity, or a meta-communication center, applies a standard composition principle on the individual partially specified rules in order to derive the complete protocol architecture (Meandzija, 1990). Some authors study cultural values in software engineering as meta-communication entities (Pereira, Baranauskas, & Almeida, 2011; Pereira & Baranauskas, 2015) presenting a Value-oriented and Culturally Informed Approach (VCIA) to sensitize and support computer science and engineering professionals in taking values and culture into consideration throughout the design of interactive systems.

Approaching a new robot, people will seek cues to help establish what kinds of relationship they might form with it. Is this a social actor or a machine? What is this body capable of? This inquisitiveness is necessary in processes of meta-communication, which Bateson (1972) explores in the classic work of cybernetic media psychology and anthropology; meta-communication is communication about communication. It helps regulate communication between animals, humans, and (according to Chesser, 2012) machines.

The black-boxed robot FURO robot performed an ongoing modulation of meanings with Robot World visitors; the approach is grounded on theoretical and methodological bases of organizational semiotics, building blocks of culture, and socially aware computing. FURO's physical design communicates even before she is switched on. She is a full-scale humanoid capable of complex movements in the head and neck. Her arms move the screen up and down, and she can bow at the waist. Her profile is a stylized maternal body, with a wide rigid plastic skirt descending from broad hips, and minimal hint of breasts. She communicates with visitors through a combination of modes: movement, flashing lights and speech both attract and communicate.



FURO at Robotworld: Human-robot meta-communication and robot media studies. Source of Robot FURO. Retrieved on 19.10.2015 and also avaiable from https://www.google.com.tr/search?q=robot+FURO&biw=1113&bih=594&tbm=isch&tbo=u&s ource=univ&sa=X&ved=0CBkQsARqFQoTCIG3jbL928gCFYqPcgodeZMJUw

The meta-communication model itself consists of two levels:

- Clarification level (where conversation for clarification takes place). At this level there are eleven clarification issues to be reflected on.
- Discourse level (where the discursive examination of contested claims takes place). At this level, there are eight discourses, which are related to the clarification issues.

In his work Ulrich (2001) suggested a philosophical staircase of ISD. The philosophical staircase is a conceptual framework that arranges basic philosophical issues of ISD in a flight of stairs that can be taken step by step, although each consecutive step depends on all the previous ones (see Table 1).

Core concept	Basic issue	Basic theory
"Information"	The philosophical step from symbolic systems to "information" How do we know that some signal or message (a stream of signs or symbols) represents information?	Semiotics: the theory of signs and symbols ≠ "information theory"
"Knowledge"	The philosophical step from information to "knowledge" How do we know that some information represents valid and relevant knowledge?	<i>Epistemology:</i> the theory of knowledge ≠ "science theory"
"Rational" action	The philosophical step from knowledge to "rational" action How do we know that the knowledge we rely on is conducive to rational action?	<i>Practical philosophy:</i> the theory of rational action ≠ "applied science"

Table 1: Three core philosophical problems posed by information systems design

Source: Ulrich, W. (2001). A philosophical staircase for information systems: Definition, design and development. *Journal of Information Technology Theory and Application* 3(2001), 55-84.

In "A Meta-Communication Model for Reflective Practitioners" Yetim (2004) extended the framework for reflective practice proposed by Ulrich (2001). Three different types of meta-communication are described:

- Ex ante meta-communication (taking place before action),
- Meta-communication in action (taking place during action), and
- Ex post meta-communication (taking place after action).

Methodology of the Presentation

The methodology of the presentation is a heuristic application of TOGA (Top-down Object based Goal Oriented Approach). TOGA is the goal-oriented knowledge ordering (conceptual modeling) tool for the specification and system/process identification (s/i) of real-world complex problems.

As such, it can be seen as an initial top/generic and axioms-based meta-model, and subsequently, the methodology of problem decomposition and specialization using available knowledge (see Figure 2).



Figure 2. The methodology of the presentation is a heuristic application of TOGA. Source: Gadomski, Adam Maria. "TOGA: A Methodological and Conceptual Pattern for Modeling Abstract Intelligent Agent [online]." First International Round-Table on Abstract Intelligent Agent, 25-27 January, 1993. Rome, Italy: ENEA. Retrieved from http://erg4146.casaccia.enea.it/wwwerg26701/AIA-toga3.pdf.

Top-down means: From most general minimal information on a problem to its detailed specification/identification (s/i). Such an approach enables a control/check of the completeness and congruence of s/i in every problem specialization step. It requires an initial sufficient amount of information, knowledge and preferences related to the problem, their subsequent acquisition during the problem s/i, and the additional specialization patterns assembled in TOGA as Knowledge Ontology Conceptualization System (KNOCS). KNOCS includes top: meta-modeling axioms, assumptions and model frames.

The dominating top-goal is defined from the socio-cognitive perspective, and it is always the goal of the human or artificial problem solver, decision-maker or designer. The goal-oriented and top-down rules of s/i are included in the Methodological RUles System (MRUS)-the third TOGA component (Gadomski, 1997). For software engineers, TOGA aims to provide the designer of complex engineering systems, an intelligent-agent-based conceptualization with a structured set of methods and rules to allow him or her to control top-down and goal-oriented conceptual modeling process/activity. It enables specifying formally agent-based systems that can be implemented within an agent-based programming platform.

For such tasks, TOGA also provides a global identification and design methodological framework for human-computer intelligence-based systems. Its level of meta-formalization, top-down and goal-oriented requirements enable one to together to cope with a symbolic (not a sub-symbolic) design and to develop a general incremental intelligence (an abstract or synthetic intelligence). From the top systemic meta-philosophical perspective, the TOGA computational philosophy is funded on the set of meta-assumptions/meta-axioms leading to the plausible motivations and choices of the TOGA axioms. Using philosophical terminology;

- TOGA is holistic (top-down) and teleological (goal-oriented).
- TOGA is goal-oriented, therefore «objective reality is not taken into account.

Its main reference-point is a subjective perspective of an intelligent; entity, i.e., it assumes that humans act on the base of always limited available domain-knowledge. Therefore, every intelligent; agent/entity has his/her/its individual philosophy, and it evolves according to their dynamics and different fusions into intelligent aggregates. It is an interpretive process, involving constructions of individuals and social collaboration (Tobin, Briscoe, & Holman, 1990, p. 411).

Dynamic models of meta-communication are discussed in Demiray, Kurubacak, and Yuzer (2012). Created software of the meta-communication model is applicable for using in virtual education process and in virtual research collaboration (Alexander, 1972). It works at several universities for the development of avatars and has significant potential to enhance realism, automation capability, and effectiveness across a variety of training environments.

Genres give off clues that can be counted, analyzed, and visualized through so called data mining (Han & Kamber, 2006). Genres constitute patterns of information and communication; as such, they indicate structures in the production and circulation of meaning across time and space. One recent study examined "a corpus of digitized texts containing about 4% of all books ever printed" in order to "investigate cultural trends quantitatively," documenting changes in, for example, language use, the understanding of fame, and the practice of censorship between 1800 and 2000 (Michel et al., 2010).



Figure 3. Typical communication process.

(Source: https://www.linkedin.com/pulse/20140503151654-23626116-effectivecommunication-model)

Communication Requirements

Some of the most non-productive time spent on a project can be meetings. Take a tip from professional business process engineers on conducting meetings (Gaitros, 2004). This research looks to improve software quality in a new way by assuming that human error is a key cause of software defects (see Figure 4). Research from cognitive psychology is used to develop a deeper understanding of the human errors that occur

during the software development process and to develop techniques that detect and prevent those errors early in the software development lifecycle. Early elimination of mistakes will improve software quality and reduce overall development cost (Carver & Walia, 2014).



Figure 4. Defect prevention process in software engineering in the performance and integrity of data stored on storage media.

This new computer program can automatically fix old code so that engineers can focus on more important tasks. CSAIL's "Helium" system revamps and fine-tunes code without ever needing the original source, in a matter of hours or even minutes. Another situation considers the human being (test engineer, developer) to be outside communication process for decision making and bug fix implementation. So we will have two different schemes of communications (see Figure 5).



Figure 5. Two communications schemes for manual and automated code fixing.

The output of that encoding is the message which is conveyed through a medium. Interference with the message is called noise and finally, the message must be decoded to have meaning for all involved.

Conclusion and Recommendations

Communication is an essential process in the world of project management (and for that matter the world in which we all live on a day to day basis). It is difficult to master, but essential to make a good effort in achieving. In this paper, we have described a meta-communication model, which extends the spectrum of earlier discussed approaches to meta-communication modeling for software engineering processes. Communication in the global context remains a challenge and the value-consensus formation nearly impossible in the short run. The suggested model provides a way for systematically and meaningfully structuring and organizing meta-level conversations within IT projects. Meta communication center, applies a standard composition principle on the individual partially specified rules in order to derive the complete protocol architecture.

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COMPUTERS MEET BIOLOGY – AN INTERDISCIPLINARY AND COLLABORATIVE APPROACH

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Abstract

Interdisciplinary methods create connections between traditionally distinct disciplines such as sciences, social studies, arts, or languages. This paper presents the experience of team-teaching Bioinformatics by faculty from Computing Science (MK) and Biological Sciences (JU) in a Computing Science undergraduate course, "Introduction to Biomedical Informatics." The main purpose, to involve students, with little or no biological background, in actual research projects related to Biology and Medicine, was accomplished by hands-on exercises and assignments using real data from a medical clinic, and real DNA and RNA data from the sequencing of genes related to seed dispersal of a parasitic plant, Dwarf Mistletoe.

Introduction

Biology depends on chemistry and physics to explain certain biological phenomena, leading to the development of the fields called *biochemistry* and *biophysics*. Correspondingly, the substantial amount of data collected by biologists needs analysis requiring tools developed within computing science. As the result, modern biologists are required to learn new skills that go beyond standard biology and have to use methods from bioinformatics, a computational branch of molecular genetics (also called *in silico* biology). Likewise, modern computer scientists have to learn interdisciplinary skills that allow them to apply their knowledge to other disciplines (Cohen, 2004).

This paper shows how to introduce computer undergraduate students to bioinformatics, and how to create practical exercises to utilize and interpret the real data gathered in genomic research. The underlying motivation for our collaborative work is to demonstrate that both disciplines can benefit from this symbiotic relationship. Therefore, the course included topics ranging from specific programming tasks (e.g., Perl regular expressions for DNA sequence processing), applications of specialized software developed for biologists (e.g., BLAST, GenePattern, Protein Database), through computational modeling techniques (e.g., sequence analysis using Hidden Markov Model) to specialized areas of computing science (e.g., machine learning techniques used in the analysis of gene expression).

Our general pedagogical approach is based on constructivism (Piaget, 1970) in which the teacher's role is to facilitate learning through creation of a learning environment and the students have an active participant role (discovering, constructing, experimenting, and validating new knowledge through analysis and interactions with other group members). As the result, the students (in consultations with the researchers) are required to determine the skills they need to solve a real world problem (Rodgers, 2002). In particular, our pedagogical approach uses methods from the following interrelated styles of learning: (a) inquiry-based learning (IBL) (Bruner, 1961) including problem-based learning (PBL) (Barrows, 1996), (b) experiential learning (Kolb, 1984), and (c) a creative research process (Hmelo-Silver & Barrows, 2006). Figure 1 shows the interactions between teaching/research environment and the students involved in studying and learning.



Figure 1. Interactions between educational components. (Adapted with permission from Kwiatkowska & Matthews, 2007.)

This paper presents the real-life experience of team-teaching by faculty from Computing Science (MK) and Biology (JU). It concentrates on teaching and learning bioinformatics in an undergraduate course, "Introduction to Biomedical Informatics." Biomedical informatics is a rapidly growing field that examines biological and medical data, information, and knowledge and their storage, retrieval, and optimal use for problem solving. The main purpose of this course is to involve the students in authentic research projects in order to create interest in biomedical informatics as important discipline and as possible future career. The course is inquiry-based, providing students with anonymized data from a clinic and RNA and DNA data from the sequencing of an aquaporin gene, taken directly from JU's research. The modelling and analysis of medical data and Perl programming is based on the research of MK. The course uses experiential learning by involving a faculty from biology (JU), who presents her research in a *wet* biological lab and the processing of the data in a computer lab. Furthermore, the course utilizes group research projects to engage the students in the research process.

The practical components include programming laboratory, data analysis assignments, and field trips to a biology wet laboratory. The group projects, carried throughout the course, encompass project proposals, formal presentations, and project reports. These hands-on students' projects develop rudimentary skills necessary for future undergraduate and graduate research (Airasian, Cruikshank, Mayer, & Pintrich, 2001; Bloom, 1984).

The paper is organized as follows. The first section describes the biomedical course context and presents the main course units. The second section discusses an example of students' research projects. The third section provides examples of the course assessment. In the last section, we present discussion and future work.

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Course Description

The biomedical course has been designed to provide the undergraduate Computing Science (CS) students with basic knowledge and data analysis skills in bioinformatics. The course is offered as an upper-level elective course in a four-year Bachelor of Science program at Thompson Rivers University (TRU). Although most undergraduate CS students should have a basic level of knowledge in Biology from high school or introductory Biology courses, the international students and mature students require brief introduction to basic molecular biology before they can challenge more difficult problems related to JU's research on genes. The introduction entails basic information on cellular and molecular biology (DNA, RNA, Central Dogma, proteins, and genes) and basic techniques used in molecular genetics: gel electrophoresis and Polymerase Chain Reaction (PCR). Whenever possible, we used real data to help students understand complex problems, such as gene expression, applications of sequence alignments (BLAST), cloning, real-time quantitative reverse transcription PCR (qRT-PCR), sequencing, and microarrays.

Sample Course Units

All units are designed using the following four assumptions: (a) content must be based on a real-life problem, must use real-life data, and provide (or contribute to) solutions to an important real-life problem, (b) learning environment for the students should be hands-on including practical laboratories using several software packages, (c) the learning process must combine individual and collaborative group work, and (d) the students should be given opportunities to work gradually with several smaller problems and to integrate their skills and knowledge in a larger meaningful research project.

Unit 1. In the first unit, students were introduced to biological concepts, for example, they studied a parasitic plant, *Arceuthobium americanum* (Dwarf Mistletoe). In addition, the real DNA & RNA data from the sequencing of genes related to seed dispersal of Dwarf Mistletoe (JU research) was used. The mode of dispersion of seeds was explained (see Figure 2) and then students were asked specific questions about the mechanism of dispersion: "Why does water move to a fruit?" and "How is that such a large pressure enables seeds to be dispersed a distance of 20 meters with a speed of 100 km per hour?" (Hawksworth & Wiens, 1996; deBruyn, Paetkau, Ross, Godfrey & Ross Friedman, 2015).



Figure 2. Arceuthobium americanum seed dispersal mechanism. (Adapted from Hawksworth & Wiens, 1996; Kelly, Ross Friedman, & Smith, 2009.)

In order to stimulate students' interest, the next diagram was shown (Figure 3), and the students were asked to explain, in their own words, which techniques can be utilized (based on their biological and CS knowledge) to obtain results seen below. The process was discussed in relation to the flow of information in which DNA holds a vast amount of data.



Figure 3. From plant tissue to sequence of bases (agtc) in DNA to protein (Aquaporin). (Aquaporin structure adapted from Da Ines, 2008.)

Students felt very engaged at this point, as they could ask discipline-specific questions and they were guided through the creation of a work-flowchart. At that time the students were given the detailed information about JU's research.



Figure 4. A flowchart with details of JU research lab work.

Finally, a conference poster (Figure 5) was shown to demonstrate how biology connects with CS.



Figure 5. JU conference poster presented at Botany Conference, Canada (2013).

Unit 2. In the second unit, MK introduced a programming language, Perl. This language has been widely used in bioinformatics, and it does not have a steep learning curve for the CS students. The students were introduced to processing DNA sequences (strings in DNA alphabet), Open Reading Frames (ORF), and FASTA file format. The following is an example of an exercise that uses the data from JU research on aquaporin:

Write a Perl program to calculate the number of four nucleotides in a sequence, the percentage of each nucleotide, the number of errors, and the percentage of G and C in the DNA. Create a FASTA file containing the gene JN857944 *Arceuthobium oxycedri* aquaporin. The gene can be found at http://www.ncbi.nlm.nih.gov/nuccore/JN857944.

Unit 3. In the third unit, MK introduced the students to the Basic Local Alignment Search Tool (BLAST) for comparing sequences (similarity measures) using existing sequences (Aquaporin *Areuthobium oxycedri* gene). The students were introduced to NCBI, BLAST and PubMed database. The following is an example of an exercise using the real data and BLAST algorithm from the NCBI server: "Use JN857944 *Arceuthobium oxycedri* aquaporin gene sequence http://www.ncbi.nlm.nih.gov/nuccore/JN857944 and use NCBI BLAST server to perform BLAST analysis."

Unit 4. In the fourth unit, we introduced an exercise on gene expression in cancer research. The unit was organized into four steps: (a) introduction to the necessary biological knowledge in order to understand gene expression and interpret the

microarray data (combination of lecture, video, and small exercises), (b) familiarization with the biology laboratory and the sequence scanner machine (visit to the biology lab and demonstration of the sequence scanning machine), (c) introduction to the machine learning software, Weka (in-lab hands-on exercise to view and understand the microarray array data), and (d) working on a larger assignment to perform gene expression classification using the leukemia data set (studying relevant research papers using several software tools, presenting the solutions in class, and preparing a written documentation).

The content of the unit was organized around the key problem: molecular classification of cancer data. In the unit, we utilized a well-known paper and we used the publicly available leukemia data sets. The students were asked to read the paper to learn about the problem of the classification of leukemias and to understand the related data. The original data file has 72 examples with about 7,000 genes. The data set contains bone marrow samples obtained from adult acute leukemia patients at the time of diagnosis, before chemotherapy. The data are for two populations of patients: acute myeloid leukemia (AML) and acute lymphoblastic leukemia (ALL). The simplified file has 72 examples with 40 genes (identified as the best classifiers). We provided the students with both files in a csv format. The leukemia data are available from the Broad Institute server with the GenePattern software (http://www.broadinstitute.org). The students had to use data mining techniques (decision tree induction J4.8 algorithm from the Weka repository) for the analysis of gene expression.

Task 1. The students were asked to read a paper written by Golub, Slonim and Tamayo (1999) and answer the following questions: (a) Why is the classification of leukemias important? and (b) Describe the distinction between a class discovery and a class prediction.

Task 2. The students were asked to (a) use the provided leukemia data sets to run the decision tree induction algorithm, (b) run the induction algorithm, and (c) visualize the decision tree and document the results. Furthermore, the students were asked to compare the genes distinguishing ALL from AML (genes listed in the Golub et al. [1999] paper with the genes included in the decision tree). The induced decision tree is shown in Figure 6.



Figure 6. Decision tree for the leukemia data set.

Task 3. The students were asked to use the GenePattern (Kuehn, Liberzon, Reich, & Mesirov, 2008; Reich, Liefeld, Gould, Lerner, Tamayo, & Mesirov, 2006) server to

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produce visualization of the most predictive genes. They had to use a heatmap and create gene profiles. Figure 7 shows an example of a profile for X95735 (Zyxin). Furthermore, the students were asked to use the National Center for Biotechnology Information (NCBI) web site to find the *cytogenetic location* (on the chromosomes). For example, the zyxin (X95735 *Homo sapiens*) gene has the location 7q32 (Gene ID: 7791).



Figure 7. Profile for X95735 (Zyxin) based on the leukemia data set.

Biology Laboratory Experience and Students' Research

The CS students had an opportunity to visit the biology wet lab and to work on their research projects. The research projects provide a good foundation for life-long learning and problem solving. The students had to learn six fundamental research skills: (a) managing a research project (planning, scheduling, time management, and communication), (b) conducting a literature review, (c) building computational models, (d) generating and testing hypotheses, (e) conducting data analysis using statistical and data mining methods, and (5) report writing (Roach et al., 2001). For example, two students (LB, MM) worked on a research project "Genetic tree analysis of aquaporin genes of *Arceuthobium oxycedri* and similar genes using Molecular Evolutionary Genetics Analysis 5 (MEGA 5)." The following is an excerpt from students' research project's introduction:

The goal for this research project was to explore how similar or different the proposed aquaporin protein of *Arceuthobium oxycedri* is from the aquaporin proteins of other plant species. We are also interested in plants that have aquaporins that are structurally similar (therefore functionally similar) to those found in *Arceuthobium oxycedri*. To explore these topics we queried protein databases to find similar aquaporin proteins to that of *Arceuthobium oxycedri* and built a phylogenetic tree of these proteins, thus looking into their history and similarity. As part of this process we performed sequence alignments between

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Arceuthobium oxycedri's aquaporin and the aquaporins found in the database and were able to visualize the proteins' similarities and differences.

To study this relationship, the students built a phylogenetic tree using MEGA 5 program and used Multiple Sequence Comparison by Log Expectation (MUSCLE), a sequence alignment tool.

Assessment Process

This course used the CS standard assessment, which includes: labs, assignments, a research project, a midterm exam, and a final exam. We discussed the labs, assignments and the research project in the previous sections. The midterm and final exam had several interdisciplinary questions. The following are the examples showing the level of the required knowledge.

- 1. Given the following DNA sequence, write a reverse-complement DNA (mark the 5'& 3') 5' T A T G C A 3'
- 2. Complete the following short (6-base) DNA palindrome GTG _? _? _?
- 3. What is the difference between mRNA and tRNA?
- 4. Using the following scoring schema: match = +2 mismatch = -1 gap = -1, calculate the score for the alignment between two sequences:
 - A G G A T A C C _ G G _ A A T C
- 5. Explain the following terms: in silico, in vitro, in vivo.
- 6. Translate the sequence (use the second and third frame) into amino acids: UUGACGGAGUAG.
- 7. Geneticists use maps to describe the location of a particular gene on a chromosome. One type of map uses the cytogenetic location to describe a gene's position. Specify the cytogenetic location for a gene which is located on a short arm of chromosome 6 in region 2, band 1, sub-band 3.

Discussion and Future Work

In this paper we discussed the importance of team-teaching in interdisciplinary courses. We described the real-life based learning units, assignments, research project, and the assessment process. We stressed the role of using real-life problems and connecting the students with the researcher who is actually conducting the studies. We described how we have engaged the CS students in each step of the JU's research process, and how the students were using the real data.

In each of the offerings of this biomedical course, we used an approach that is learnercentered, interdisciplinary, problem-based, and inquiry-based. The students were able to work with minimal supervision on real world problems. This interdisciplinary research was both challenging and highly motivating for the computing science undergraduate students. Additionally, the students were able to learn how to communicate professionally with faculty and students from other disciplines (biology and environmental studies). We have conducted a standard course evaluation at the end of each course offering, and the students commented positively about their learning experience. For example, they asked for a second course in bioinformatics: "There should be a Bioinformatics II." Moreover, they expressed their enthusiasm about learning the applications of computers in biology: "It was good to learn something about biology and its relating to computing." Additionally, one student, MM, presented his learning experience during educational seminar at TRU and two students, LB and MM, continued their research in a final capstone project course in CS, and they have published a paper in bioinformatics.

Following students' comments and our discussions with other faculty members in CS and biology, we are planning to expand our work in three directions: (a) development of new course modules in wet laboratory to have hands-on experience with extraction of DNA from plants, running PCR, and studying the obtained DNA sequence using computer-based techniques such as BLAST, (b) application of other programming languages, for example, Python, and other ML techniques, for example, associative rules induction, and (c) creation of a course-specific students' evaluation (currently, the students use generic evaluation forms).

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UPPER SECONDARY SCHOOL TEACHERS' DIGITAL COMPETENCE: ANALYSED BY DEMOGRAPHIC, PERSONAL AND PROFESSIONAL CHARACTERISTICS

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Abstract

Educational technology provides an opportunity to improve the quality of education. There is however a lack of uptake in utilizing the equipment provided, as well as a lack of well-established methods for monitoring the use of educational technology. In this paper, which is based on one of the largest ICT studies in secondary schools in Norway, we explore the relationship between upper secondary school teachers' digital competence analysed by demographic, personal and professional characteristics. The implications of this study are that demographic, personal and professional characteristics, such as a teacher's age, work experience, gender, screen time and ICT education, predict teachers' high or low digital competence in upper secondary school to a certain degree. Further research is recommended in order to validate these preliminary findings.

Key words: Digital competence; upper secondary school; teachers; professional characteristics

Introduction

Advancements in computer technology have provided great opportunities to improve the quality of education. However, despite great investments by national and local authorities to make the latest educational technologies available within education facilities internationally and in Norway, there has been a lack of uptake in teachers' utilisation of such technologies (Cuban, Kirkpatrick & Peck, 2001). This apparent reluctance to make use of educational technology might be due to technophobia, scepticism or other reasons (Somekh, 2008). Recently, Howard (2013) found that teachers' scepticism to integrate educational technology in classroom teaching is influenced by negative affective responses to technology, general risk-aversion in teaching and the perceived value of technology in teaching. At the same time, experiences from the practice field show that there are also teachers who are 'frontrunners' in the use of educational technology that seem to possess a high level of digital competence. However, anecdotal evidence is not enough-we need more research-based knowledge on what kind of demographic, personal and professional characteristics constitute such digital competence among teachers. In order to achieve this, it is important to use well-established methods to monitor the professional development of teachers' digital competence and their use of educational technology and examine whether, for example, information and communications technologies (ICT) education has any significant benefit in relation to digital competence.

Following a request from the Norwegian Association of Local and Regional Authorities (KS) and the Eastern Norway County Network, the research group Digital Learning Communities (DLC) accepted the assignment to carry out a comprehensive research study (SMIL¹) exploring the connection between ICT use and learning outcomes in upper secondary schools. In particular, this study focused on teachers' digital competence. Earlier research dealing with teachers' adoption of ICT (e.g., Mumtaz, 2000; Erstad, 2005; Somekh, 2008; Sefton-Green, Nixon, & Erstad, 2009; Erstad, 2010; Ferrari, 2012) shows that there are different perceptions concerning how to describe this kind of competence and different strategies regarding how to improve teachers' ICT skills and digital competence. Earlier studies also indicated that there have been gender differences among teachers' ICT use (Yuen & Ma, 2002), and thus it seems to be important to examine whether there are gender differences among teachers' ICT use in the context of Norwegian secondary schools. A common recommendation found in these studies is that there seems to be a need for continuous ICT education for teachers, and several Norwegian policy documents and national reports have stated the same (KD, 2009, 2014; Norgesuniversitetet, 2014). However, there is a need to examine this area more in depth within the Norwegian context among teachers in upper secondary school. This paper will therefore present the findings from the SMIL study concerning this issue and will revolve around how demographic, personal and professional characteristics such as ICT education influence teachers' digital competence in upper secondary school.

The SMIL study, which is the largest ICT study carried out in upper secondary schools in Norway, involved 17, 529 students and 2, 477 teachers as well as school owners, school leaders and representatives from student councils and the Norwegian Student Organization. The study was conducted from 2012 to 2013 in seven counties in Norway and relates to how school owners and school leaders exercise leadership, how teachers teach and how students learn in the technology-dense classrooms in these counties. Moreover, we explored whether the national curriculum (LK06) has changed any of the underlying premises of school leadership, teaching and learning in upper secondary schools. All these issues have been important to investigate due to the increased technology density in Norwegian classrooms $(1:1)^2$ resulting from digital teaching aids, students' digital lifestyle and the focus in the national curriculum on pupils' digital competence (digital competence is currently the fifth basic skill in all subjects throughout their education). For teachers to handle this complexity, it goes without saying that teachers need to have professional digital competence in today's digitised schools. However, what constitutes teachers' individual digital competence? The main objective of this paper is thus to examine how demographic, personal and professional characteristics influence teachers' individual digital competence. In this paper we will present the quantitative part of a mixed method design. The research question is as follows: How is upper secondary school teachers' digital competence predicted by their demographic, personal and professional characteristics (i.e., a teacher's age, work experience, gender, screen time and ICT education)?

Conceptual Framework

Throughout the last two decades, several researchers and academics have been grappling with the definition of digital literacy in a digitised society and what it means for everyday people, pupils, teachers, teacher educators, etc. Buckingham (2003, 2006), Gilster (1997), Knobel (1999), Lanham (1995), Lankshear and Knobel (2003), Erstad (2005) and Tyner (1998) have made important contributions to the concepts of

computer literacy, media literacy, digital literacy and digital competence. Studies conducted by Dwyer, Ringstaff and Sandholtz (1991) and Hooper and Rieber (1995) have focused more directly on teachers' digital literacy, and Christensen and Knezek's (2008) Will, Skill, Tool (WST) model is one of the most promising attempts to determine the degree to which a teacher's will (attitude), skill level (technology competency) and access to technology tools are vital elements when integrating ICT into teaching. However, in the review article "Factors Affecting Teachers' Use of Information and Communications Technology: A Review of the Literature," Mumtaz (2000) found a number of challenges related to teachers' use of technology, which are related to demographic, personal and professional characteristics. Cox, Preston and Cox (1999) and Cuban et al. (2001) found the same tendencies as well as challenges related to the school management level. Recent studies conducted by Sipilä (2014), Howard (2013), Loveless (2011) and Underwood and Dillon (2011) show that teachers' use of ICT in teaching can represent a number of new possibilities as well as a number of challenges (which are also related to a lack of digital competence³). One assumption that is shared by several different positions and studies dealing with digital literacy and ICT in teaching is that teachers' digital competence is more complex than digital literacy in other occupations and among average citizens. It is therefore important to be aware of the complexity of digital competence and also that the way in which teachers carry out and experience the pedagogical use of ICT will very often depend on their high or low digital competence. Studies conducted by Sefton-Green et al. (2009), Erstad (2010) and Ferrari (2012) confirm this and have contributed to developing a better understanding of what digital literacy and digital competence mean in and out of school settings as well as what constitutes the digital competence of today.

However, recent studies still indicate some confusion regarding what digital competence actually means for teachers, pupils, teacher students, teacher educators and school leaders. Is it the same across these groups or is it different? Even if there are several common traits across these groups, it is important to underscore that the groups have different roles in our educational system, and thus digital competence has to be seen in relation to what role each group has in school and in teacher education. So then what constitutes teachers' individual digital competence in school contexts? Based on the national curriculum in Norway (LK06) (KD), we can generally say that teachers need a generic digital competence where they are mastering general skills and knowledge about educational technology in the digital learning environment; they need a *subject didactic digital competence* where they apply their digital competence in subjects; and, finally, they need a professional digital competence which includes elements that occur outside the teachers' teaching but are simultaneously within the teacher profession. However, these are very general descriptions and there seems to be a gap between the arena of formulation and the arena of realisation when it comes to this issue due to the different interpretations of digital competence. ICT and educational technology are therefore often perceived among teachers in a way other than that intended in the policy documents. This paper attempts to bridge some of this gap through the use of a digital competence model that is attached to the curriculum and is more concrete in order to avoid common misunderstandings and too many different interpretations.

Research shows that ICT is often perceived in teacher education only as a tool that can be handled with elementary ICT skills (Tømte, Hovdhaugen, & Solum, 2009). In both teacher education and in school, there seems to be confusion and a discrepancy between

the concepts of *basic ICT skills* (similar to the OECD's term *key competencies*, which is defined as "decisive for learning and development and attached to the national curricula in school") and elementary ICT skills (a simple, first step towards ICT skills). Ottesen and Møller (2010) also found that there is frequently a mismatch between *elementary* skills and basic skills among teachers in school, especially concerning digital skills. To avoid further confusion around this distinction, Krumsvik (2013) describes elementary skills in the use of digital tools as the way teachers manage to use a PC and digital tools (such as turning on a PC or iPad, using a word processor, etc.) effortlessly in school. Furthermore, he describes basic skills in the use of digital tools as the way teachers manage to use digital teaching aids (such as digital learning platforms and digital teaching aids attached to the curricula) in the school setting and in teaching in a basic way. The author explains that the main distinction between these two definitions is that one is related to elementary skills (which involve a more generic digital competence), whilst the basic ICT skills are pedagogically related directly to the school context and the national curriculum (i.e., to the competence aims). The two definitions are also dialectically related and are the "starting point" for the teachers' digital competence model presented below.

Considering the implications that this situation and context may have particularly for the teachers' role and digital competence, we have suggested the following definition to describe *digital competence* for teachers: "Digital competence is the individual teacher's proficiency in using ICT in school with good pedagogical judgement, and his/her awareness of its implications for learning strategies and the digital Bildung of pupils" (Krumsvik, 2012, p. 466). This definition is attached to a visual model (Figure 1) of teachers' digital competence. The model was developed on the basis of empirical research carried out in Norway from 2004 to 2012 and the implementation of the Norwegian school reform known as *The Knowledge Promotion* in 2006, where digital competence became the fifth basic skill in the national curriculum (MOK, 2006). The first version of this model had a special focus on pupils, while later versions have also encapsulated teachers and teacher educators. The model presented in this paper is directed only towards teachers' digital competence since the research question focuses on the teacher's role.

The model consists of five parts representing the stages that a teacher goes through during his/her digital competence development. These five parts are also connected to the three sections in the national curriculum (parts I, II & II in LK06, MOK, 2006) which the teachers have to follow. We will elaborate on the theoretical underpinnings of the model in the section below.

Today there is a need to link the macro, meso and micro levels within our understanding of teachers' digital competence. Krumsvik's (2012) digital competence model aims to reduce the complexity in this varied area by focusing on what are considered the most important parameters within digital competence for teachers. Based on previous research and theories, the model attempts to categorise the different characteristics by identifying the typical phenomena traits and theoretical assumptions of the model. With these premises as a backdrop, in the following section we will describe the teachers' digital competence model in depth.

Particularly important in this model is the intersection of a *mental digital competence journey* (self-awareness, vertical axis) and a *practical competence journey* (proficiency,

horizontal axis). The theoretical foundations of this *intersection part* were inspired by Wertsch (1991, 1998), Apple Classroom of Tomorrow (ACOT) (Dwyer et al., 1991), distributed cognition (Hutchins, 1995) and situated learning (Lave & Wenger, 1991). The essence of the model is that cognitive processes are continuously offloaded to digital artefacts when teachers are using computers and that this kind of process is increasingly situated everywhere in teachers' digitised school day. The computer thus becomes an 'intellectual prosthesis' for teachers because in this SMIL study (and in general), they have access to technology anywhere and at any time. An important theoretical underpinning for mastering such processes as part of the model is Wertsch's (1991, 1998) concepts of mastery and appropriation, where the term *appropriation* is the process of mastering and appropriating cultural tools. Wertsch means that in the process of appropriation it is quite common that there will be a kind of contradiction and "friction between mediational means and unique use in mediated action" (Wertsch, 1998, p. 54). The term *mediated action* is linked to the context and refers to how human action is mediated through the use of cultural tools within social practices. One concern that Wertsch discusses is "how the introduction of novel cultural tools transform the action" (Wertsch, 1998, p. 42). ICT is such a cultural tool, and below we will elaborate on how these theoretical underpinnings are made explicit in the teachers' digital competence model.



Adoption Adaptation Appropriation Innovation

Figure 1. Teachers' digital competence model (Krumsvik, 2007, 2012).

The vertical axes (self-awareness) shows that the *digital competence journey* begins with the teachers being relatively unaware (*adoption*) of what he or she can or cannot do in relation to educational technology and ICT, then gradually becoming more aware and reaching the different stages of *adaptation*, *appropriation* and *innovation* over time (some teachers can, of course, be placed directly into the model at the appropriation

stage, for example, because they have already mastered the technology use and are somewhat digitally competent). This journey takes time for novices (several years) and is a great challenge for teachers; they might have never been taught (in their own teacher education) how to achieve such digital competence. Furthermore, they might have no formal ICT education, and it might not have been a natural part of their professional development (continuing ICT education). Additionally, even if psychological obstacles, such as technophobia and scepticism, have decreased among teachers over the last decade, we still find some tendencies of this documented in recent studies conducted by Egeberg, Guðmundsdóttir, Hatlevik, Ottestad, Haug, and Tømte (2012), Howard (2013) and Krumsvik, Ludvigsen, and Urke (2011). However, while this might be gradually fading away as a barrier in both teacher education and in school, we need more updated research knowledge about this in the years to come.

This 'mental' part of the model has to go hand in hand with *the practical competence journey* (proficiency, horizontal axis), which also consists of *adoption*, *adaptation*, appropriation and innovation. This often becomes the explicit part of the *tacit* knowledge, know-how and awareness that are acquired throughout the mental competence journey. In the first part of this process (adoption and, to a certain extent, adaptation on the horizontal axis), the teachers are mostly occupied with elementary ICT skills (e.g., being able to handle the PC etc.) and basic ICT skills (e.g., using the school's digital learning platform and digital teaching aids in relation to the curriculum, etc.) and overcoming the obstacles that have previously prevented them from handling ICT artefacts. At this stage, ICT artefacts are not immediately comprehensible to the teacher, and the importance of overcoming this stage is obvious. Even if this stage presents a struggle for many teachers, these technological thresholds are considerably lower in comparison to how it was 10 years ago. This is likely a result of more userfriendly technology, decreased technophobia and the more frequent use of ICT among teachers (like other citizens) outside of schools in their spare time. This issue is documented in other parts of the SMIL study, where we found that 32.6% of the teachers had a screen time (use of laptops, iPads, PC, mobile phone, TV etc.) of 4-6 hours per day and 27.2% spent 6-10 hours per day. This indicates that teachers' ICT use is considerably higher than it was a few years ago (see, e.g., Hatlevik, Ottestad, Skaug, Kløvstad, & Berge, et al., 2009) and that they are handling their elementary ICT skills well. Therefore, the first significant obstacle might occur during the appropriation phase (third phase, horizontal axis), and this can be related to the concept of affordance (Gibson, 1977, 1979; Norman 1988, 1990; Kirschner, Martens & Strijbos, 2004). Based on these studies, the SMIL study made a distinction within this concept of affordance: real affordance, which means that teachers are able to recognise and utilise the educational technology's potential widely and in an optimal way in teaching, and perceived affordance, which is often related to teachers' inability to perceive, recognise and utilise the technology's potential in teaching. In Howard's (2013) study the teachers' perceived value of technology in teaching was a challenge and can be related to this distinction, especially to the perceived affordances.

The pedagogical implications of this are that the teachers who have reached the stage of recognising the *real affordances* are permitted to use his or her professional competence and authority in a way that is not interrupted by technical obstacles, i.e., "form over content." Some case studies have shown that when teachers in school reach the point where educational technology and ICT are perceived as something with educational potential and are clearly understandable to them, they recognise more easily the need to

acquire a broader view of knowledge (Krumsvik, 2006a, b, 2008a, b) which influences their way of teaching.

Until now, we have described the two axes of the model—the vertical axis, which is tied to teachers' self-awareness, and the horizontal axis, which relates to teachers' practical proficiency. We will now concentrate on the centre of the model, where we can see that elementary digital skills (1) comprise the first category and are a prerequisite for the other categories. Elementary digital skills refer to the fundamental technical skills, such as being able to use PCs, laptops, iPads and mobile telephones as a teacher. The second category, basic digital skills (2), means that the teacher has to be able to handle the administrative and subject tools for teaching in schools, such as email, LMS, interactive whiteboards, digital teaching aids, etc. The third category, didactic ICT competence (3), is related to teachers' pedagogical use of digital teaching aids in classroom settings. This also means that the teachers have to possess a double dimension role as an important part of this didactic ICT competence in classrooms. In other words, teachers will, in one way or another, be role models for the pupils with regard to the didactic and pedagogical use of digital teaching aids. Hence, teachers' ability to "teach as they preach" will be an important guiding star for the pupils. At the same time, the teachers must continually make didactic judgements that focus on how digital teaching aids can expand the learning possibilities for pupils. This double dimension involves didactic ICT competence, which is similar to other occupations, but at the same time it is distinctive because teachers are preparing pupils for certification in school (summative assessment, exams), for further higher education and for future practice in society. A typical example of teachers' didactic competence is when a teacher, through his or her wide teaching repertoire in the classroom, is able to blend paper-based and digital teaching aids seamlessly and thus expand the possibilities for the pupil to understand the subject content. This is closely related to the next category of the model which highlights not only the teachers' didactic ICT use in the classroom but also how new *digital learning strategies* (4) used before, within and after classroom teaching can expand teachers' way of teaching and pupils' way of learning.

This next part therefore relates to the digital learning strategies that are required for teachers' own professional development as well as their ability to guide the pupils towards achieving new digital reading and learning strategies through the use of educational technology and ICT. Norwegian educational authorities provided a new definition of reading which included digital reading on screens in 2012. Regarding the PISA 2009 study. Frønes and Naryhus state that it is remarkable that the Norwegian percentage variance for digital reading is 19 percent, whereas for reading on paper about half (10 percent). In other words, the difference between the schools for the same students on the same sample is larger in digital reading than reading on paper, and Frønes & Narvhus state that it is natural to assume that this is due to differing digital practices in schools (Frønes & Narvhus 2012, p 112). Norway is also one of the countries where socio-economic variables mean less in terms of their impact on digital reading (Frønes & Narvhus, 2012, p. 110). Therefore, an important part of digital reading is the teachers' ability to show the pupils how multimodal texts should be used in their digital learning strategies to increase their learning outcome (especially for boys, who perform significantly weaker than girls on digital reading tests like PISA 2009). An example of such new digital learning strategies for the teachers is *flipped* classrooms or flipped learning (see Hamdan, McKnight, McKnight, & Arfstrom, 2013), where the pupils learn new subject material by watching 'homework' videos combined

with other teaching aids and assignments in class during school hours when the teacher is available to provide guidance and elaborate on certain topics if necessary. The idea is that the teachers have the necessary digital learning strategies to guide both digital reading and these new digital learning strategies and to be a mentor for the pupils in both the physical and the virtual classroom. This implies that the teachers must utilise the pupils' basic digital skills as a starting point but must also maintain a strong focus on the metacognitive aspect, which enables pupils to delve deeper into the pedagogical use of ICT as an entry point for developing new digital learning strategies.

The final category of teachers' digital competence is linked to ethical considerations with regard to *digital Bildung* (5). This means a techno-cultural Bildung (*digital dannelse*) which is based on a more holistic understanding about how children and youth learn and how they grow and develop their identity in a digitised society (Løvlie, 2003). For today's upper secondary students in Norway (the majority being between 16 and 19 years old), the network society, the media and technology are important building blocks in their Bildung journey, where they can be described as *digital inhabitants*. This, of course, has an impact on how schools should utilise this new reality positively, even if many teachers may be *digital immigrants* and have witnessed the difficulties of weaving technology constructively into their teaching.

In summary, these five categories in the digital competence model (as well as the horizontal and vertical axes) are inspired by research and practice and aim to understand teachers' digital competence in school on a general level in research and in school monitoring; however, they are also an attempt to bridge the national curriculum's demands with teachers' competence needs. To incorporate these five categories in this theoretical digital competence model in the study, eight questions were selected in the questionnaire concerning these five categories and were then factor analysed (see Methodology).

School Monitoring and Indicators

Why is there a need to develop monitors for educational technology like the SMIL study? According to Scheuermann and Pedro (2009, p. 5), "Despite the fact that education systems have been heavily investing in technology since the early 1980s, international indicators on technology uptake and use in education are missing." They continue, stating that "... policymakers and researchers cannot be in a position to monitor what is truly going on in schools unless critical indicators about intensity, purpose and context of use of technology in education are available" (Scheuermann & Pedro, 2009, p. 6). School monitoring, therefore, makes it possible for school owners and school management on the regional and local levels to keep track of and monitor their school's development over time based on research (and not anecdotal evidence)including how teachers' digital competence increases or decreases. For example, Harrison, Comber, Fisher, Haw, Lewin, Lunzer, McFarlane, Mavers, Scrimshaw and Somekh (2002) made an important contribution to this issue in the ImpaCT2 study in Great Britain; however, in order to facilitate accurate monitoring, there is also an increasing need to develop indicators for educational technology and ICT in Norway (see Krumsvik, Egelandsdal, Sarastuen, Jones, & Eikeland, 2013). This type of monitoring can generally be considered as a continuous evaluation that is part of a circular policy process that includes several stages. In this paper the focus is on a typical secondary indicator: teachers' digital competence.

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Pelgrum (2009) suggests the following five stages when monitoring within the context of education: policy goals, assessment, evaluation and reflection, diagnosis and intervention. Pelgrum further claims that there is an imminent need nationally as well as internationally to develop *indicators* for monitoring within education, suggesting that this will make school leaders better prepared to implement research-based measures to increase pupils' learning outcomes when ICT is used in teaching. Krumsvik et al. (2013) describe an indicator as something one can *navigate* by when monitoring education, which can give us more insight over time with regard to the development within core areas in education. When operationalising the concept and implementing monitoring in education, the term *indicator* is usually seen in relation to concepts such as indicator area,⁴ indicator definitions,⁵ indicator statistics, primary and secondary indicators and indicator system.⁶

The Norwegian context is examined in this paper, and it is important to bear in mind that different ICT policies in different countries influence our perception of how to define teachers' digital competence based on its attachment to curricula. Thus, "[...] context is not always everything, but it colors everything" (Pajares, 2006, p. 342). In order to be able to compare outcomes internationally, the OECD report *Assessing the Effects of ICT in Education* (OECD, 2009) and its framework were used as a starting point in the SMIL study so that national (and maybe international) indicators for ICT use in school could be developed.

Methodology

In the SMIL study we aimed to explore whether there is a relationship between ICT and learning outcomes. An important part of the study is presented in this paper, where the attention is directed towards the relationship between demographic, personal and professional characteristics and teachers' individual digital competence. In order to be able to measure these relationships, we needed to develop a number of indicator areas and indicator definitions, as Pelgrum (2009) implied above, and teachers' individual digital competence is one such indicator area and indicator definition. Following analyses of relevant policy documents and literature reviews, six indicator areas were considered significant. These were primarily based on recommendations from the framework created by Kikis, Scheuermann and Villalba (2009), which can be found in the abovementioned OECD report. Findings within previous research and suggestions from our employer (KS) were also important when developing the indicator areas.

The six indicator areas consist of implementation strategies, access to PCs, curriculum and competence improvement, infrastructure to support learning, degree of ICT use in teaching and educational ICT activities (pupils). In the SMIL study all six indicators areas were explored with a number of relevant groups; however, in the current paper we concentrate on teachers and their individual digital competence. Indicator definitions were developed based on the indicator areas identified. These were rooted in wellestablished, distinguished theory, and the mixed methods design that was utilised in the wider study ensured that we also maintained a broad empirical foundation. The indicator definitions were then used when developing the instruments for collecting information. They were divided into operationalised indicator definitions, which means that they could potentially be used again when monitoring similar phenomena in the future.

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In the wider SMIL study both qualitative and quantitative data were utilised as the basis for the data collection and analyses. The data were collected in sequences, and one of the important goals of the SMIL study was to give equal emphasis to both types of data and combine them in the analyses. In this paper we present only the quantitative data (survey) since the focus and the research question are directed towards the relationship between demographic, personal and professional characteristics and teachers' individual digital competence. The survey consisted of four parts, including demographic data, digital competence, approaches to digital educational resources and compliance between classroom management and digital competence. The teachers' digital competence part was further sectioned into five categories:

- 1. Elementary ICT
- 2. Basic ICT skills
- 3. Didactic ICT competence
- 4. Digital learning strategies
- 5. Digital Bildung

In the questions concerning teachers' attitudes, opinions and views about digital competence, adjectival Likert scales were used, offering seven response options ranging from "to no extent" (1) to "to a very large extent" (7). This prevented having a mixture of different types of scales and provided more stability and validity within the analyses. It also facilitated a more straightforward construction of indexes. The scales were rooted in theoretical models and were tested empirically to measure their robustness.

An online questionnaire was developed based on the goals of the education monitor, tentative findings in the qualitative interviews in the SMIL study, findings from previous research, the framework for the SMIL project and indicator areas and definitions. The questionnaire was piloted by two researchers in four schools in the Eastern Norway County Network using *live surveys* (Student Response System). Information was gathered from 153 teachers and 921 students in this pilot. KS's project group and the SMIL project's scientific advisor also examined the questionnaire during the pilot phase. When the pilot phase was completed, an electronic survey⁷ developed in the online questionnaire system SurveyExact was completed by teachers and students in the Eastern Norway County Network.

The study sample was drawn using *purposeful selection* (Maxwell, 2005) and was comprised of 2, 477 teachers from all public upper secondary schools in the seven counties in the Eastern Norway County Network.

Statistical Analyses

The research questions explore whether there is a relationship between demographic, personal and professional characteristics and teachers' individual digital competence. The survey questionnaire was imported directly from the electronic database into Excel and then into SPSS for statistical analyses. Demographic data were explored using descriptive analyses calculating average scores, standard errors and minimum and maximum values. The data material was thoroughly examined and was presented as frequencies.

In order to explore the relationship between the variables, correlation analyses were used—Pearson's product moment correlations were used for variables at the interval level and cross tabulations were used for variables at lower levels.

To measure the relationship between demographic, personal and professional characteristics and teachers' individual digital competence, it was necessary to convert the digital competence model into a measurable quantity, or an *index*. The teachers were asked to estimate their digital competence in areas such as elementary and basic ICT skills, didactic ICT competence and learning skills related to directing pupils when using ICT and digital judgement (i.e., digital use, digital learning strategies and digital sophistication). Eight of the questions measuring how teachers perceive their own digital competence were considered to be most relevant based on face value. These were then factor analysed in order to reveal possible factors that could be used to develop the digital competence index. The questions that were chosen had the same scale designs and were therefore directly comparable. An exploratory factor analysis was chosen since the scale used in the survey was newly developed. The questions were analysed for their internal consistency by means of Cronbach's alpha. Cohen's guidelines were used, where a correlation coefficient of .10 is considered to represent a small correlation, a correlation of .30 is considered medium and correlations above .50 are considered large (Cohen, 1969). The sample consists of 2,477 teachers, so due to the high N, the significance level is 0.001 in all analyses. The factor analysis was conducted using an oblimin rotation, which allows the factors to be correlated (Russell, 2002). The factor loadings are outlined in Table 1 below.

Table 1

Factor Loadings	(Oblique R	otated) from t	the Principal Axis	Factor Analysis	(N = 2477)
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Questions	Factor 1	Factor 2	Communalities
"How would you rate your <i>basic skills</i> when using digital tools in school?"	.86	.01	.76
"Based on the previous questions, how would you estimate your overall digital competence in relation to teaching?"	.84	.51	.78
"How would you rate your <i>elementary skills</i> when using digital tools in your leisure time?"	.81	02	.72
"How would you rate your skills within didactic ICT use?"	.77	.38	.63
"How would you estimate your competence to guide students' digital judgement related to their digital lifestyle within and outside of school?"	.66	.56	.58
"How would you rate your skills in guiding students in the use of digital learning strategies?"	.62	.57	.55
"Based on the previous questions, how would you estimate the students' overall digital competence within school subjects?"	.27	.75	.57
"To what extent do you believe the teachers at your school are good role models for the students' curricular ICT use in education?"	.13	.74	.56
Eigenvalue:	3.9	1.3	

Question 8 and question 10 load on both factors produced from the analysis (see Table 1). Hence, they must be interpreted according to the other variables loading on the two factors. Factor 1, as we see it, is the (an) indicator of teachers' individual digital competence; factor 2 indicates a contextually related competence scale that also included teachers' understanding of their own competence and skills.

Factor 1 statistically explains 48.5% of the variation. Six out of the eight variables analysed show loadings above the guidelines for identifying significant factors (Hair, Anderson, Tatham, & Black, 1998), and these were used to create an index representing the teachers' digital competency. Questions 12 and 13 were not included in the index due to their low factor loadings. Compared to the other questions, questions 12 and 13 are more related to how the teacher perceived others' (pupils' and colleagues') competence rather than their own digital competence.

Technically, the index is the arithmetical mean of the answers to the six questions included. A Cronbach's alpha value of .86 indicates that the internal consistency of the digital competence index was high.

Having identified the teachers' digital competence index, a regression analysis was completed in order to analyse whether the demographic, personal and professional characteristics, such as the teacher's age, work experience, screen time or ICT education, could predict their individual digital competence. All statistical analyses were conducted in SPSS version 22.

Results

The teacher survey consisted of four parts, including demographic data, digital competence, approaches to digital educational resources and compliance between classroom management and digital competence. Some of the demographics as well as the main findings related to digital competence are reported here as these are most relevant for the research questions and discussion in this paper. For a full description of all the results, see Krumsvik et al. (2013).

The demographic data show that 53.5% of the teachers were female and 46.5% were male. Most age groups were represented. Twenty-one percent of the teachers stated that they had worked 15 years or more in upper secondary education, 29.8% had worked 7–15 years, 11.1% had worked 3–7 years and 13.6% had worked 3 years or less. Other significant information relates to teachers' opinions about whether the good access that pupils have to PCs in schools is important when it comes to learning outcomes: 49.4% of the teachers answered that they thought it was very important. However, from these teachers, 27.3% answered "5," which is the next scale number above the middle; 27.8% of the teachers considered the access to PCs to be of medium importance and 22.8% of the teachers thought that good access to PCs had little significance.

The teachers' self-reported data concerning the five elements of the digital competence model revealed that on a adjectival Likert scale offering seven response options ranging from "no skills" (1) to "very good skills" (7), they answered in the following way: 21.4 % answered "5," 34.5 % answered "6" and 38.4 % answered "7" on *elementary ICT skills*; 25. 6% answered "5," 40.6 % answered "6" and 24.0% answered "7" on *basic ICT skills*; 20.5 % answered "4," 36.7 % answered "5" and 25.3 % answered "6" on *didactic ICT competence*; 15.4 % answered "3," 32.9 % answered "4" and 27.6 %

answered "5" on *digital learning strategies* and 22.8 % answered "4," 32.7 % answered "5" and 23.0 % answered "6" on *digital Bildung*. When teachers considered their overall digital competence (with all the five elements included), 21.8 % answered "4," 40.9 % answered "5" and 23.3 % answered "6."

A digital index covering six questions based on the theoretical model was developed. In order to explore whether there was a relationship between demographic, personal and professional characteristics and teachers' digital competence, the index was statistically analysed and compared to a number of factors.

Table 2 presents an overview of mean scores and standard deviation for digital competence in relation to the *gender*, *work experience* and *age of the teachers*. Women have a higher mean score of digital competence than men; teachers with over 15 years of work experience have the lowest mean score of digital competence and digital competence and digital competence decreases for teachers aged 50 years and older.

Measure	Mean	Standard deviation	(N)
Gender*			
Men	5.0	0.93	(1143)
Women	5.2	0.83	(1334)
Work experience*			
3 years or shorter	5.1	0.77	(342)
3–7 years	5.2	0.82	(567)
7–15 years	5.3	0.87	(571)
15 years or more	5.0	0.93	(998)
Age*			
20–31 years	5.3	0.79	(30)
32–37 years	5.3	0.76	(170)
38–43 years	5.3	0.79	(268)
44–49 years	5.3	0.82	(443)
50–55 years	5.2	0.86	(466)
56–61 years	5.0	0.88	(399)
Over 61 years	4.8	0.91	(298)

Table 2

Teachers' Digital Competence in Relation to Gender, Work Experience and Age

Note.* p < .00.

Table 3 shows how teachers' formal ICT education has an impact on their level of digital competence. Teachers with the longest formal ICT education are those with the highest level of digital competence. Teachers with continuing ICT education have higher digital competence than teachers with no continuing education.

Table 3

Teachers' Digital Competence in Relation to Type of ICT Education

Type of ICT education	Mean	Standard deviation	(N)	
Formal ICT education*				
No formal ICT education	5.0	0.85	(1 645)	
15 credits or less	5.3	0.81	(247)	
15–30 credits	5.4	0.84	(187)	
30–60 credits	5.7	0.79	(273)	
Continuing ICT education *				
Yes	5.4	0.85	(573)	
No	5.0	0.86	(1 776)	

Note.* p < .00.

Table 4 shows how the digital competence varies with teachers' screen time. Teachers with low screen time are those with the lowest digital competence and digital competence increases with an increase in screen time. The digital competence evens out when it reaches a screen time between 10–12 hours per day. As Table 4 shows, few teachers report their screen time to be above 12 hours a day (2.6 %).

Table 4

Teachers' Digital Competence in Relation to Screen Time

Sama an time at	Maar	Standard	(N)
Screen time*	Mean	deviation	
0–2 hours	4.6	1.09	(205)
2–4 hours	4.9	0.86	(641)
4–6 hours	5.1	0.78	(815)
6–8 hours	5.3	0.80	(459)
8–10 hours	5.5	0.82	(215)
10–12 hours	5.7	0.81	(79)
12–14 hours	5.6	0.77	(35)
14–16 hours	5.3	1.30	(11)
Over 16 hours	5.5	1.09	(17)

Note.* p < .00.

Digital competence is correlated with the independent variables as follows (Pearson's bivariate correlation): gender (-.08), age (-.18), work experience (-.10), screen time (.28), formal ICT education (.28) and continuing ICT education (.19).

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(N=2477)												
	Model 1		-	Model 2		Model 3		Model 4				
	В	SE B	Beta	В	SE B	Beta	В	SE B	Beta	В	SE B	Beta
Gender #	12*	.05	07	19*	.03	10	14*	.03	08	15*	.03	09
Age	09*	.01	018	09*	.01	18	07*	.01	14	08*	.01	16
Formal ICT edu.				.25*	.02	.30	.23*	.02	.27	.18*	.02	.22
Screen time							.13*	.01	.22	.13*	.01	.21
Work experience							01	.02	01	02	.02	02
Cont. ICT edu.										.28*	.04	.14
R2	.038			.122		.166		.182				
F/sign.	42.6/.00		2	236.7/.00		62.0/.00		39.7/.00				

Table 5

Hierarchical Regression Analysis for Variables Predicting Teachers' Digital Competence (N=2477)

Note. * p < .00. # Gender (0=W; 1=M). Abbreviations: Formal ICT education (Formal ICT edu.) Continuing ICT education (Con. ICT education)

Table 5 shows that formal education contributes mostly to the determination coefficient in Model 2, where age and gender from Model 1 are included as well. The significant negative effects of age and gender indicate that male teachers and older teachers show slightly less digital competence compared to females and younger teachers. In Model 4, teachers' screen time and work experience are included. Only the amount of screen time contributes significantly to digital competence. In the last Model, teachers with continuing ICT education have significantly more digital competence than those without such education. However, the beta coefficient shows that the effect of formal (and prior to this) ICT education is higher (0.22 vs. 0.16), but teachers' self-reported screen time use is close to formal education in terms of the effect (0.21).

Discussion and Implications

The main objective in this paper was to describe the part of the SMIL study related to teachers' individual digital competence. More specifically, we wanted to examine whether demographic, personal and professional characteristics influence teachers' individual digital competence with the following research question: What is the relationship between teachers' individual digital competence and demographic, personal and professional characteristics (teacher's age, work experience, gender, screen time and ICT education) in upper secondary school?

The study shows that when examining the SMIL teachers' individual digital competence, there is a clear tendency indicating that they have quite good elementary and basic ICT skills, but their didactic ICT competence, digital learning strategies, digital Bildung and overall digital competence are more blended.

As demonstrated above, we found that it is statistically possible to draw on a theoretical model in order to explore the relationship between teachers' individual digital competence and demographic, personal and professional characteristics. Through the regression analysis we found that the variables formal education and teachers' self-reported screen time contribute mostly to explaining the highest individual digital competence among teachers. We also found that those teachers with continuing ICT education have significantly more digital competence than those without such education. These results mean that these variables can predict some of the complexity of what constitutes teachers' individual digital competence in upper secondary school, but at the same time we need more research on other factors and characteristics that can provide a complimentary picture of what constitutes teachers' individual digital competence index was measured to be high, which indicates that the theoretical model has certain potential within this area and can be followed up with by, for example, confirmatory factor analysis to examine the model's further potential.

The implications of this part of the SMIL study are that demographic, personal and professional characteristics, such as a teacher's age, work experience, gender, screen time and ICT education, predict teachers' high or low digital competence in upper secondary school to a certain degree. Our findings are related more generally to those of Christensen and Knezek (2008), Yuen and Ma (2002), Mumtaz (2000), Sipilä (2014), Howard (2013), Loveless (2011) and Underwood and Dillon (2011), which shows that it is often a combination of demographic, personal and professional characteristics that affect teachers' use of ICT in teaching and digital literacy. Our findings complement Ferrari's (2012) analysis of the framework of digital competence in practice.

On a more general level, our study contributes to monitoring what is going on in schools when it comes to teachers' individual digital competence. The theoretical digital competence model with high internal consistency revealed in the digital competence index can be seen as an indicator developed in this study (at the theoretical and methodological levels). This can be used by other researchers and school owners in future studies to examine and monitor teachers' individual digital competence over time in school settings. On a more practical level, we found that formal ICT education, continuing ICT education and teachers' self-reported screen time can be seen as indicators of teachers' individual digital competence. The implication of these findings is that school owners have to monitor such indicators in the years to come and implement strategies that support vulnerable teacher groups in order to increase their individual digital competence (e.g. though continuing ICT education).

Limitation

The digital competence index in this study is based on teachers' self-ratings, and this might be a limitation of the study.

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Notes

- 1. Sammenhengen Mellom IKT-bruk og Læringsutbytte (the relationship between ICT use and learning outcomes).
- 2. Pupils in all Norwegian upper secondary schools are provided with one laptop each.
- 3. In this paper digital literacy and digital competence are similar concepts, but in our SMIL study we used digital competence, which is the most commonly used concept in the Scandinavian countries.
- 4. Indicator areas are general areas one wishes to explore (such as infrastructure).
- 5. Indicator definition means the indicator's exact formulation for what one wishes to study (such as PC density per student).
- 6. In the SMIL study a set of primary and secondary indicators were developed in order to answer the main research question. Collectively, they represent an indicator system that school owners can use when monitoring education in the future.
- 7. Available from the first author upon request.

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TEACHING FESTIVALS AND COMMEMORATIVE DAYS FOR EARLY CHILDHOOD IN A DEVELOPING TECHNOLOGICAL ERA – DILEMMAS AND PRACTICAL SUGGESTIONS: CHRISTMAS AS AN EXAMPLE

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Abstract

This paper discusses the teaching of the Christmas festival in a kindergarten (3-6 years), in the digital era, in the contexts of religious ethnographic, folklore and education. Arab Christians are part of a multicultural society in Israel, where festivals help to shape individuals' identities and reinforce affiliations, but also help them to recognize and contain others, reinforcing intercultural relations. Kindergartens expose children to the practices and underlying rationales of festivals as a means to transmit social, moral and national values. The child absorbs the festival's religious and cultural dimensions from both the environment, and the experiential transmission process taught in the kindergarten.

The Influence of Technological Communications on the Celebration of Christmas in Society and in the Kindergarten

Communications technology contributes to the celebration of Christmas in three main ways: enlarging the possibilities for characterization of the festival (by providing extra means for representation); providing convenient accessible means of communication; and providing contents from within and outside the local culture. Children in the kindergarten are influenced generally by the events in society and external technological developments, since they are part of the larger society. They receive accurate information and suitable activities for their development mediated by their teachers, who also use communications technology to plan and perform their activities in the kindergarten. One major example of this use of communication technology by kindergarten teachers is for the planning of Christmas festival activities, including the transmission of its symbols. This will be explained and elaborated in a broader manner in the lecture and this paper.

The paper discusses educators' dilemmas concerning the use of different types of communications technology to teach the festivals in kindergartens. The paper also includes practical proposals for the teaching of Christmas as an example.

In recent years we witness the expansion of Christmas festivities around the world, and this is also true for the Christian community in Israel. This expansion is undoubtedly influenced by rapidly developing communications technology media at different levels. The present paper relates to the influence of this technology in the context of a particular ethnographic-religious folklore.

Kindergartens at present face the question of whether technological communications can contribute effectively to their educational, didactic and pedagogic work, since infants in early development stages need to receive their education through appropriate mediation by an adult. The main discussion here will focus on the following dilemma: in light of this debate: Can the festivals be taught in kindergartens with the aid of communication technology? The main debate is between those who advocate the use of computers in kindergartens and those who prefer to educate without this means. The advocates of the use of innovative technological means believe that it can assist the development of children's literacy, graphic abilities, logic, access to knowledge and cognitive development and help to train the child to enter a society that uses 21st century sophisticated technological media. Those who oppose this trend are concerned that the introduction of computer technology in the kindergarten will come at the expense of social interaction, play and creativity (Yogev, 1999), especially because, in the present era, the almost sole interaction of children with their peers takes place in educational settings.

The Researcher and the Interviewees

As an ethnographic researcher and a woman who has celebrated Christmas as part of her home experience, I also work as an educator and have written about teaching the festivals and trained student-teachers on this subject¹. With the development of global technological changes, I felt it important to investigate how these changes affect cultural aspects of the celebration of Christmas and how this is expressed in the Holy Land in kindergarten educational work.

To better understand this phenomenon, I held conversations with pedagogic mentor colleagues, acting kindergarten teachers and trainee kindergarten teachers – students in the Early Childhood college stream (not all Christians). I also studied my students' works in the field of folklore and the festivals over the last ten years. My work as a pedagogic mentor for future school and kindergarten teachers gave me an advantage in the conversations that I conducted with interviewees for this research and helped me to understand their socio-cultural context (not all of the kindergarten teachers, trainee teachers and mentors, who were interviewed are Christians). As an internal ethnographer I was able to directly and immediately record my impressions regarding the educational settings that I visited and the societies in which they exist.

Communications Technology in the Classrooms

In the last decade, global communications technology in different and parallel channels (television, computers, laptops, tablets, smartphones, etc.) has increasingly penetrated private homes and is not exclusively limited to educational institutions. From the interviews and observations that I conducted in the field over the last decade, I have found that the attempt of the Ministry of Education since the beginning of the 21st century to introduce a vast amount of computers into kindergartens², has in my opinion not produced the desired results. Computers distributed to kindergartens in Arab society amounted in a good case to one or two computers per kindergarten. The computers have not been maintained properly, and there has also not been a structured program to encourage and adapt computer-assisted thinking and work in a way appropriate for Arab speakers. Thus, many Arab kindergarten teachers consciously declined to use the computers in the kindergarten that could have served as tools for creative activities to develop social and creative interactions³.

A small minority of the kindergarten teachers, computer-literate and with computer skills who managed to attain budgets for the maintenance of their computers (repairs, updating, and Internet connections) from the local municipalities or raised funds for the installation or purchase of an interactive whiteboard, actually use the computers in

supervised activities. But these computer-assisted activities are not used instead of interpersonal communication activities with the children or instead of the use of playground games (sandbox, and playground games, reading corners, drama, music, puzzles, nature trips, creative work etc.). Rather they used the computer games in addition to these activities in the few cases where they were used. Moreover, we should not ignore the fact that over the years, with the development of work in the field of linguistic literacy for early childhood, many kindergarten teachers used the computer to teach children the letters and the basics of typing and writing, where the goal was mainly to produce linguistic literacy, and this did not require expensive programs. Other kindergarten teachers used different drawing programs that they were able to purchase. These were used mainly to enable the children to train themselves in creative work, in a period that communication technology was not yet part of daily life and the computers in the kindergartens were still relatively new.

However, in practice, because of the lack of computer resources, I, as the educator of future teachers, who advocates communication technology and even encourages the use by my students during the lectures, often prefer to forego the use of an old, unworkable computer that cannot be easily used in the kindergarten for productive interactive activities, unless the computer can be properly maintained and the kindergarten is equipped with suitable programs for the desired activities, something that I would suggest is also relevant with regard to the planning of teaching of Christmas activities as explained below.

Thus, the model of the independent learner in which the child goes to the computer in order to discover something or to experiment, whether with or without the teacher's mediation, is not a useful model since the desktop computers in the kindergartens, as mentioned above, are not necessarily available or in working order. In conclusion it can be said that computerized kindergartens where there is a computer for each child with a control mechanism for all the computers are not a strong feature of kindergartens in Arab communities in Israel.

A Question for Discussion

Given the above-said, it seems pertinent to ask: How can communications technology make the teaching of festivals in the kindergarten more effective, in an era of developing computer technology, without forgetting for a moment the fact that Christmas is a universal festival and that the natural local environment of the kindergarten teacher and the child is not detached or free from globalization processes and their influences? If so, how can the teacher teach Christmas in a kindergarten when global messages encompass the image of the festival in the home and society? And how can the teacher enlist communications technology to benefit the program that she plans?

Correct Information as a Source for Appropriate Planning

Given the fact that the kindergarten teacher is not the sole source of knowledge, and her role becomes that of mentor and guide, the teacher needs to be prepared for the use of 21st century skills, equipped with suitable methods to assimilate computer-literacy and to teach and mediate information through the digital environment⁴. Using all the rapidly developing communications technology channels in addition to her professional training in education and her religious and cultural knowledge, the teacher can plan the subject that she teaches in an appropriate manner. In the present case these resources could be used to plan work on Christmas (a universal festival rich in festivity and ideas) and to

introduce concepts and different means of celebration in the kindergarten. Even if the teacher does not have a PC or mobile computer in the kindergarten, the smartphone in many cases can solve the problem by supplying information. Indeed, if she is able to access digital information of whatever kind it will be beneficial since every screen offers different social and technological interaction characteristics (National Association, 2012). Thus, whether the kindergarten is equipped with suitable communications technology or not, the relevant communication channels may be accessible to serve the kindergarten teacher, expanding the teacher's knowledge, enriching it and providing her with tools and ideas to apply in teaching the children about the festival in an appropriate manner. The development of the smartphone in this case responds to the need for communications technology because the teacher can attain all the necessary information and any activity or song through an Internet search at any given moment.

The Festivals

The festivals capture a central position in folk cultures, they strengthen affiliations and contribute significantly to fostering individual and social identities, especially in a multicultural society. In cultures that live together or one beside the other similar texts and practices can be found that reinforce the individual's sense of his or her their own culture and strengthen intercultural ties with neighboring cultures (Sela', 1995). Christian Arab society in Israel contains many cultures, stemming from different Orthodox and Latin churches, and these are just part of the multiple cultures of Arab society in Israel including Muslim and Druze cultures. And in turn these Arab cultures are part of a larger multi-cultural circle including Jews from different parts of the diaspora and from different ethnic groups, non-Arab Orthodox Christians and Latin Christians (Greek, Russia, Syrian, Coptic and Armenian) and foreign workers, especially from the Far East and Eastern Europe (Da'eem et al., 2016). The cultural uniqueness of each of the ethnic groups and religions living together in Arab society in Israel does not prevent members of one national group or culture from celebrating together with members of another culture despite religious differences, since they speak the same language, hold the same values and have similar texts and practices⁵.

The festivals are special occasions distinguished from the normal passage of time. On these days routine activities cease, and special ceremonies and symbolic acts are performed in order to note events rooted in history, religion or nature. The festival strengthens the social and emotional unity of a people. Participation in the festivities from an early age ensures the continuation of that people's values. Tradition includes national values, customs and accepted social behaviors passed on from generation to generation. Among the functions of a kindergarten, it is expected to instill social, moral and national values and to expose the child to a complex of practices for festivals and commemorative days and to explain their underlying rationales (Da'eem, 2011).

Christmas in the Kindergarten

The kindergartens deal with Christmas as one of the important subjects in the annual cycle. The teaching of the festival in the local context is undoubtedly influenced by changes in universal communications technology. Although the kindergarten program draws contents and activities from the child's close environment to respond to the child's need, it also provides the child with rich opportunities to help them to learn to assimilate and to cope with the surrounding world, according to the child's level of development (Brunner, 1966; Misrad, 2010). Like other festivals, the celebration of Christmas in a multicultural society contributes to the shaping of the individual's
awareness of his or her own identity and the identity of others in the following ways (Sela', 1995):

- 1. Shaping individual identity, reinforcing the individual's religious affiliation, encouraging observance of religious duties, getting to know the individual's historical, cultural, religious and spiritual background and shaping the individual's inner value system. This bonding with an inner world of values reinforces the individual's connection to his culture and heritage in the past and present and ensures his continued affiliation.
- 2. Training the individual to recognize and contain the "other," his culture and ethnic group in an active manner and also to become familiar with and strengthen his own identity by distinguishing what is similar and what is different in the culture of others, without relinquishing his own identity.

From a didactic viewpoint, the teaching of Christmas helps the child to get to know the historic and religious story of the festival and to become familiar with its religious and social practices and values and the holy sites of Christianity. Using dictionary work and assignment sheets with the symbols of the festival it can help to develop the child's vocabulary and acquisition of scientific and mathematical concepts (Tannus & Zahalqa, 1996).

The child becomes familiar with religious and folk symbols in the close environment and this influences his sense of belonging to his people; the child learns to internalize values such as tolerance, help to others, respect for parents and giving presents. Aesthetic education is also imparted as the children become involved in decorating and preparing the table for the festival, decorating a Christmas tree and the home, the church and environment and the kindergarten. The child learns the traditional aesthetic customs relating to Christmas. The close environment of the child and the child's natural curiosity are exploited in order to gain educational benefit from the different activities (Da'eem et al., 2016).

The child absorbs the concepts and rituals of the festival through two complex inseparable channels (Da'eem, 2011):

- The external channel influenced by the environment and everything that happens there.
- The internal channel organized by the kindergarten teacher in a transmission process teaching the children about the festival in an experiential manner.

It is difficult to separate these two channels since the child brings his family experience (especially in regard to Christmas for those who are Christian) into the kindergarten and their social experience (Christian, Muslim or Druze in a multicultural society)⁶ together with all they have absorbed from the mass media, which imports Christmas knowledge from all over the world even before the date of the festival. In parallel the kindergarten teacher relies on the child's accumulated experience to teach him in an experiential manner about the festival as she has planned ensuring continuous developing interaction between the child and the festival.

The teacher can turn the child's attention to what is happening in the environment and link the changes in that environment with the festival activities in the kindergarten. This can help to increase the child's knowledge, vocabulary and creativity. Among other things the child can learn about his people's customs and folklore, and learn to respect their religious and cultural values.

My vision as a researcher and also as mentor for student-teachers is to enlist communications technology for the teaching of the festival in the kindergarten and to offer suitable action programs for a wide range of children. I would also like to expose these children to complex experiences which would enable them to realize their inherent abilities and allow them maximal functioning in their close physical and human environments. Using activities concerning the festival, the child would get to know culturally rich contents with the values of the society to which they belong and in which they are raised. I would like to exploit communications technology in a maximal way for the child's benefit at any given moment whether the kindergarten is equipped with a network of new computers or just one single computer and whether the teacher advocates use of technology as a foundation for the educational work of the kindergarten or believes in interpersonal interaction as the tool for work with the children.

However, before relating to the practical plan for Christmas I feel it pertinent to mention that the festivals and the work on the festivals in the kindergarten are different and distinct from the regular routine work. Thus, the kindergarten's educational program for the festival should be innovative, adopting technology-enriched activities, adapted to the character of the festival, exploiting the technology to the maximum.

It is worth noting that even when she believes in the importance of interpersonal communication for the child's development in early childhood, the kindergarten teacher can still use communications technology in a focused and controlled manner in the kindergarten especially because children today are increasingly exposed to communications technology in the home and they master its tools, at least technically. The teacher can exploit this technology for two main purposes:

- 1. To provide the child with a different experience during the period of the festival, different from the normal kindergarten routine using activities and activation relating to Christmas.
- 2. To mediate contents to the child and to guide him in the correct and controlled use of communications technology tools, explaining the risks of surfing to unsupervised sites without adult supervision or over-use of tools that may in particular harm the development of motor and sensory abilities. This mediation can be especially productive when the teacher uses pleasurable technological materials that differ from routine experiences.

Christmas in the Technological Era in Society and in the Kindergarten⁷

The influence of communications technology on Christmas in society and in the kindergarten is felt in three main areas:

- 1. Broadening the range of festivities.
- 2. Comfort and easy access to communications.
- 3. Combining contents from within a culture and those from other outside cultures.

Communications technology has contributed to the development of cultural customs relating to Christmas in the Middle East since it broadcasts events in real time from different world sites in which Christmas is respected. Even in the multicultural Holy Land, members of different ethnic and religious groups have begun to imitate customs from different countries.

Helped by globalization, importers bring in all sorts of accessories for the festival used in the home and in public spaces in new forms unknown in the past. New activities develop and are published aided by communications technology including exhibitions, bazaars, celebrations, parades, Christmas trees lit up at social occasions, etc. The activities begin in October while in the past they would begin a week or ten days before the festival. In the past, greetings would arrive for selected people in the form of Christmas cards, but this has given way to rich and varied electronic messages sent quickly and cheaply. Awareness of Christmas as a cultural act has increased among members of different ethnic groups, who adopt a large selection of customs and take part in many activities, not only because they live in a multi-cultural society but because of the interaction that is created mainly through communications technology. This interaction enables individuals to form dynamic relations between their own culture and those around them, and Christmas with all its events holds a central place in these dynamics.

The various innovations are assimilated by the members of the different Christian ethnic groups to the extent that new practices are adopted in homes such as setting the Christmas tree in the home or inviting Santa Claus to distribute presents. In addition, these new cultural activities have influenced the education system because the educators themselves live in a multi-cultural society and are exposed to the different communications networks' festival events. The educators then bring them in a formal or informal way into the schools or kindergartens. The children in the kindergartens are influenced in a general way by events in society and external technological developments since they are part of the larger society. They also receive accurate information and suitable activities for their development through the mediation of their teacher who also uses communications technology for many of the activities concerning the festival and its symbols.

The Fundamentals of Christmas in an Era of Communications Technology – Proposal for a Practical Program

Fundamental technological means needed to transmit Christmas with technological appliances like:

- 1. At least one working computer for use by the teacher and/or the children.
- 2. A projector linked up to the computer.
- 3. Connection to the Internet contributes significantly to the application of the proposed program and assists the teacher's search for materials and activities.

The basic historic, religious, cultural and social elements of Christmas constitute the foundation for the teaching of the festival in kindergartens while maintaining a structured gradual progress from the easiest, closest and most concrete to the abstract and more difficult (see: Ibn-Khaldoon [1377 – 14th century], 1992; Brunner, 1966). The use of communications technology helps the teacher to find materials, films, pictures and activities on the one hand and to provide the children with enjoyable experiences that satisfy the children's natural curiosity (Misrad, 2010).

The use of communications technology is suitable for all the kindergarten children since they each develop in the kindergarten according to their own pace (Sela', 1995). Most of the children have not yet learnt to read and write (Salama, 2010), and there may be some children, with as yet, unidentified learning disabilities. Advanced technological tools allow children to learn and enjoy what they see or do according to their own developmental stage.

The Book Corner and Listening

The presentation of the festival story includes the historical background for the period of the birth of Jesus, folk stories relating to the meaning of Christmas or the Christmas festivities, stories relating to Santa Claus, and stories of "here-and-now.". It should be taken into account that if the children are younger (3 years old) they will hear stories relating to their close surroundings, and when they are older (5-6 years) they will hear history stories. The teacher can scan the story of the festival and present the pictures and text on a large screen, she can record the story in her own voice accompanied by written text and illustrations. She can also find appropriate film clips on the Internet.

Although it is important to use pictures and stories in order to maintain interpersonal communication (Da'eem, 2015), we should not forget that this is festival time activity that allows us to deviate from the norm as on the festival itself. The use of films on the screen can be enjoyable and facilitate learning for children who find it difficult to absorb the story in the form of illustration or text. It should also be remembered that the children are exposed to films and video clips on various types of communications technology at home.

The kindergarten book corner should also include pictures of holy sites and holy icons that are accessible on the Internet and can be printed at a reasonable cost, but it is also possible to present them on a large screen and to conduct a conversation concerning the religious story using the icon or to show a presentation of several icons that the child can study as part of a personal activity in the kindergarten (Salama, 2010).

Although communications technology outside the kindergarten may have a negative influence since they expose the child to the violence and chaos prevalent in the world, using suitable films that present universal social and humanist values such as tolerance and love and not necessarily particular religious or historical values, it becomes possible to present the children with a vision of a better world than that which they encounter in the mass media and to instill in them values of self-worth and acceptance of others. Christmas is some festival rich in song and music. The children hear the songs of Christmas everywhere and at different times. The teacher can collect all the relevant songs for the children in the kindergarten and print their lyrics, presenting them to the children together with the melody.

Didactic Activity (Da'eem & Younis, 2007)

One of the advantages of the use of communications technology and technologyassisted activities is that they help to prepare the child for the skills required in the technological era of the 21st century, with the necessary cognitive, literacy and mathematical abilities. And since the child is in the pre-school stage, meaning that he has not yet learned to read and write the child can learn literacy skills and mathematical abilities while enjoying pleasurable activity with technological tools. Children with learning difficulties cannot always be identified in early childhood but activities with technological tools have value-added for these children since they can understand them easily and so they can be included in such activities.

Linguistic and mathematical literacy. Cards with letters and numbers in graphic form and musical notes can constitute an interesting game for children. In this context mathematical computer activities relating to form and amount and linguistic elements (single-plural, male-female, opposites can be adapted to include festival content and symbols.

The calendar. Reading the names of the months, the days and festivals on a computerized calendar strengthens the child's perception of the annual cycle, and contributes to their literal literacy. The child can read the words and also hear them simultaneously on the computer.

Computer puzzles and matching games. Puzzles and matching games such as lotto and jigsaw puzzles, and any other card games or a series of narrative pictures that have to be placed in a logical order to tell a story can be challenging and interesting for the children's linguistic and cognitive development and can be adapted to teach about Christmas using the festival symbols.

Task sheets. These are pages on the computer with assignments that allow the child to perform a task such as drawing a line between a shape and a word or searching for a suitable word among a set of words, etc.

Observation of Processes

In the past, Christians in the Middle East would plant seeds in clay, glass or plastic pots on a mat of cotton wool, to symbolize the beginning of new life, to decorate the home at Christmas. Children would watch the growth of the seeds, which they planted in the kindergarten. Today the Internet sites are full of pot planting games showing seeds and their harvesting, including competitive games. It is therefore possible to develop similar technological games in which Christmas seeds are planted, or typical Christmas plants such as the Christmas flower (poinsettia) or Holly and Ivy, and to observe the way in which they grow. All the work with the symbols of the festival (presents, the tree, lights and candles, the cave (stable), Santa Claus, the star etc.) whether it is handiwork or digital work is based on the accumulated culture of the festival.

Computerized activities include receiving presents from Santa Claus in a game where the object is to succeed in the task or digital decoration of the tree and cave according to instructions, or writing a digital greeting card, all of which improve the learning of the cultural aspects of the festival. The local cultural foundations of Christmas are not reduced by globalization at all. The mutual in-culture (within different Christian societies) and ex-culture influence between cultures in a multicultural society affects the manner of celebration, which it seems is the element most affected by mass media and contributes much to the way in which educational work is performed in the kindergarten.

The Connection with Nature and Environmental Preservation

In parallel to the development of communications technology there has been increasing international awareness of the need for environmental quality among kindergarten teachers. In my opinion this is the result of two main factors: the first, extensive

publicity relating to environmental quality that reaches the teachers through the media, and secondly the teachers succeed in implementing the philosophy of nature preservation through the use of recycled materials in many creative ideas for arts and other activities. The kindergarten teachers often use recycled materials to create decorations with the children, for example, decorating the Christmas tree or the classroom. The use of recycled materials helps to preserve the environment and develops creativity.

As noted above, teachers are increasingly exposed to learning materials advertised on the Internet and derive practical ideas from innumerable sites dealing with Christmas, accumulating stories and creative and decorative activities for children, assignment sheets, sketches and stencils, greeting cards, songs, etc. However, as the teachers enjoy the computer in many ways as they learn new methods and activities concerning Christmas, their need to occupy the children in practical creative work that will contribute to their development grows. As noted, they try to do this with cheap recycled materials. Having a printer in the kindergarten can help the teacher to print assignment sheets whereas in the past she would have to draw things by hand or with a stencil on a suitable number of pages for each child.

Greetings cards have almost disappeared in Israel although they still exist in other places in the world. The teachers make them with the children and even make sure to recycle cards. They then take the children to the post office to send a greeting card to their parents. One additional prevalent activity is composing a greeting card on the computer and printing it. Of course, this is only possible if the kindergarten has a computer in working order and a printer.

Summary

Christmas is an international festival that is celebrated in various different and rich ways in different locations. The use of communications technology in the kindergarten prepares children for life in the technological era of the 21st century, allowing them to connect to universal channels relating to Christmas.

Communications technology cannot replace the interpersonal communications in the kindergarten, and so I would not recommend complete computerization of the kindergarten, rather appropriate planning of the children's use of computers in the kindergarten, especially since the children are exposed to the use of different intelligent appliances in their homes. What is really needed is the teachers' mediation for the proper use of various types of technological accessories.

At the same time, communications technology has influenced the work of the kindergarten teacher, both deepening and expanding it. This is expressed in the teacher's direct work with the children. The teachers learn from many world Internet sites and especially from films that show how to make handicrafts from simple and recycled materials; they attain new ideas that until not long ago would have necessitated greater efforts to learn or access. They can now find an activities book that might not be available on the local market, or learn from other teachers, or try to be innovative and creative with the assistance of the ideas of others.

The teachers sing songs in the kindergarten and lead dramatic productions of the Christmas story. They search on the Internet for Christmas stories that are not easy to attain, including picture books relating to the festival published abroad. They also look for historical, religious and artistic films telling the Christmas story and scan stories to show as presentations or with a projector.

The value added of the use of communications technology in the kindergarten is that it is possible to adapt the activities including didactic activities for children with learning difficulties, who can learn and develop in these alternative ways. Technology has an influence on the development of Christmas celebrations at the socio-cultural level, and it seems that the kindergarten can benefit from this technology to reinforce the authenticity of Christmas.

Notes

- From 2007-2012 I headed a team writing a guidebook for the teaching of festivals in Arab (Christian, Muslim and Druze) kindergartens (Da'eem et al., 2016) in line with the immense development of communications technology in the last decade, including YouTube and smartphones.
- 2. On the issue of introduction of computers to kindergartens in Israel see Yogev, 1999.
- 3. Finding from the interviews conducted for the writing of this paper.
- 4. In 2012, Israel's Ministry of Education initiated a project known as "A mobile computer for each kindergarten teacher" together with several NGOs and sponsors, the vision being that they would reach their target in the field by 2016. The program included the distribution of mobile computers to each teacher that participated in a 90-hour course in computer literacy. The purpose of this initiative was to develop the teacher's basic skills in computer-literacy and 21st century skills, so that the mobile computer would become the teacher's work desk, to promote organizational work with different official and professional entities, and this would assist pedagogic activities and contact with different stakeholders including the children's parents (Hadad et al., 2012).
- 5. The rational discussion concerning multiculturalism is based, among other things, on the report of Shinhar (1994).
- 6. Some of the kindergartens in Arab society have mixed populations with different religions (Christian, Muslim and Druze) since they are situated in districts populated by members of all these religions.
- 7. See Da'eem et al., 2016; Da'eem & Younis, 2007; Tannus & Zahalqa, 1996.

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THE APPLICATION OF A NOVEL VOICE-DRIVEN MIDI CONTROLLER IN MUSIC EDUCATION AND TRAINING

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Abstract

Music technology is an integral part of music education and training today. A series of applications are developed to assist musicians to record their performance to write music score, to analyze rhythmic and melodic patterns and evaluate their progress. However, the human singing voice which is the dominant means of musical expression it lacks this feature. The system presented in this paper implements an efficient method to convert Electroglottographic signal into MIDI messages. The paper describes the characteristics the operation and the limitation of this novel system and examines its potential application in music education and training.

Introduction

The evolution of computing systems along with the advent of music synthesizers during the last decades, created a new field of technology that of Music Technology. This evolution, gave new potentials for music and music education and made the music creation accessible to all. As a consequence, a significant need for encoding the musical performance appeared. Thus, several MIDI controllers that replicate piano keyboards, guitars, wind and brass instruments and percussions have been designed. However, the human singing voice, which is the dominant means of musical expression, lacks this feature. This is because unlike the other music performance actions, which deliver mainly mechanical information, singing voice provides performance information which can only be obtained through its acoustic impact, which is the produced audio sound. In this paper a novel method of extracting singing performance information is presented (Garcia, 1854). The paper describes and analyzes the characteristics and the abilities of a voice-driven MIDI controller based on the electroglottographic signal.

The electroglottographic signal is a relatively simple signal comparing to its related audio. It gives information for the closure time of the vocal folds by measuring the variation of their electrical impedance and it contains all the necessary information to describe singing. The system presented here is based on the authors' previous research and implementation of an efficient way to convert electroglottographic signals into MIDI messages. In this work we describe the characteristics, the setup, and the operating principle of the system, discuss its limitations and examine its potential application in music education and training.

The remainder of this paper is organized as follows: in section two and three, the fundamentals of the Electroglottography and the MIDI protocol are presented respectively. In section four, the operation of the proposed EGG-driven controller is described. In section five, an evaluation of the proposed system is performed. In section six, the potential application of the system in music training is discussed. Finally, in section seven, the conclusions of this work are presented.

The Electroglottographic Signal

Electroglottography (EGG) is a non-invasive method for describing and analyzing vocal folds' operation. An EGG device, known also as laryngograph, produces a signal that is directly related to the closure time of the vocal folds by measuring the electrical impedance variations (due to abduction and adduction) of vocal folds. This is achieved by means of a small A/C electric current applied by two electrodes, externally on the neck on both sides of the thyroid cartilage. The acquired signal gives an accurate description of the vibration period of vocal folds, especially because it operates on the source of phonation, this way avoiding the interferences related to vocal tract and airborne noise (Howard, 1995). The electrodes of the device apply a high frequency (300 kHz to 5 MHz) and low voltage (approximately 0.5 Volt) signal, which flows across the larynx and the nearby tissues (Henrich, Roubeau, & Castellengo, 2003). The produced waveform is a representation of the glottal movement. Figure 1 shows an acoustic waveform (vowel /a/ phonation that corresponds to note A2, ~110 Hz), along with its respective EGG signal.



Figure 1: Microphone signal (vowel /a/ phonation, top) and its corresponding EGG signal (bottom).

Figure 2 shows a single period of the EGG signal and its interpretation when it comes to the glottal cycle. The graph describes the open and close periods of vocal folds and shows the contacting and de-contacting event.



Figure 2: The EGG signal.

The MIDI Protocol

The musical Instrument Digital Interface (MIDI) standard is one of the biggest and most long-lasting innovations in the history of music technology. It was officially introduced in 1983, and it was designed to regulate the communication between different types of music devices such as synthesizer, sampler, drum machine, computer with sequencer and etc. MIDI is a serial asynchronous digital command protocol that encodes actions taken during musical performances into digital messages. MIDI messages are able to encode parameters that describe not only the start and the end of a musical note's execution, the pitch of the note and its variation, but also a plethora of control actions

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that are used to differentiate the musical expression in various instruments such as vibrato, breath control, sustain and dumper pedals, after-touch and many others (Chousidis, Rigakis, Hadjinicolaou, & Antonidakis, 2010). The success of the protocol is due to the fact that it has almost 120 different control messages that are able to describe with clarity all kinds of musical expressions. An important feature is also that the protocol provides a fundamental system of networking based on 16 channels. This allows the formation of simple star or daisy chain networks where several independent MIDI devices are able to operate and exchange information over the same infrastructure.

An in-depth analysis of all types of messages and features included in the protocol is beyond the scope of this paper. In the system analyzed here the basic *note-on* and *note-off* messages are used to encode the initiation and the termination of a singing tone. In addition, the *volume control* message is used to encode the variations of loudness and the *pitch-bend* message to encode the pitch variation during singing.

The *note-on* message is generated whenever a note is played in a MIDI controller. The message consists of 3 bytes. The first byte is called the *status byte*, and it contains information about the type and the channel of the message. The second and third byte are called *data bytes*, and they contain information regarding the note number that is played and the initial volume of the note called velocity, respectively. The termination of a note played can be achieved in two ways in MIDI. The first way is the transmission of a *note-off* message for the specific note. This message has the same format like *note*on with a difference only in the code part of its status byte. The alternative way is the transmission of a *note-on* message with the value zero in the velocity data byte. The system described here uses the second method. The *pitch-bend* message is used to modify the pitch of the notes played on a given MIDI channel. The *pitch-bend* message uses two *data bytes* to describe a 14-bit of information that provides a range of 16384 values. The two bytes are used here to provide the necessary resolution required for a smooth transition within the pitch values. The volume control message is a controlchange message that is generated from a MIDI controller every time a variation of the initial velocity value of a specific note takes place. This message is used for notes with long duration and consequently applies in singing. It consists of one status and two data bytes. The first data byte describes the type of the control message (volume control in this case), while the second data byte describes the value of the controller. Figure 3 provides a detailed description of the above described MIDI messages.



Figure 3: The format of note-on, pitch-bent and control-change MIDI messages.

Operation of the EGG-Driven MIDI Controller

The first task of a voice-driven MIDI controller is to generate a *note-on* message at the beginning of a phonation. This message must contain the pitch and the loudness of the note. Then, during the duration of the note, the controller must identify any possible variation of the pitch or loudness and generate the appropriate *pitch-bend* and *volume control* messages respectively (Kehrakos, Chousidis, & Kouzoupis, 2016). Therefore, a voice driven MIDI controller must be able to perform two main operations, which are to constantly identify the pitch and the loudness of the phonation.

Pitch Extraction

The extraction of the pitch from a complex audio signal is a popular research topic. The main task in this process is to identify the value of the fundamental frequency f_0 . This is, however, a relatively complex task especially when the source signal has a rich harmonic content such as singing voice. The most efficient methods for pitch extraction, when it comes to complexity are the Time-Domain methods. Time-Domain methods use a basic approach to the problem of f_0 estimation by usually looking at the acoustic pressure waveform and attempting to detect f_0 from that waveform. These methods are easier to be implemented and require less computational time. However, they perform better when they are applied to simple signals, which have a relatively low harmonic content. For that reason, the EGG signal is used in this implementation instead of the acoustic signal. A relatively efficient time domain method of extracting the f_0 of a signal is the method based on autocorrelation. The autocorrelation function is the correlation of a waveform with itself and it is defined in equation (1).

$$R_{xx}(t_1 t_2) = E\{X(t_1)X(t_2)\}$$
(1)

For a harmonic signal in the form of $X(t) = A \cdot sin(\omega t + \theta)$, equation (1) can be expressed as in (2).

$$R_{xx}(t_1 t_2) = E \left\{ A^2 \right\} \frac{1}{2} \cos(\omega [t_1 - t_2])$$
⁽²⁾

From (2) it is shown that the autocorrelation function is also a periodic function, and it is a measure of similarity as a function of time lag (t1-t2). When this method is used, the EGG signal provides accurate information for the fundamental frequency of the signal. Figure 4 shows the advantage of using the EGG signal over the acoustic signal for pitch estimation using autocorrelation.



Figure 4: The autocorrelation function in EGG and audio signal.

Main Operation

The main algorithm that describes the system's operation it is shown in the block diagram in Figure 5.



Figure 5: The autocorrelation function in EGG and audio signal.

When the RMS value of the EGG signal passes a predefined threshold, the attack time and steady state part of the waveform are calculated. That is considered as the beginning of the sound production. As long as the signal remains in steady-state, the envelope identification algorithm acts as a trigger for the pitch identification algorithm. During the attack time interval, but also during idle, the pitch detection algorithm creates no signal. Thus, unnecessary calculations are avoided. The frequency estimation takes place for each predefined frame using autocorrelation. With the calculation of the sound envelope, we actually get information for both the attack and volume of the signal. The algorithm scales and assigns integer values in the range from 0 to 127 and then appends these digitized values to the MIDI messages. The calculation of the fundamental frequency provides the information for the identification of the musical note produced by the singer. However, the identified frequency as it is expected, will not always match an exact musical note. Rounding this value to the closest note will cause confusion to the performer who in most cases, gets a real-time feedback of the sound he or she produces through MIDI. In the system analyzed in this paper this problem is addressed by using the *pitch-bend* MIDI messages. The algorithm generates a note-on message only the first time a note is triggered. After that, all pitch variations are conveyed using *pitch-bend* messages to correct the pitch of the initially identified musical note. This feature is a significant novelty of the proposed system over other similar implementations.

System Evaluation

The proposed system was tested using numerous recorded EGG files collected from both male and female professional singers. The resulting MIDI messages were recorded into MIDI files in order to be able to compare them with the EGG source signal. In this section we examine the accuracy of the system when it comes to the identifications of the fundamental frequency f_0 and loudness and also its ability to generate the appropriate *note-on*, *pitch-bend* and *control-change* messages. Figure 6 shows the EGG signal of the note E3, singing the vowels /a/, /e/, /i/, /ou/ and the calculated RMS levels.

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Figure 6: A typical (~8 s duration) EGG signal along with its extracted level values.

Figure 7 shows the calculation of the fundamental frequency and the generation of noteon messages by calculating the corresponding note number and velocity values.



Figure 7: Pitch extraction and note-number and velocity calculation.

Figure 8 presents the *pitch-bend* generation process. It is shown here that a great number of *pitch-bend* messages follow after each *note-on* message in order to capture the frequency variations during singing. The *note-number* messages marked in red have the same value with those preceding them, as they are acting as *note-off* messages, (Note-On with velocity zero). These messages are generated by the system when the phonation ends.



Figure 8: Generation of Pitch-Bend messages.

Application of the System

The human voice is the oldest and most expressive musical instrument. Developing vocal skills requires time and practice. Singing training is a much more complex process than learning a regular music instrument. This is mainly because the sound production system (i.e., the instrument) is part of the singer's body and its operation is not fully controllable.

Singing training focuses in a number of issues that we are not usually facing in the regular musical training. Some of those are, the proper posture of the body, proper breathing techniques, appropriate control of the phonation system, enhancement of the pitch and loudness range etc. Singing training also requires significant self-study and practicing, probably much more than the regular instruments training. Education and training of conventional acoustic and electronic instruments have benefited from the evolution of music technology. Keyboard, guitar, percussion, and wind instrument students can monitor their performance using music software, record and repeat their exercises, identify and correct their mistakes and generally monitor their progress. The EGG-driven MIDI controller presented in this paper, gives these advantages to the singers. The system can be used with any music production software such as Pro Tools, Cubase, Logic etc. without the need of additional microphones and amplification systems. Singers can get a real-time visual and audio feedback on their pitch, vibrato and loudness (Hoppe, Sadakata, & Desain, 2006). They can also record and reproduce their performance and make corrections. They can also use the controller to write scores in order to capture and share their musical ideas. The controller can be used in combination with the multitrack functions of the music software to practice vocals and singing in parallel melodic lines.

Singing teachers also can benefit from the system presented here. By visualizing of their examples, they can make explanation easier, they can provide a more efficient feedback and highlight vocal issues.

In addition to the above the EGG-driven MIDI controller presented in this work can be a very powerful live performance tool for singers. With appropriate training, it can be used to drive synthesizers, control automation systems, effect processors and even DMX lighting networks simultaneously with singing as it is an independent source of information which is not affected by the noise level of its environment.

Conclusions

In this paper, the characteristics the operation principles and the potential applications of an EGG-driven MIDI are presented and analyzed. The system uses electroglottographic signal to identify the singing information and generates appropriate MIDI messages that describe the initiation and the termination of a phonation and also the variation in pitch and loudness. The novelty of the system is that monitors continuously the pitch of the produced note during the phonation and not only at onset and constantly tunes the corresponding MIDI note using pitch-bent messages. This allows the system to have a plethora of implementations in music education and training but it also be used efficiently in live performance.

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THE USE OF BRAINWAVE MONITORING TECHNIQUES TO INVESTIGATE THE EFFECT OF AUDIO STIMULI ON STUDENT CONCENTRATION LEVELS IN A LEARNING ENVIRONMENT

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Abstract

The properties of audio stimuli, such as the frequency and strength of a sound/voice, can have both positive and negative impacts on audiences' cognitive processes. This is especially important for students who study in a learning environment where the information is mainly passed on through audio/voice communication, such as a traditional lecture. The brain goes through different neurological activities reflecting the positive and negative impacts. These activities can be monitored and analysed from their distinctive brainwave outputs using a special electroencephalographic device. In this study, the key properties of audio stimuli that may affect the student's concentration level were investigated. These include: (a) the frequency and strength of the main communicating voice and (b) the type and strength of background sounds behind the main voice. A special electroencephalograph device was used. This device places small non-invasive electrodes on a participant's head, picks up tiny amounts of electrical activity created by the brain, and interpolates the outputs into a *concentration level* (i.e., neurological attention values) measurable on a scale of 0-6.

The study was carried out by monitoring the participants' concentration level when they were listening to a selection of different voice clips presenting the same information. Effect of background sounds was investigated by playing different types of background sounds at various levels behind the same learning material. Results showed that the properties of the main voice can influence the audience's concentration level, some music that does not use predominantly sounds occupying the critical voice bandwidth can help to improve the concentration, and environmental noise, specifically vocal sounds (such as a distant argument or raised voices), can detract audience from the learning experience.

Introduction

The properties of audio stimuli, such as the frequency and strength of a sound/voice, can have great impacts on students' learning experience especially in an environment where the information is mainly passed on through audio/voice communication, such as a traditional lecture. These impacts can be positive or negative for an audience's cognitive processes depending on what neurological activities the brain goes through. Benefiting from the rapid developments of Electroencephalograph (EEG) techniques in recent years, these brain activities can be monitored and analysed from their distinctive brainwave outputs now.

When the brain goes through neurological activities, neurons are electrically charged by membrane transport proteins, which push ions across their membranes. As ions of similar charge repel each other, this causes a ripple effect across the brain. The EEG device places multiple small non-invasive electrodes on a participant's head. When this ripple reaches the electrodes on the scalp, it can be captured and measured by the EEG.

In this paper, the key properties of audio stimuli that may affect the student's concentration level will be investigated, including

- The frequency and strength of the main communicating voice.
- The type and strength of background sounds behind the main voice.

The participants' concentration level will be measured when they are listening to (a) a selection of different voice clips presenting the same information and (b) different types of background sounds at various levels behind the same learning material. An EEG device will be used to pick up tiny amounts of electrical activity created by the brain and interpolate the outputs into a "concentration level" (i.e., neurological attention values) measurable on a scale of 1-6.

Methodology

A selection of sound clips were created to carry out the test. They are designed to investigate how sound will influence the subject. A wide variety of psychoacoustically influenced sounds (Stoller-Conrad, 2012) were used in an attempt to influence audiences' concentration levels.

The Four Parts of the Test

The test includes four parts, each of which includes two listening stages. Between different stages the subjects take a five-minute break, listening to a song or watching a video, in order to prevent the test speeches from sounding too repetitive and adversely affecting the result.

Part 1

The subjects are required to listen to a brief speech made by a Scottish woman with a relatively high pitched speech range (Track A) and an English man with a very low voice (Track B), both using very different styles to present the speech. They will have 5 minutes break between the tracks. Voice A typically speaks in a soft, calming manner with slight traces of the Scottish accent, whereas Voice B uses a very loud, powerful manner of speech, but also speaks very clearly with an English non-descript accent. The speaker for Track A produces far more high frequency content than the speaker for Track B. The speech used for this test was Mary Schmich's Famous "Wear Sunscreen" speech.

Part 2

The subjects are required to listen to the same 2 speeches with a quiet piece of music playing along with the speeches. The music chosen was "The Heat" by Jungle, an upbeat, but soft and relaxed, synth-driven track.

Part 3

The subjects are required to listen to the same speech once again. But this time the music track in the background is "All the Kings' Horses" by Two Steps from Hell, a decisively more upbeat, intense and attention grabbing track.

Part 4

The subjects are required to listen to the same 2 speeches with intermittent sound effects in the background, including banal / common sounds (such as birds chirping and construction works noise) and more sudden and jolting sounds (such as distant gunfire or muffled shouting). This is to gauge the attentiveness and focus of the subjects when

exposed to sudden unexpected sounds, and how well they return to focusing on the speech after these audio disturbances.

The Electroencephalograph (EEG) hardware used to pursue this study was a modified variant on a consumer "brain toy" with all unnecessary features and aesthetics removed. The output signal amplified and fed into an easy to read box, which uses the chipset developer's (Neurosky) own interpolation of Raw EEG values (eSense data), into easy to handle 0-100 values of Attention and Meditation. The EEG eSense data values will then be presented on the box by 6 Light emitting diodes (LEDs) representing the 6 consecutive levels.

The eSense data from the EEG electrodes are also sent to and recorded by a microcomputer, Arduino. The data can then be further process and analysed using "Arduino Brain Library" (Vidich & Yuditskaya, 2013).

Results

Due to a short time scale and a limited budget of this project, only four participants were found to undertake all the stages of in this study. However they covered an age range from 18 to 38 and both genders. These subjects who were able to participate will be referred to as Subject A, Subject B, Subject C, and Subject D here. The background of each subject is listed in Table 1 for the purpose of cross referencing any findings.

Table 1

	Exposure to Commercial Media (Films, Television, Video Games, Radio)	Exposure to Professional Public Speakers (Lecturers/Teachers)	Profession	Physical Activity Levels/Lifestyle Factors
Subject A Age – 19 Gender – M	Daily exposure to films and videogames, some TV, little/no radio	Few times weekly, no exposure or interest outside of university	Student, Sport Coaching & Development	Very active, athletic
Subject B Age – 27 Gender - M	Infrequent exposure to films, and TV, daily exposure to radio in car & at place of work	Occasional "TED talk" and web based instructional videos	Carpenter & Carpentry Instructor	Sedentary, slightly overweight, infrequent exercise, smoker
Subject C Age – 18 Gender - F	Daily exposure to TV, common to film, infrequent videogames, no radio	Few times weekly, no exposure or interest outside of university	Student, Fashion Journalism	Overweight, smoker, motivated to get healthy.
Subject D Age – 38 Gender - F	Daily exposure to TV, infrequent film, rarely radio, no videogames	Regular attendee of conferences and presentations	Teacher, Modern Languages	Underweight, smoker, recreational drug user

Background of Each Subject

Study Results

Subject A Part 1

Subject A showed a measurable increase in attention towards Track A, over Track B. During Track A, the subject had a 2 on EEG activity and remained visually attentive and listening. However, during Track B, the EEG was constantly fluctuating, between 0 and 3 sporadically. The subject was noticeably paying less attention to the audio, as evident by considerably more fidgeting and other signs of boredom.

Part 2

During track A, Subject A displayed a relatively consistent level of attention throughout, noting that prior to the study the researcher was not aware that the subject was a fan of the music chosen for this part. With Part 2 Track B the subject displayed slightly more fluctuating attention levels and verbally described the speaker as "not being a good match for the music."

Part 3

In track A, Subject A's attention was not very focused and displayed erratic EEG activity, as opposed to Part 3 Track B, in which the subject's attention remained on average consistent.

Part 4

The subject displayed a good level of attention to Track B, whilst still seeing similar fluctuations as Part 1. However, in Part 4 Track A the subject was distracted far more easily by the environmental sounds, specifically the distant sounds of two people arguing. The construction and traffic sounds caused some mild distraction, but did not distract anywhere near to the degree that the argument did.

Subject B

Part 1

Subject B showed on average a higher level of attention to Part 1 track A over Track B, with a consistent EEG level at 2. The subject also displayed a similar level of attention to Part 1 Track B on average, but with slightly more erratic spikes.

Part 2

During Track A, the subject was noticeably distracted, with EEG levels fluctuating much faster. The subject later described that his attention drifted more to the music over the speech, but found it difficult to focus on one or the other. He felt constantly being distracted, re-focused on one aspect, and then becoming distracted again. As Track B played the subject displayed much more consistent attention to the speech and was not distracted as much as Track A

Part 3

With Track A, subject B displayed an initially good attention level but soon became distracted by the music, specifically at stages where the speech was very mildly masked by the similar frequency content of the music track. The subject also displayed very similar results in Part 3 Track B to Track A.

Part 4

At the start of Track A, the subject was noticeably becoming bored of the same speech again, and EEG levels reflected this with noticeable changes to the average when the subject lost concentration or "phased out" as he described it. This was noticeably compounded by the environmental sounds, specifically in this case the repetitive 2kHz

square wave "alarm" effect, which caused the subject's attention to drop and then fluctuate. During Part 4 Track B, the subject displayed much more consistent attention levels and was not as easily distracted by any of the environmental sounds. The subject did still display some loss of concentration when exposed to the sounds of a distant argument, but not as much as with the alarm tone.

Subject C

Part 1

Subject C displayed a far more consistent level of attention to Track B over Track A, though the level of concentration on Track A was till at an acceptable level, averaging between 2 and 3.

Part 2

The subject was noticeably more attentive to Track B over Track A, verbally confirming that in Track A the music actively detracted from the delivery of the speech, whereas Track B was far clearer over the music.

Part 3

The subject displayed very erratic EEG activity, fluctuating from 1-3 during Track A, which indicated the subject was losing focus and trying to concentrate again. The fluctuation was less during Track B where the subject managed to concentrate more consistently on listening to the speech.

Part 4

Subject C showed a very similar response to the start of Track A as she did during Part 1, but she was easily distracted by the environmental effects. The subject identified that by this point of the study she was more interested in the distant argument sounds than hearing the speech again. Consistent EEG wave activity levels were showed when she was trying to focus on the speech. Erratic fluctuation appeared at the start of these sounds and subsequently when she was attempting to return focus towards the main speech after this section. Subject C displayed very similar results during Part 4 Track B as she did during Track A. However certain environmental sounds such as construction works and traffic did not affect the levels of attention as much as they did during Track A.

Subject D

Part 1

Subject D displayed a far higher level of attention during the duration of Track A over Track B, with EEG levels for the latter being more erratic than the relatively stable results of former.

Part 2

During Track A, the subject displayed a fairly consistent EEG wave level throughout, remaining relatively focused. With Track B the subject produced similar results, albeit with slightly more aberrations, but nothing to indicate anything less than a fair amount of attention paid throughout.

Part 3

During Track A the subject displayed very different results to the prior sections of the test, showing EEG wave fluctuations and a lack of concentration throughout. With Track B the results were similar to that of Track A, but less pronounced. In verbal feedback the subject described the music as too distracting in Track A, and not as bad in Track B.

Part 4

Subject D displayed similar attention levels to both Track A and B to begin with and was not easily distracted by a large majority of environmental noise. However, the distant argument sound caused the subject's EEG wave levels to rise, indicating less attention was paid to the speeches.

Discussion

Some Interesting points can be found from the data gathered from Part 1 of this test. Despite many modern techniques in public speaking pertaining to the idea that a powerful and deep voice is far better at capturing the attention of the listener (Dholakia n. d.), from the results found here, the subjects gave on average a stronger amount of concentration and focus to Track A. This may be due to a phenomenon described by Julian Treasure (Treasure, 2014) that an alternative technique of public speaking which requires the speaker to present the information in a calm, clean, and arguably too quiet vocal style is effective. The theory is that with the speaker talking more quietly the audience is then required to consciously listen more carefully and, unintentionally, pay far more attention.

The problem with this theory, as Part 4 of the test indicated, is that this technique only works well if there is (a) an audience who wants to listen (a common struggle in teaching younger students) and (b) no external audio interference or environmental disturbance. While the subjects' responses to Part 1 support Treasure's theory, the results from Part 4 highlight the problems with using this method of public speaking in a variety of environments. Subjects were found to be easily distracted by environmental noise, and distant voices detracted immensely from how well the information was delivered. The subjects' responses to Part 4 Track B, however, produced far more consistent levels of attention.

Part 2 of the test indicates some disparity with the results. Some subjects paid closer attention and concentration with Part A, and others indicated that Track B was better at capturing the listeners' focus. The point could be made that perhaps this is due to the similar crossover in frequency content between the music and the voice. Perhaps in Track A, the subjects were in fact paying more attention to the music, where in Track B the voice is louder and more forceful over a soft calming piece of music. This identifies a potential issue with the study's methodology. It is feasible that for Parts 2 and 3, the monitored attention levels of the subjects may not be entirely representative of the subjects' actual levels of concentration devoted to the speaker, and perhaps by this point (having already heard the speech a number of times) more attention was paid to the music. This is compounded by the results of Part 2 Track B, wherein most subjects displayed infrequent attention with some fluctuation. These fluctuations may well indicate where the subjects' concentration shifted focus from the speech, to the music and vice versa.

A study by Dr Nick Perham states: "We found that listening to liked or disliked music was exactly the same, and both were worse than the quiet control condition." According to Cutler (2013) "Perham asked his subjects how they think they performed when exposed to different tastes in music. Each reported performing much worse when listening to disliked music, although the study's results showed no difference."

Within Perham's study (Perham & Vizard, 2010), the results were gathered by evaluating subjects as they performed serial recall tasks, and he concluded that the

control group performed better. His study (as well as from the results of Part 2 and Part 3 in this study) indicated that listening to music whilst aurally receiving information is fairly detrimental to the subjects' quality of learning. However, it should also be noted that Perham's study also found that listening to music *prior* to study, and during repetitive tasks, regardless of complexity, the preferred music very much did show a higher quality of results than disliked music.

A progressive route for further study here could be studying the EEG wave levels of subjects while listening to music subjects, such as music they do not like and music they are indifferent to, while they are sked to perform a variety of tasks, such as a serial recall task, a physical puzzle, etc.

Within Part 3 of the test, subjects displayed erratic EEG wave levels that made it clear they were having difficulty concentrating. This may be in part due to the far more intense style of the music, which contains a far wider dynamic range and higher amplitude than in Part 2. Judging from the results, it is apparent that Track A experienced some simultaneous masking over areas of commonly shared frequency content, whereas Track B had a higher dynamic range and the speaker spoke over the music (Haritaoglu, 1997). This may be attributable to the male speaker's lower fundamental speaking range.

Within Part 4 of the study the subjects found themselves easily distracted by some environmental sounds, but not to others. In particular, the sounds of a distant argument proved far more distracting than other common urban environmental effects like stereotypical traffic sounds, construction works, etc. The sounds of a car/fire alarm, a repeating 2kHz square wave, also distracted the subjects to a fair amount. It could be suggested that both of these points relate to a very human perception of sound, our biologically preferential response to the critical voice bandwidth (Kob, Henrich, Herzel, Howard, Tokuda, & Wolfe, 2011).

Conclusion

The subjects all displayed varying erratic attention levels during Part 2 and 3. This makes it apparent that while specifically listening to aurally presented data, having music play in the background was detrimental to the attention given to the speaker. This may well be because of the crossover of active frequency content between the music and the speaker. So with this in consideration, it can be surmised that if a public speaker were to use music as a background for enhancing the delivery of his/her speech/lecture, it would be far more conducive to the learning experience of using music with little or no specific focus on the critical voice frequency range. For example, a piece of music featuring acapella singing would detract far more than it would enhance the delivery of the information; likewise a piece of instrumental music, featuring woodwind instruments which characteristically produce a higher fundamental frequency (Clarinet, Oboe, Flute, or Piccolo), which occupies primarily a range of 1kHz to 8kHz, would be just as distracting. (IRN 2006)

From the results of this study, and as supported by previous studies, any music featuring predominantly frequency content occupying the critical voice frequency band can be more detrimental to a learning experience than music that does not, regardless of the method of learning. This is also supported by the results found in test Part 4, where the presence of audio in the critical voice range is more distracting when compared to the

other sounds being heard (Assmann, 1996). All subjects were noticeably distracted by the sounds of an argument, therefore in summation; if a music bed is desired for a public speaking event or situation, music which is more rhythm based than melody, would be more appropriate.

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A NOVEL APPROACH TO GRADING AND GENERATING FEEDBACK FOR PRACTICAL ASSESSMENTS

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Abstract

This paper discusses the design and implementation of a practical assessment using Microsoft Excel to automatically grade and produce feedback based upon heavily quantised scores. The aims are to design an assessment that encourages experiential learning, efficiently and consistently produces effective feedback, and produces an appropriate distribution of grades that link to the intended learning outcomes. The pedagogic merits are discussed and some operational considerations. A pilot project is evaluated based on the tutor perspective with the intention to discuss the student perspective in a future paper. Findings from the pilot suggest that the project was largely successful, with the core aims met.

Background

When developing assessment practices, it is important to consider the context and profile of the students involved. Not all practices are likely to work in every scenario.

About the Institution

Southampton Solent University is a post-1992 UK institution with a remit for widening participation; Solent's strategy (Southampton Solent University, 2015) includes aims to recruit undergraduate students from non-traditional educational backgrounds and socioeconomic groups. These are generally first generation applicants with vocational qualifications whom may have limited experience of the teaching and assessment strategies typically employed within Higher Education (HE). This poses challenges when developing inclusive assessments that do not rely upon prior experience or understanding of HE (Duke, 2015). Solent validates its units, levels and courses against learning outcomes and assesses students using grade marks that use criteria linked to these outcomes.

The Media Technology Programme comprises a range of Bachelor of Science degree titles in which the students learn about the development, systems integration and operation of the technical equipment used within the broadcast and audio engineering fields. They are essentially applied electronics degrees with a focus on developing the contemporary technical and personal skills required by related industries. The broadcast industry is suffering from an aging demographic and skills gap (Poray, 2012), and the course team is working closely with a variety of professional partners to help address these issues. The intention is to use this as an impetus to develop new work-based leaning models as discussed by Marshall (2016, p.153).

The course team has run Employability Self Evaluation (ESE) surveys with student cohorts to better understand their confidence in a variety of areas of employability. This aligns with the work of Jones and Sant (2013) and their capital compass model. The

results have shown that Media Technology students generally lack confidence in personal and professional networks and self-efficacy.

Review of Typical Assessment Strategies

Several texts discuss the merits of common assessment strategies in detail such as Race (2015) and Harris and Bell (1996). The discussion below is not intended to provide a detailed literature review but briefly summarises the elements that a new approach should aim to preserve and avoid. Baartman, Bastiaens, Kirschner, & Vleuten (2007) also provides a useful list of quality criteria to consider for assessments.

Presentations and viva voces. It has been said that the best way to test your understanding of a topic is to try to explain it to someone else (Rusczyk, 2016; Paul, 2011). Presentations require the students to understand a topic and impart some knowledge onto an audience. Therefore, students hone communication skills that are vital to their employability as well as demonstrating knowledge. However, many students dislike speaking in front of groups, and the pressure can mean they don't demonstrate their true academic ability. Viva voces can go some way to alleviating these issues as the interaction provides a mechanism for reassurance from tutors and allows them to use their professional judgement to extract knowledge from the students. Furthermore, the tutor is able to provide some immediate verbal and nonverbal feedback resulting in a more heuristic learning experience that aligns with the ideals of constructivism and "assessment for learning" (Biggs & Tang, 2007, p.21, p.201). The mode of assessment used in this project is a viva voce structured around a portfolio of lab work.

Comparison with other methods. Several other methods of assessment are routinely used within engineering courses including formal exams, in-class tests, time-constrained assignments, reports and portfolios. Formal exams and in-class tests are widely used to assess knowledge and are reasonably quick to prepare and mark. Grades should be consistent with the use of model solutions and key word marking, which enables multiple tutors to mark submissions. However examinations are known to cause anxiety and can encourage superficial learning by students focussing on rote retention of facts albeit depending on the students' approach to their learning. (Boud & Feletti, 1997; Biggs & Tang, 2007) Furthermore, students from vocational backgrounds may not be rehearsed in exam strategy; students who have previously been assessed by other means - such as BTEC students who tend to complete portfolios - may score lower than peers from A-levels encompassing exams. The disposable nature of exam questions also necessitates a constant stream of new questions, increasing the risk of errors. In-class tests retain many of the characteristics of exams but aim to reduce anxiety by using a familiar setting. Sequences of shorter tests can be formative and encourage reflection. The Media Technology programme uses in-class tests with a *limited open-book* format in an attempt to balance knowledge with understanding and encourage reflection.

Time constrained assignments (TCAs) include assessed practical activities and aim to establish what students can *do* rather than what they *know*. These encourage students to learn through application and experience, and so the assessment should be representative of what the student can do rather than recall. This requires the students to commit to the activities and undergo a deeper learning experience that features concrete experience and reflection (Kolb, 1984). These have traditionally been used in medical

and engineering disciplines, but they are time-consuming, and it can be difficult to provide feedback beyond how the task should have been completed.

Reports and essays are often based upon a project or specific learning experience. Like TCAs, they aim to assess what the student can do. They encourage the students to engage with the learning experience and to use the resources available to them to achieve the best outcome. However they are very reliant on the students' written communication and their ability to manage a project, often focussing on quite specific aspects of the unit. Tutors may become anxious when grading large numbers of reports as the feedback may not always align with the grades, and it becomes difficult to maintain consistency across the cohort (Biggs, 2003; Merry, Price, Carless & Taras, 2013).

Portfolio assessments require the students to wrap a number of tasks into a single body of work. This provides an opportunity for formative feedback on each of the tasks and allows the assessments to contain a wider range of topics than a single report. This can encourage student engagement throughout the unit and provide an assessment of the students' full range of abilities. Previous studies have suggested that students are motivated to complete work that they perceived to be graded (Gibbs, 1992) so portfolios can be an effective way to encourage completion of formative work and continuous reflection. However, portfolios can be very time consuming to create and mark, and there can be confusion over what students should include and how their work will be assessed (Race, 2015).

Drawbacks of presentations and viva voces. Viva voces are no golden bullet. They may penalise students with poor oral communication, and others may not show their abilities when faced with a person of authority (Race, 2015). Heavily structured interviews can also restrict the latitude for the respondent. Tutors should therefore use prepared questions as a starting point for unstructured discussion (Harris & Bell, 1996).

The Media Technology programme uses a range of assessment techniques but relies largely on reports to assess what the students can do. This reliance risks assessing their written communication more heavily than their knowledge, understanding or practical abilities. This is true even though the tasks themselves are largely practical. It is also time-consuming to read reports and to produce detailed feedback for large cohorts. Responses received by the programme from the *National Student Survey* (NSS) indicate that students expect quick and detailed feedback. In order to address this with financially viable staff-student ratios, a new approach is needed.

A New Approach

Based on the review of typical assessment strategies it was decided that the assessment strategy should:

- Encourage students to engage with learning experiences throughout the year
- Assess what the students can do as well as what they know
- Provide the students with some practical experience
- Provide detailed and prompt feedback
- Be efficient for tutors to mark consistently
- Allow multiple tutors to mark segments of the cohort

The ESE survey suggested Media Technology students struggle with networking and may not have established networks. Therefore, it is important to develop their communication skills. To overcome their low self-efficacy, it was felt this was best achieved using a viva voce as it provides a bidirectional communication channel. The subject of the viva voce is to be a series of laboratory activities that are run throughout the year. The sessions then become formative in nature, and the students are motivated to complete the preparation and reflection. The students are also required to keep a portfolio of their work as a prompt during the viva voce; the assessment serves as motivation to complete this good practice. The tutors will assess the conversation around a number of elements by providing the student with heavily quantised scores; the possible scores are restricted to a value out of around three rather than out of 18 possible grade-marks or even a percentage as is common.

Implementation

The design of a new assessment should start with the learning outcomes for the unit such that a grade reflects the extent to which a student has met these objectives. The process was therefore broken down into a series of stages as depicted by Figure 1.



Figure 1. Interdependencies of stages when devising practical assessments.

The Design Process

As indicated by Figure 1, the interdependencies between these stages were not nessarily simple, and the author had to maintain an holistic overview during the process. As with traditional assessments, the process started with devising a task and writing suitable criteria on which to base the assessment. These stages were not distinct as they tended to influence each other; the task chosen affected the areas being assessed, and the desire to assess certain areas inevitably had to inform the task. Once these were created, the author developed a scorecard. This comprised a number of elements for the tutor to score the student against. In order to reduce ambiguity – and thereby increase consistency – the elements are very specific and the scores heavily quantised for example, "Has the student cited external research?" with a binary response, or "Number of labs completed," with a score of zero to three. The range and depth of the areas on the scorecard needed to be appropriate for the task and criteria and also generate enough data to form a range of sensible feedback and grades. It was important that the

assessment maintained the holistic characteristic of a practical assessment and avoided becoming analytical like an exam (Biggs & Tang, 2007). The feedback phrases needed to be written in such a way that they related to the student's performance and offered constructive feedback. An algorithm was then developed to combine the quantised scores from the scorecard and produce grades for each of the criteria. Tecniques to help with these aspects are discussed below. Deveoping a scorecard that was simple to complete but provided insight was crucial, and this part of the design process was iterative. Once all of these stages were completed, the assessment was tested by trying a variety of input data and reviewing the grades and feedback. Finally a pilot was conducted where the students were directly assessed against the marking criteria as well as using the algorithm.

Generating Feedback

When assessing a student, the tutor notes the scores for each of the elements on the scorecard and enters them into a spreadsheet. Feedback can then be generated using lookups within Excel. A separate phrase was prepared for each possible score such a shown by Figure 2. The phrases were written to be fairly specific and as constructive as possible, which relied on careful deisgn of the scorecard. The cell in the feedback sheet then references the score given and the lookup table. Phrases and words are concatenated to form larger, more natural paragraphs.

	А	В	С	D	
1	Element	Score	Notes	Feedback	
2		0	None	There is no physical evidence to suggest you have completed the activities.	
3	Number of Labs Completed	1	Few	It was a shame you had only documented a few of the lab activities. Make sure you attempt all tasks.	
4		2	Most	You had documented most of the lab activities; ensure you catch up with all activities in the future.	
5		3	All	Well done for including all of the activites.	

Figure 2. Example feedback lookup table.

Grading Submissions

Microsoft Excel features a range of formulae that can be helpful in developing the grading algorithm. The weightings for each element were aligned to the assessment criteria with specual attention given to boundary cases and which combinations of scores resulted in a pass.

At its simplest, each element that feeds into a criteria was graded using a sum of VLOOKUP tables. The sum of the highest scores was 100 with appropriate weightings between the elements. A grade could therefore be calculated. For exmaple, students were required to summarise a laboratory activity and draw conclusions from their experience. The tutor then asked a series of easy, medium and hard questions from a prepared bank.

In some instances, grades were also be multiplied by an element within a VLOOKUP table rather than a simple summation. This was useful where an element reflected the quality of several other elements within the criteria such as whether the student's portfolio was presented as a single organised entity.

Conditional IF statements were also useful to cap grades to avoid awarding grades above the appropriate criteria. For example, the marking criteria states that students must correctly format references for a B grade, so a conditional statement ensures that they cannot exceed a C even if they have extensive and professionally written research.

Impact Assessment

The impact of the assessment strategy was assessed in two ways.

Methodology

A sample of 10 viva voces was graded by the same marker using the automated scorecard and using a traditional rubric. The grades and feedback were reviewed by an independent academic to evaluate their merit and whether the students would be likely to generate a similar action plan for self-development based on the two sets of feedback. The distribution of the grades from each of three markers was compared for the population of 20 students per marker. Analysis included standard deviation, mean average, interquartile range; the focus was the consistency between markers and adherence to the university's expectations of a 'normal' unit. See Table 1 and Figure 3.

Results

Table 1

Grade Distributions for the Three Markers

	Average Grade	Standard Deviation
Marker A:	68 %	14.03
Marker B:	60 %	14.04
Marker C:	59 %	15.5







Figure 3. Grade distributions by marker.

Discussion

The feedback and grades were analysed after the entire population had completed the assessment.

Comparison of feedback. There were clear differences between the manual and automatic feedback comments. Firstly, the automatic system was able to provide more feedback than the manual method, simply because of the limited time available to the marker. This is likely to be of significant value to the student, as it is able to provide feedback on a greater variety of elements of the assessment than would otherwise be possible. Secondly, whilst supportive, the manual feedback tended to be more negative, leaning toward justification of the grade awarded with limited suggestions on how it could be improved. The automatic feedback was more balanced, in that it could identify areas that required improvement and suggest strategies to do so. Again, this is partly because suggestions for improvement were written into each feedback phrase, guaranteeing their presence in the feedback.

There was also evidence of a third, subtler factor. The quality of the automated feedback was influenced by the time spent ensuring that the comments and phrases used were very clear to the reader. Manual, real-time feedback was more likely, in places, to be a little more ambiguous, probably as it was less rehearsed.

However, the manual feedback was, in almost every case, more personal. It tended to identify an aspect of feedback that was unique to the individual student's work that, in some way, separated it from that of the rest of the cohort. It is possible that this unique information is actually of limited pedagogic value to the student – there is not enough evidence of this in this study to be conclusive. However, the emotional reactions of students to obviously individualised feedback may be different to those for feedback which is automatically criterion-generated.

Grade distribution. The grade distributions are best compared using Table 1 and the box plots of Figure 3. As can be seen, the distributions are extremely close. The average grades from the three markers are within 9% with healthy and similar standard deviations. The averages show slight variance, but it is not unusual to find differences up to a grade (~12%) during moderation so the variance falls within what would normally be expected. The standard deviations and interquartile ranges suggest that all three markers awarded a reasonably wide range of grades and with a similar spread. The symmetry of the upper and lower quartiles and close proximity of the mean and median within each plot suggest the grades from each marker are evenly spread around the mean with little skew. It is worth noting that no outliers were identified during this analysis. The university considers a 'normal' assessment at level 5 to have an average mark between 48 and 68 and a standard deviation of above 5. This assessment falls well within those bounds.

Conclusions

Results from the pilot study indicate that the assessment strategy provides consistent grades with extremely similar distributions from the three markers. The feedback is comparable to that manually produced and is generally more thorough and constructive. The automatic feedback would, however, benefit from a couple of personalised

comments. The tutors involved found the assessment easy to administer with anecdotal comments such as "all assessment should be marked like this." One concern is that the format could disadvantage those with poor oral communication skills so a mixed diet of assessment within a programme is still imperative.

At present the tutors have no easy way to return the feedback to the students. Macros can be used within Excel to print the feedback to PDF titled by student ID so it should be possible to automate publishing these to the students via a backend script on the virtual learning environment.

The author intends to investigate the effectiveness of the assessment from the student perspective in due course.

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THE USE OF DIGITAL ASSESSMENT GUIDES TO IMPROVE STUDENT GRADES AND SATISFACTION WITH THE ASSESSMENT PROCESS

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Abstract

This study assesses the use of digital assessment guides (DAG) to improve student attainment and satisfaction with the assessment process. The value of DAG comes in the 'just in time' nature of the resources, giving students the key information not only at their point of need, but also at their point of *understanding*. The study saw DAG introduced to 230 students across three modules on an undergraduate computing degree in a UK university. The results demonstrated an improvement in student grades, and students were highly satisfied with the DAG, noting the positive affect they had on their learning and module outcomes.

Introduction

This study emerged from the lecturers taking part in the study becoming increasingly overburdened with the number of emails received from students for clarification on assessment elements. Before digital assessment guides were conceived of, the lecturers in question had tried a number of avenues for reducing the numbers of assessment queries. These included:

- Asking students to submit questions at the start of the assessment and then publishing a question and answer sheet that could be referred to when the students were working on the assessment.
- Publishing answers to emailed questions to the whole cohort on the virtual learning environment (VLE).
- Discussing the traditional paper based assessment guide in class in an attempt to clarify any misunderstandings face to face.

Despite these interventions, the emails continued to flow, often asking questions already answered in class or on the published answers to questions. The number of emails increased steadily towards the assessment due date and were especially high in the week before submission.

It was clear that students were emailing their questions at point of need; they asked questions about individual sections as they were working through the assessment (as expected) and many suggested that the discussions in class when the assessments were introduced were very useful but quickly forgotten. This last point highlighted the idea that these 'useful' explanations of what is expected were really required by the students at their own point of need. Students should be fully informed about each of their assessments, the expectations and how it fits into their overall learning experience. Increasing their understanding of these factors through clear communication is "not only an ethical practice but also good pedagogy" (Suskie, 2009, p. 42).

This is how the idea of introducing digital assessment guides was conceived of. The DAG would record the lecturer talking through the requirements for each section of the assessment, incorporating the usual clarifications that were requested by students. The DAG were created using iSpring, which allows the creator to clearly structure the presentation so students could easily and quickly move to the section of the assessment they were working on at any given time. Any package that allows the recording of audio over animated slides would be suitable. The DAG were provided in addition to the traditional written assessment booklet/guide. The idea was to give the students access to the tutor description of the assessment sections at their point of need. It is important to note that whilst we called the intervention *Digital Assessment Guides*, the intervention is not related to the field of digital assessment, as the guides produced were simply a support mechanism and as such do not include any elements of digital assessment.

Research Aim

The aim of this study was to analyse the effectiveness of using a DAG to improve student satisfaction with the assessment process and their overall grade. The research questions were:

- 1. Can the use of digital assessment guides improve student grades?
- 2. Can the use of the digital assessment guides improve student satisfaction with the assessment process?

Literature Review

The authors initially set out to situate the DAG in current similar just in time approaches in higher education. However, the literature search highlighted that just in time or point of need approaches, whilst common in industries of all types, are not common in higher education (HE) for assessment purposes. As a result, the focus turned to the guiding principles behind the creation of the DAGs. Colleagues of the lecturers using the DAGs suggested that they may simply be 'spoon-feeding' students and that giving a structured description of expectations would reduce creativity. However, it was felt that the DAG was more of a scaffold to the assessment process. It was easy to see why colleagues may have this belief as the DAG could be viewed through the lens of different learning theories. Stewart (2012) noted practical applications of learning theories. His *principles of pedagogies* specify different approaches within each theory, and each specified approach has clear alignments with the use of the DAG.

For example, for behaviourist perspectives Stewart notes having "an emphasis on the teacher specifying the structure, content and delivery of learning activities" and "Individualised programmes that allow students to work at their own pace" (Stewart, 2012, p. 5). He suggests constructivist perspectives posit "the role of the teacher as a guide, providing 'scaffolding' to learning to ensure the student has the requisite knowledge, skills and support to negotiate a new piece of learning, and prompting through questioning or modelling" (Stewart, 2012, p. 11). Cognitivist perspectives Stewart notes use a variety of mixed media in teaching to accommodate sensory preferences and "present concepts in varied ways, for example in constituent parts and holistically, to cater for different cognitive styles" (Stewart, 2012, p. 10). Finally, social and situated learning perspectives Stewart notes allow identification of what students can already do and supporting learning in the zone of proximal development (ZPD) (Stewart, 2012, p. 14).
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Whilst it is clear to see how each of these learning theories can be related to the DAG approach, it is more difficult to justify one approach having facets of all of these disparate theories. The theory that most suits the DAG approach is that of social and situated learning perspectives, especially related to the ZPD. The *zone of proximal development (ZPD)* is a concept introduced by Vygotsky (1978) and is the difference between what a learner can do without help and what they can do with it. The main focus with the ZPD is that with more capable peer or teacher assistance, students are able to operate at a higher level than they could on their own, and this enables them to learn to operate independently at this level (Wass & Golding, 2014). Wass and Golding (2014) introduce *scaffolding* as the element of assistance (Figure 1). This clearly fits with the DAG approach, as the tutor in this case is not 'assisting' in person, but using a tool (the DAG) to scaffold the students' learning at the point of need.



Figure 1. Teaching – students are scaffolded to complete a task (triangle) that is within their ZPD. After teaching – students can do this task independently (Wass & Golding, 2014, p. 676).

The scaffold in question here effectively reduces the students' cognitive load. Cognitive load theory suggests that "effective instructional material facilitates learning by directing cognitive resources toward activities that are relevant to learning rather than toward preliminaries to learning" (Chandler & Sweller, 2009, p. 293). The DAG in particular helps to reduce extraneous cognitive load, which is the type of cognitive load that is said to be under the control of instructional designers.

Research Design and Methodology

This mixed methods case study analysed whether a DAG can be used to improve student grades and satisfaction with the assessment process. A concurrent mixed methods design was used (Creswell, 2014). In this study quantitative and qualitative data from a student survey sent to all students taking the three modules that are part of the study was used to assess students' perceptions of the use of DAG, and whether they felt the intervention had any impact on their satisfaction with the assessment process and their grades. Qualitative data from a focus group also explored students' perceptions of the use of the DAG.

Methods

The digital assessment guides were introduced in three traditional face-to-face modules, one first year module and two third year modules. The DAGs were introduced for the second assessment for all modules, meaning students had completed the first assessment without a DAG. The DAG did not replace the traditional paper/written assessment guide, but was presented as a supplementary guide. The students were shown the DAG as the second assessment was introduced; it was played in full in class so students could immediately see the value of using it. A link to the iSpring DAG file was placed on Blackboard so students could access the recording at any time. The iSpring file format allows access from all devices and platforms.

As shown in Figure 2 the DAG has a clear structure allowing students to select the section they want to view on the right-hand side, or just listen to the whole guide in full. They can also pause and replay each section as they wish.



Figure 2. Screen shot of one digital assessment guide (DAG).

Focus group. The focus group consisted of five students, all of whom self-selected after a call for participation in the final seminar. The focus group was recorded and transcribed verbatim. The data analysis method chosen for this study was thematic analysis, incorporating the data-driven inductive approach of Boyatzis (1998). This method related to research question two.

Survey instrument. The survey consisted of fifteen questions using a mixture of open and closed questions. The survey was distributed online in the final classes, of the approximately 230 students introduced to the DAG, 50 students chose to complete and submit the survey anonymously. The qualitative data from the open-ended questions was analysed in the same way as the qualitative data from the focus groups, using the same process of thematic coding. This method related to research question two.

Collection of student marks. Marks from students using the DAG were collected and compared to assess any change in attainment. This was in order to answer research question one.

Results

Quantitative and qualitative results are presented here, with the discussion of these in the next section.

Quantitative Results

Quantitative results inform both research questions in relation to improving student grade (RQ1) and satisfaction with the assessment process (RQ2). Results demonstrated:

- 100% of students agreed that their experience of using the DAG was positive.
- 96% of students accessed the DAG outside of the classroom.
- 96% of students felt they produced a better piece of work due to the DAG.
- One DAG was accessed 551 times by just 29 students.
- The structure of the DAG meant that 94% of students chose to dip into it at their point of need.
- Only one module used had student grades that could be compared due to changes in assessment between years. This module saw a doubling of the numbers of students achieving a grade over 70% (of a class size of 35-40). Given the small number of student within this module, no detailed statistical analysis was undertaken.

Qualitative Results

The qualitative results answer research question two in more detail: Can the use of the digital assessment guides improve student satisfaction with the assessment process? The analysis of the qualitative survey results highlighted six themes. The themes were: clarification of requirements/more detail in DAG, the value of accessing the DAG at point of need, accessible, preference for audio description, time saving and structure. The numbers of comments coded under each theme is shown in Table 1. Some example comments are also shown to clarify each theme.

Table 1

Code/Theme	No. Instances	Example Student Comments		
Clarification of requirements/ more detail in DAG	60	"Made it easier to know what the lecturer wanted" "It explained in detail how to tackle different parts"		
The value of accessing the DAG at point of need	61	"It helped with the coursework as I would be able to skip to the slide that held the information I needed"		
Accessible	18	"I liked that it was accessible whenever we needed it" "I have hearing impairment so sometimes miss important things in class, being able to listen over at home ensures I don't miss key points"		
Preference for audio description	23	"easier to understand that reading" "it's in the words of the lecturer so its easier to understand"		
Saves time	6	"Provided help again and again without having to go to the tutor over and over"		
Structure	9	"I like the way you can view the slides () and you can rewind fast forward and play as many times as you please"		

Qualitative Survey Results

Table 2

Focus Group Results

Code/Theme	No. Instances	Example Student Comments	
Clarification of requirements/ more detail in DAG	4	"I only used it towards the end of the assignment but when I did it answered a lot of the questions I had" "I found that it did explain it (the assessment) a lot more than the (written) assessment guide. It explained exactly what was wanted"	
The value of accessing the DAG at point of need	10	"I went back to the parts I needed when I needed them"	
Structure	1	"it broke the assignment down in to parts"	
Preference for audio description	2	"It gives more sense to what's going on so when you read a line it is just a statement but when someone is saying something you can interpret it and get the meaning behind it easier"	
Not having to rely on memory or notes	3	"I knew as soon as I got home what you said would be gone" "Even when I take notes sometimes I look at them and they don't make sense"	

Discussion

The questionnaire and focus group results were collected and analysed separately, with the results then merged. On merging the two sets of results, it is clear to see that they are complimentary, with overlaps in the thematic analysis of both the qualitative questionnaire answers and the focus group discussions (see Tables 1 and 2). These overlaps included the clarification of requirements/more detail in DAG, the value of accessing the DAG at their point of need, the value of the structured approach to the DAG and the preference for the audio description of requirements. The only additional element that came out of the focus groups that was not apparent in the questionnaire results was how the students valued not having to remember the tutor's initial description of requirements, as some felt their understanding, memory, and/or notes were letting them down.

One element that is particularly important to note is that the research has demonstrated the importance of using the DAG as an additional resource alongside the traditional written assessment guides/booklets. Whilst the DAGs were clearly loved and welcomed by most students, many noted that they used both the digital and written guides in conjunction with each other. This fits in with the cognitivist perspectives noted in the literature review in relation to providing choice to students. Another reflection from the focus groups was that those students not present at the initial class where the DAG was introduced did not appreciate what it was or its value. This highlights the importance of ensuring all students are aware of it and how it may enable their study.

To re-assess the initial research questions. *Can the use of digital assessment guides improve student grades?* This was demonstrated as a success as results show that there was doubling in the numbers of students achieving the highest grades (above 70%). *Can the use of the digital assessment guides improve student satisfaction with the assessment process?* This can also be argued as a success. Students were overwhelmingly in favour of the use of DAG, and the results of both the quantitative and qualitative analysis demonstrate this fact. The thematic analysis was important as it allowed the researchers to pull out the key aspects that the students felt were actually improving their satisfaction with the assessment process when using the DAGs.

Discussion Related to Learning Theories

Using Stewart's (2012) *learning perspectives* identified in the literature review, we can see how the DAG aligns with these perspectives and how the results back up the authors' initial identification of how the DAG could help. There were many student comments regarding the helpful structuring of the content and clarification of what was required, which aligns with the behaviourist perspective. The DAGs also facilitate step-by-step attainment by allowing students to use the knowledge gained in classes to add to explanations given in the DAG. This also allows students to work at their own pace as they can revisit the guide at a point suited to the pace of their work.

The role of the teacher as a guide who provides scaffolding to learning to ensure the student has the requisite knowledge, skills and support to negotiate a new piece of learning supports the constructivist view (Stewart, 2012, p. 11). One issue that was apparent from the student comments was the issue of remembering the initial explanation of the assessment given by the tutor, with comments such as "I knew as soon as I got home what you said would be gone." The DAG as a scaffold is a clear constructivist benefit for the students, and it also suggests the cognitive load reduction suggested in the literature review is a factor.

The main benefit felt by the students appears to be tied to the *requisite knowledge* element of the above statement from Stewart (2012), introduced in the literature review. If we consider the initial explanation given to students in week one regarding assessment outcomes and expectations, it is often very difficult for them to effectively understand and apply that explanation as they do not yet have the requisite knowledge to build a clear mental picture of the requirements. For example, one of the modules DAG was introduced into was a third year project management module, with terms such as PRINCE2. Product Breakdown Structures and Product Descriptions all described as requirements for the assessment. However, it is not until the students have the associated seminar that they start to understand these terms in context and in any detail. Therefore, the DAG provides the scaffolding necessary to allow students to access these detailed descriptions at a point when they have the most understanding of the necessary concepts. Indeed, the data supported the fact that students were dipping in to the DAG at multiple points, with one DAG being accessed 551 times by just 29 students on one module. The zone of proximal development (ZPD) is supported as learning occurs through the DAG when the student is assisted by the tutor with explanations of requirements or concepts that are outside the students' skill set at any given moment, therefore *scaffolding* the process (Wass & Golding, 2014).

Finally, the qualitative themes such as "not having to rely on memory or notes" and "the value of accessing the DAG at point of need" link back to Chandler and Sweller's (2009) suggestion that directing resources toward activities that are relevant to learning reduces their extraneous load. The DAG, therefore, becomes an enabler or scaffold for student learning and attainment.

Conclusions

Overall the outcomes of the DAG project were very pleasing. Emails and assessment enquiries dropped significantly for the tutors using the DAG approach. Student results improved, and students started to ask other tutors in the department to provide digital assessment guides for their modules. As suspected, the detailed explanations of what is expected in assessments were required by the students at their own point of need. The results demonstrate that they used the DAG with this 'dip in' approach, which in turn supported their understanding of requirements and ultimately led to improved grades. Students should be fully informed about each of their assessments, the expectations and how it fits into their overall learning experience; the DAGs provide this support.

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FUNCTIONS AND ROLES OF SCAFFOLDING AND META-COMMUNICATION IN DISTANCE EDUCATION FOR DISTANCE LEARNING MATERIALS

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Abstract

Up to the 21st century, the usage of Internet, Skype, Broadband, Facebook, Blogs, Wikis, Netiquette or iTunes was not as popular as nowadays. With also the recent digital development of Open Education Resources (OER) and Massive Open Online Courses (MOOCs), these emergences towards free and open resources and courses bring about potential democratization of distance education applications. This paper looks into the impact and the types of evidence that are generated across initiatives, organizations and individuals in order to make a summative analysis and give recommendations from the perspective of functional roles of scaffolding and meta-communicational within the digital learning environment.

Keywords: Digitalism movements and innovations, democratization in education, industrialization of education, OERs, MOOCs.

Introduction

The changes in education of the 21st century as a result of the digital "tsunami" are huge. In the context of education, open and distance education (ODL) has become the watermark for recent and fast growing numbers of multimedia learning materials and applying digitalized materials in online platforms and practices in a variety of institutions and enterprises. Recall that in the year 2000, Internet broadband, Facebook or iTunes were not readily available, and they are now an integral part of our daily lives. Changes in technology will continue to accelerate at a greater speed; the shift to digital needs to be adaptive in par with the educational landscape. Open Education Resources (OER), Massive Open Online Courses (MOOCs), and, more recently, initiatives such as OERU, Coursera, Udacity, EdX are technology-enabled platforms that have a tremendous potential to democratize higher education. This means that developed technologies generate opportunities for the field of open and distance education. It confirms that information and communication technologies have produced an era of digital *tsunami* and are driving the restructuring of academia by forcing educators to realign and re-design their academic work dramatically.

Especially, they are adapting their traditional course materials to the ODL system multimedia environments by using new technologies. The ODL, for instance, with the assistance of technologies has given access to any level of education to those who would otherwise have been unable to access education due to the lack of formal qualifications or the inability to combine traditional studies with work or personal family matters. Further, in the case of ODL, through the division of labor, specialization and the economies of scale created by media and advance technology, the access-quality-cost triangle ideology can actually be re-configured. As Kanwar (2012)

mentioned -- technological innovations can now be applied to widen access to content and resource materials to achieve economies of greater scale than several decades ago.

Thus, they are more active participants in the shift from broadcast to interactive learning than most of their faculty, subsequently, many of whom come from an era of entertainment, and education now may seem embarrassingly archaic. Today students prefer to discover than to be taught, to create a customized curriculum rather than accept one that is prescriptive in content, format and delivery. This approach, and variants of it at hundreds of institutions around the world, is being referred to as the *virtual campus* (it also gets labeled as distance ed, distal ed, distributive ed, digital ed, mediated ed, external ed, etc.).

In this technological age, while the training needs are growing like a snowball due to new skills needs, on the other hand we are increasingly served by free on-line educational materials coming on with an incredible speed. Two reasons dominate this change: the first and most important one is new learning trends; the second is wide spread technology use in daily life. Regarding the costs of sustainable educational online tools, instruments and trainings materials, technology developers and related stakeholders look for new ways and propose promptly new solutions to public, private institutions and to the business world. New solutions encourage learning tools and technologies to move to the cloud, to share as much as possible educational contents, products tools and services. However, at this step we are confronted with social, cultural linguistic, administrative and services related barriers. Technology based education became integrally a new industrial sector with its own lateral sub branch and financial resources, requiring meta solutions given the number of thousands of potential end users, development, management, hosting, certification, security and backup related costs (Demiray & Ozkan, 2012).

The digital technologies gave rise to many new providers of education and increased the competition in the academic globalized market; which is witnessing a growing trend of collaborations and convergence of academic practices enhanced by the new media. The growth of non-traditional ODL institutions, such as the distance education institutions, ODL universities, and free and commercial open online course companies has, especially in recent years, been on a continuous rise. The fact that these institutions have been able to develop courses produced on an industrial scale has made it possible to offer educational opportunities to a greater number at a lower or no cost.

What started with MIT's Open Course Ware (OCW) project has now been replicated to reach more countries in the world. A recent development of Massive Online Open Course (MOOC) or Massive Online Open Courses (xMOOCs) is known virtually by its open access of quality courses to anyone. In fact, it provides a way of connecting instructors and learners across a common topic or field of discourse and may prove to be one of the new digital technology innovations in our present time. Webley (2012) indicates that MOOC may be a silly-sounding acronym, but this new breed of open and free online classes has been heralded as revolutionary, and it is considered as the single most important event that will democratize any level of education and end the era of overpriced both traditional and open and distance education cost.

Here, distance education via information communication technologies (ICT), is the appropriate mean of reaching communities far away; also, creating relations with them

despite long distances and limitations of traditional methods of education is remarkable. It is then possible to be in contact with masses and share information, values and world views.

But many universities are not yet ready for this change – and governments have been slow to take the lead. While there are instances of innovation, the landscape is fragmented, various barriers prevent widespread uptake, and fully fledged institutional or national strategies for adopting new modes of learning and teaching are few and far between (Vassiliou, 2014, p. 4). So this is why, we need to study on steadily new reports on "Improving the quality of teaching and learning in higher education institutions," which are adopted themselves for the modernization of higher education to set out recommendations on enhancing higher education through new technologies.

Internationalization is often confused with the term globalization. Altbach and Knight (2007) define *globalization* as the economic, political, and societal forces pushing 21st century higher education toward greater international involvement. Global capital has, for the first time, heavily invested in knowledge industries worldwide, including higher education and advanced training.

The Industrialisation of Distance Education

Transforming existing organizations for an uncertain, competitive environment and for such innovative practices as eLearning requires a systemic approach that encompasses many organizational dimensions. It requires a vision of what higher education will look like in the future and a clear plan and methodology to transform the institution to achieve this vision. Moreover, the transition depends not only on the efficiency of the transformation process itself, but also on the commitment and entrepreneurial capacities of senior and middle managers and staff. This may be particularly difficult for the traditional single-mode university, more accustomed with face-to-face contexts and client groups within readily identifiable local catchments (Ulukan, 2005).

In an attempt to counterbalance this trend, NGOs have developed to emphasize humanitarian issues, developmental aid and sustainable development. According to eReadiness Rankings 2009, broadband and mobile connectivity levels continued to increase for almost all countries, notwithstanding the downturn. Some major findings from 2009's up to now eReadiness analysis (Economist Intelligence Unit, 2009) are:

- Emerging markets continue to rack up the biggest advances in connectivity, or the extent to which people are connected to communication networks.
- Government ICT strategy in emerging markets is bearing fruit.
- ICT development may benefit from the recession.
- Policy concerns exist on the near and longer horizons.

eLearning with mobile learning is the long term method for learning's future, not a niche part of educational development. It will become part of a mainstream of what educators will do for teaching and learners will do for learning. In Turkey, all classes in formal education are offered as face-to-face, and distance learning is almost nonexistent in the practice. Face-to-face learning, despite many positive aspects, is among the main reasons of the limited capacity. This may be overcome through conducting certain classes in formal education through e-learning (Demirci, Yamamoto & Demiray, 2011).

The consequences of these changes may also have bearing on the role of traditional institutions themselves. A fundamental question that will have to be considered, as put forward is whether the *digital age* opens new doors for open and distance learning/ education in due course. If so, what are the functional roles of scaffolding and meta-communication concepts in this digital learning environments

Era of Digital in Distance Education

During the last decade a perfect storm of capacity, distribution and need has created the conditions for exponential increase of free, accessible and open educational resources. This storm of free accessible and open educational resources is known as Open Educational Resources (OERs), and is started as a grassroots movement to make education available to everyone.

It all started when Massachusetts Institute of Technology (MIT) made its historic announcement to make its courses open and fully accessible, known as MIT OpenCourseWare Project in 2002. Over the next few years many other institutions followed MIT's lead (Matkin, 2013). The OER movement has then become an institutional movement in higher education communities. Other prestigious educational institutions, such as Harvard, Yale, Stanford, Carnegie Mellon, and U.C. Berkeley had made some of their educational content freely available online as well. According to the Global Industry Analysts the global market for eLearning will grow to reach \$52.6 billion by 2010. GIA stated that in 2007 only in USA the eLearning market was \$17 billions in 2007, and 30 billions 2020.

One of the most significant reasons is related to the cost of training. The literature is filled with reports about how much money companies saved by implementing elearning. Increasing employee retention, rapid development, deployment and updating of courses, providing more effective training, availability of courses anywhere at any time are some of the other motives for corporations to invest in e-learning. Although there are quite impressive developments, eLearning in Turkey is still in its infancy stages (Aydin & Tasci, 2005).

Distance learning has become a major force by which individuals all over the world are acquiring the necessary training, skills, and education required to enter the job market. On the other hand, one of the major developments in the field of education in Africa 20th Century, apart from the taking over by Africans of the running of their education systems from departing colonialists, has been the relative growth of DE. To remain competitive, educational institutions are pressured to embrace DE.

Distance learning has changed dramatically since the 1990s as it has become a dominant part of the landscape of the higher education global industry of the 21st century. Today we have mega-distance learning corporations, colleges, and universities operating on all continents and offering training, continuing education, and academic degree programs in various fields. Open and distance learning/education opportunities respond effectively to the demands of individuals in the fast-paced globally competitive world of the 21st century. Consequently, programs are instituted without adequate consideration of stakeholder participations. To effectively accommodate new technologies, leaders must evaluate and address possible challenges. Faculty support has been identified as influencing DE effectiveness.

Functional Roles of Scaffolding and Meta-Communication for Knowledge Building in Digital Learning Environment

Meta-Communication

There are auditory means, such as speech, song, and tone of voice, and there are nonverbal means, such as body language, sign language, paralanguage, touch, eye contact, as well as writing. Communication is thus a process by which meaning is assigned and conveyed in an attempt to create a shared understanding.

Over time, technology has progressed and has created new forms and ideas about communication (http://www.k12.wa.us/CurriculumInstruct/Communications/default.aspx). These technological advances revolutionized the processes of communication. *Meta-communication* is the process between message designers when they are talking about the learning process, as distinguishable *substantive* learning out of their articulation. The hope is to increase the focus on the substantive knowledge, and understanding will be developed, by providing a separate channel for the support communication, and to do it in an easy, focused, and context aware manner (McLean, 1999).

Reported examples of meta-communication largely refer to particular utterances of the primary communication, often intertwined with the primary content of communication. Tanskanen, (2007) poses a number of examples where particular asynchronous textual utterances can even refer to themselves retrospectively, in the middle of the message, or prospectively. Yetim (2006), building upon Päivärinta (2001) and Ulrich (2001). discusses meta-communication as a means for discursive-ethical reflection on and elaboration of genres of (primary) communication. A genre of communication is a recurring communicative action within a community, which has a more or less shared purpose and form (Yates & Orlikowski, 1992). Tanskanen (2007) poses a number of examples where particular asynchronous textual utterances can even refer to themselves retrospectively, in the middle of the message, or prospectively. Meta-communication can refer also to the communication context in general, beyond particular primary utterances or genres. Hoppenbrouwers and Weigand (2000) give an example where norms for using e-mail in general as a medium were discussed. The idea of relational meta-communication (Wilmot, 1980) seems also to refer to the communication context and stakeholder relationships beyond particular utterances or genres.

Roles of Meta-Communication

Education in the 21st century is based on the improvement of global and information focused skills. These skills are searching in the Internet, reaching information, collaborative learning, effective communication, critical thinking and creativity. The Internet has the feature of being widely used in education, and it is inevitable that this feature is becoming more important day by day. As distance learning evolves, so too does the value and excellence within online education. Within the online environment, more and more instructors are incorporating meta-communication models into their courses to create collaborative and supportive learning opportunities. Three meta-communications' means highlight influence high-quality teaching and effective student learning in a distance learning environment such as interactivity, social context, and communication technologies. According to research completed by Sloan-C: A Consortium of Institutions and Organizations Committed to Quality Online Education, more than one in four higher education students reported taking at least one class online (Perkins, 1991). The meta-communication model of interactivity, social context, and

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appropriate communication technologies requires students' participation in reflective thought and applied analysis, which in turn must be communicated to peers and the instructor through dynamic participation. Students are therefore imposed to higher level thinking due to potential opportunities presented by other learners as well as the instructor to challenge their understanding through a meta-communication method. Interactivity is an important component to build into a distance learning course. Instructors create learning environments that encourage students to work in small and/or large groups through discussion and debate with the goal of sharing new knowledge and at the same time challenging existing knowledge schema or previous understanding. Instructors design opportunities for learners to think critically about topics and content by challenging peers and their own previous knowledge.

The social context of the meta-communication model is important as well. Interactivity is increased when learners are engaged in small and large group activities, which encourage them to be social. Within this social environment, learners again have the opportunity to test their understanding and to compare it with others' through the process of social negotiation. This allows learners to determine if they are accurate in their knowledge acquisition. The role of the instructor is that of a facilitator who guides the learner through direct and indirect questions (Perkins, 1991; Vygotsky 1978; Piaget, 1973; Bruner, 1966). The instructor ensures that all learners are challenged appropriately, the learning activities are structured to achieve relevant learning goals as well as are meaningful and applicable, and learners utilize appropriate communication technologies. This critical reflection and thought benefit the learner by providing cognitive dissonance, which allows learners to question their understanding and ultimately create a shared and coherent knowledge structure developed through collaborative interactions within the learning community (Sorensen et al., 2006).

The instructor takes on the important role of helping to provide learners with a sense of social presence within the course. Technology tools provide applications for announcements, discussion forums, and e-mail communication between the instructor and learner and between learners. However, it is still possible to perform an effective learning program via distance education. Anadolu University distance learning teaching staff proposes some methods and their outcomes for distance education. To achieve that, there are certain points which should be noted comprehensively as well. The first point to pay attention to is that while preparing a learning program an inter-instrumental structure should be used as a base. Each tool has different capacity regarding mind operation. While preparing learning and study materials, this should be taken into account and concept construction, different characteristics of different tools in language and visualization should be employed coordinately.

To that end, first of all the deficiencies of tools should be clarified. The gaps which are likely to emerge in the act of learning should be filled by making use of other tools. These deficiencies can be given as below:

- For the interaction through listening, lack of visual image.
- For the interaction through reading, the stability or mechanical immobility of visual image.
- For the interaction through seeing-listening, shift of attention to visual images or lack of abstraction.

• For interactivity, motivational lacks caused by spatial distance and metacommunicational deficiencies.

This reflective thinking requires learners to ask thoughtful and effective questions that are built upon their higher levels of domain knowledge and meta-cognitive skills developed through the course and collaborative design. When instructors develop the course, it is important to build in a peer-questioning scaffolding framework that will help facilitate the necessary meta-cognition and learning that will allow for the knowledge transfer in an online discussion, for example. This framework helps to create the meta-cognitive knowledge which is necessary for learners to begin generating meaningful interactions and develop higher order knowledge construction to work on complex problems surrounding the intended learning objectives. The ideal knowledge sharing culture is one where communication and coordination between groups is emphasized, where experts (e.g., teachers) share rather than guard their knowledge, and where knowledge construction is actively and visibly encouraged at all levels of the classroom through recognizing and rewarding knowledge sharing. Knowledge reconstruction can help to trigger a cognitive dissonance, or a gap, between a learner's beliefs and their experiences.

This conflict is necessary for constructing of knowledge at a higher level. The instructor builds on this conflict by asking probing questions and encouraging students to ask good questions of their classmates. This ultimately allows all students to build on their knowledge creation and overall understanding (Choi et al., 2005; Piaget, 1985). Eventually, through peer questioning and the multiple responses and perspectives to this same discussion by their peers, the learner recognizes differences within understanding and with guidance from the instructor recognizes the strength and weaknesses in their own response. This articulation of gaps of understanding through verbal discourse is the beginning of a learner's knowledge construction (Choi et al., 2005).

To sum up, the final point to consider is the role of individuality in the success of learning. Each receiver has a different mental structure which eventually determines the final success of education. For instance, for a person with high visual intelligence television or internet would be an effective channel while for a receiver with high verbal intelligence the opposite holds true. In order to prevent this, students enrolling in distance learning program should receive pre-tests and be offered different programs according to their intelligence types. The application of knowledge to the meta-communication process is strongly related to knowledge strategy encompasses knowledge management principles with operational goals and objectives; so that knowledge resources can be leveraged, in this case sense of direction obtained.

The overall use of a knowledge strategy can be seen as a dynamics chain of events to create, identify, collect, review, validate, share, adapt, and use knowledge. When these events are managed well, individual knowledge becomes community knowledge, which then turns to be class knowledge. As a result of this collaboration and validation, the course now has dynamics knowledge. Effectual knowledge educators are needed for leadership in 21st century schools.

As is emphasized in the text, meta-communication is a very important, powerful and functional concept during knowledge building for preparation of the course materials in education field. In this meaning, concept is becoming a more carefully designing course

for language learners. Good language learners are the ones who can understand and use meta communicative elements in communicating in English.

Some other supportive techniques and strategies may be developed as well. For instance, teachers may bring some videos to the class on which Indians, Africans and other people from different nationalities use as a study material, student will better understand the internationality and multiplicity of the ways in which these study materials are performed through different agents across cultures. Study producers may bring extra reading texts apart from the ones in their course book materials to familiarize students with other cultures and make them competent inter-culturally (Tomak, 2011). By doing so, students will also improve their intercultural competence by acquiring information about other cultures as well. In this experimental curriculum native speakers may be invited to enroll in the class or assist in the lessons. Teachers may create blogs or carry out online activities to support and develop students' critical thinking capacities. English textbooks and materials should be written that reflect other cultures and identities; so, the students can engage in relating the textbooks into their own cultural terms and expressing their identity rather than miming the others by gaining awareness of meta-communicative factors, actors and aspects of their targets (Istifci & Demiray, 2011). In conclusion, curriculum developers and material designers may discuss their educational course materials for re-building (at any level such as printed, audio, visual, electronic and verbal) from the point of function of metacommunication and knowledge building theory perspectives according to recent developments and learners' needs.

Scaffolding

Significant use of scaffolding to organize and support the student investigation or inquiry, to keep students from straying too far off the path while seeking "the truth" about whatever issue, problem or question was driving the project. The least successful efforts assumed too much about student skills, organizational abilities and commitment. Young ones were sent off on expeditions with little in the way of structure or guidance. We should have learned by now that exploration by students' progresses most effectively when those students have been well equipped, well prepared and well guided along the path. Here, the focus is upon the scaffolding techniques that have proven especially worthwhile in an electronic context. (McKenzio, 1999).

Educational (or *instructional*) *scaffolding* is a teaching method that enables a student to solve a problem, carry out a task, or achieve a goal through a gradual shedding of outside assistance. It was first coined by researchers David Wood (Nottingham), Jerome S. Bruner (Oxford), and Gail Ross (Harvard) in their 1976 report, "The Role of Tutoring in Problem Solving." According to its original definition, scaffolding enlists the instructor as an whose role is to facilitate the student's incremental mastery of a concept. *Fading* is the process of gradually removing the scaffolding that was put into place for the student until he or she internalizes the information and becomes a self-regulated, independent learner (Pinantoan, 2013). Larkin (2002) suggested that teachers could employ the following effective techniques in scaffolding:

• First boost your students' confidence. To improve self-efficacy, begin by introducing students to tasks they can perform with little or no assistance. Provide enough assistance to allow students to achieve success quickly. This will help lower frustration levels and ensure that students remain motivated to

advance to the next step. This will also help guard against students giving up due to repeated failures.

- Second, help students "fit in." Students may actually work harder if they feel as if they resemble their peers. Avoid boredom.
- Once a skill is learned, don't overwork it. Look for clues that the learner is mastering the task. Scaffolding should be removed gradually and then removed completely when mastery of the task is achieved.

Characteristics of Educational Scaffolding

Lange (2002) states that there are two major steps involved in instructional scaffolding:

- Development of instructional plans to lead the students from what they already know to a deep understanding of new material.
- Execution of the plans, wherein the instructor provides support to the students at every step of the learning process.

Five feature describe scaffolding very clearly: intentionality, appropriateness, structure, collaboration and internalization.

McKenzie (1999) presented eight characteristics of scaffolding:

- 1. Scaffolding provides clear directions: Web-based research units offer step-bystep directions to explain just what students must do in order to meet the expectations for the learning activity. Instructional designers try to anticipate any problems or uncertainties, writing user-friendly directions in ways that minimize confusion, place a premium on clarity and speed students toward productive learning. The operating concept here is the "Teflon lesson," a learning experience that has been well tested in advance so that anything that might go wrong is considered in advance and eliminated if possible. We don't want our students wandering about like prospectors on the desert.
- 2. Scaffolding clarifies purpose: "Why are we doing this?" Scaffolding keeps purpose and motivation in the forefront. Rather than offering up one more empty school rituals like the status report, the scaffolded lesson aspires to meaning and worth. Built around essential questions, the scaffolding helps to keep the "big picture" centrally and in focus.
 - "We are looking at this question because it is central to being human."
 - No "trivial pursuit" here.
 - Students are let in on the secret early. They are told why the problem, issue or decision is important, and they are urged to care about it. They do not lapse into simple collecting or gathering. They are not caught up in mindless activity traps.

Their work remains purposeful and planned. Each time they act, it is in service to the thought process, the discovery of meaning and the development of insight. Traditional school research placed too much emphasis upon collection, while scaffolding requires continuous sorting and sifting as part of a "puzzling" process --the combining of new information with previous understandings to construct new ones. Students are adding on, extending, refining and elaborating.

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It is almost as if they are building a bridge from their preconceptions to a deeper, wiser, more astute view of whatever truth matters for the question or issue at hand.

3. Scaffolding keeps students on task: By providing a pathway or route for the learner, the scaffold lesson is somewhat like the guard rail of a mountain highway. The learner can exercise great personal discretion within parameters but is not in danger of "off road" stranding. Each time a student or team of students is asked to move along a path, the steps are outlined extensively. No need to wander, stray or stumble. Students may "take the curves" without fear of going over the edge. This is more than a matter of clear directions that could just as easily be printed out on paper.

The Web-based lesson provides structure and guidance coincident with each step of the journey. The progression of activities is liberating yet controlling at the same time. The student moves through something like a garden, taking each Web page like flag stones. There may be more than one path wandering through the garden, but none of them leads into the jungle or a swamp or a tiger pit.

- 4. Scaffolding offers assessment to clarify expectations: From the very start, scaffolded lessons provide examples of quality work done by others. Right from the beginning, students are shown rubrics and standards that define excellence. In traditional school research, students were often kept in the dark until the product was completed. Without clearly stated criteria, it was difficult to know what constituted quality work.
 - Is it a matter of length? the number of sources cited?
 - Does originality count?
 - Does the logic and coherence of my argument matter?
 - What constitutes adequate evidence?
 - There are a dozen issues, all of which deserve attention and elaboration. As an example, consider the online rubrics for successful multimedia reports available at <u>http://www2.ncsu.edu/ncsu/cep/midlink/rub.multi.htm</u>
- 5. Scaffolding points students to worthy sources: Most educators complain that the Internet suffers from a low "signal to noise ratio" the confusing, weak and unreliable information (noise) outweighs and threatens to drown out the information worthiest of consideration. Wary of wasting time, teachers have little tolerance for "data smog" and "info glut." They want to see students putting their energy into interpretation rather than wandering. Scaffolding identifies the best sources so that students speed to signal rather than noise.

Looking for the best websites on Columbus, Drake or Magellan to decide which would have been a better leader, the scaffolded lesson created by fifth grade teacher, Gretchen Offutt, identified 4-5 sites for each captain.

- Explorer Homeport
- http://wwwsil.bham.wednet.edu/Curriculum/homeport.htm
- Knowing that the Web is filled with sites not worth visiting because of quality, bias or reading level concerns, the teacher visits 100+ sites per captain before winnowing the list down to 4 or 5 per captain

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• Does this mean the student has no options? It depends upon the teacher. And it depends upon the school.

In some cases, students must stick to the sources pre-selected by the teacher. In other cases, the student may use these sites as a starting point, extending further out into Cyberspace in search of something unusual. The scaffolding serves as an introduction, not as a corral.

- 6. Scaffolding reduces uncertainty, surprise and disappointment: The operating design concept for scaffolded lessons is the "Teflon lesson" no stick, no burn and no trouble. Lesson designers are expected to test each and every step in the lesson to see what might possibly go wrong. The idea is to eliminate distracting frustrations to the extent this is possible. The goal is to maximize learning and efficiency. Once the lesson is ready for trial with students, the lesson is refined at least one more time based on the new insights gained by watching students actually try the activities.
- 7. Scaffolding delivers efficiency:
 - If done well, a scaffolded lesson should nearly scream with efficiency. Teachers and students should shake their heads in disbelief.
 - "It felt like we completed ten hours of work in just two!"
 - "How did we get so much done?"
 - This perception is achieved, in part, by virtue of comparison with the old kind of school research that was mostly about wandering and scooping. Boredom fed by irrelevance slowed the passage of time. It took forever to get the job done.
 - Scaffolded lessons still require hard work, but the work is so well centered on the inquiry that it seems like a potter and wheel. Little waste or wobbling. Scaffolding "distills" the work effort. Focus. Clarity. Time on task. The student is channeled. No mud flats, shoals or other navigational hazards.
- 8. Scaffolding creates momentum: In contrast to traditional research experiences, throughout which much of the energy was dispersed and dissipated during the wandering phases, the channeling achieved through scaffolding concentrates and directs energy in ways that actually build into momentum. It is almost like an avalanche of thoughts, accumulating insight and understanding. "Students in resonance," the work gathers speed. The drive toward meaning is accelerated. The essential question and its subsidiary questions create suction, drive, urgency and motivation. The search for understanding inspires and provokes. One loses sleep. One awakens in the middle of the night, wondering, pondering, considering.

Roles of Scaffolding

Instructional scaffolding or simply known as *scaffolding* in education is defined as a guidance or support from teachers, instructors or other knowledgeable persons that facilitate students to achieve their goals in learning.

Scaffolding means providing students with instructions during the early stage of learning before shifting the responsibility to them in the process of developing their own understanding and skills. Since scaffolding is a kind of support or assistance to

learners with "just-in-time," "just enough," "just-for-me," "just-in-case" approaches, it has usually been used in face-to-face education until recently. In distance learning environments *learner support* strategies are used (Kesim & Ozan, 2010).

Scaffolding is the concept that is commonly related to the socio-cultural perspective on teaching and learning. This concept was introduced by Wood, Bruner, and Ross (1976), in which scaffolding was defined as the tutorial assistance an adult provided for a child for learning that is beyond the child's capabilities. The aim of scaffolding is to build the child's or learner's knowledge in order that he or she is able to complete a task, and complete the same task without assistance in the future. The mother or the teacher takes responsibilities for controlling the elements which are initially beyond the child's or learner's capacity (Wood, Bruner & Ross, 1976). Similarly, Vygotsky (1978) suggests that learners should be guided or scaffolded by a more capable peer to carry out a task. Ge and Land (2003) pinpoint that these notions of scaffolding emphasize the role of dialogue and social interaction (Patcharee-Scheb-Buenner, 2013).

Currently, the form of instructions that emerge between teachers and students is mediated through technology, and the learning communities exist in the online settings. Thus, it is important to acknowledge the suitable form of support required for the students, especially in an online learning environment (Jumaat & <u>Tasir</u>, 2014). A teacher who encourages freedom of learning and is open to it can accelerate the transition of learning from being teacher-centric to student centric. According to Roger Hiemstra, a scholar of adult learning and self-directed learning, a teacher plays six roles in self-directed learning – she is content resource, resource locator, interest stimulator, positive attitude generator, creativity and critical thinking stimulator, and evaluation stimulator.

How the six roles are played eventually depends on the social setup, the attitude of the student and the willingness and enthusiasm of the teacher to engage in promoting self-learning among her students (see: Self-directed Learning in the Digital Age, 23 Apr 2016 <u>http://content.mobicip.com/content/self-directed-learning-digital-age</u>).

For example, in one of the vocabulary activities, after completing the exercise following the textbook, the teacher extended it by asking the students to think more about vocabulary in their real life situations. This is described as contingent scaffolding because the teacher felt that his students might need to acquire more vocabulary knowledge. However, there were evidences to show teachers not providing contextual support when dealing with a reading comprehension. Having analyzed the scaffolding patterns in both types of activities, it is apparent that the features identified in the teachers' and students' interaction reflect Wood, Bruner and Ross's (1976) frameworks. The interaction can be viewed based on the two frameworks since they conceptually align with each other. For example, reducing or simplifying a task makes a problem easier for learners. An easier problem or task may come down to the actual competence level of the learners. This scaffolding also concerns human interpersonal relationships since it describes one of the scaffolding features in "frustration control." Teachers who can identify that frustration may be able to help the students at the critical moment effectively. The last feature of Wood, Bruner and Ross (1976) functions exhibits ultimate help which reveals a maximum or the highest degree of help.

In addition, Wood, Bruner and Ross (1976) also mention this scaffolding in terms of temporary support and gradual withdrawal when learners become independent (Patcharee-Scheb-Buenner, 2013).

Digital self-directed learners are typically those who are tech-savvy and aware of their responsibility in making learning meaningful. They are motivated and persistent, independent, self-disciplined and goal-oriented. However, the effectiveness of selfdirected learning depends as much on the availability of knowledge as on the attitude of the learner. The advent of the Internet has breathed new life into self-directed learning, given the extensive knowledge and support available online, which transcends geographic barriers. Online learning opportunities, pedagogical shifts and easy accessibility of Internet through multiple devices offer attractive opportunities for learners to assume greater responsibility and initiative in their own learning. While the Internet is a veritable source of all information, if not knowledge, lack of control mechanism and checkpoints makes it tricky to navigate the stormy ocean of information. Thus, individual skills in deciding upon the validity and reliability of information become essential, but this needs practice and time to develop. Scaffolding involves assisting students initially, with slow withdrawal as their competence increases. While teachers are the primary scaffolds in traditional face-to-face learning environments, online learning environments, by their limits on face-to-face interaction, open up new definitions, opportunities and protocols for scaffolding.

Teacher's scaffolding approaches in the digital era include providing resources and activities that present questions for critical thinking and providing procedural guidance on how to access information online. These approaches are best mediated through the use of web-based or app-based tools that can creatively combine a range of learning technologies. Thus, teachers can use modern telecommunication technologies including instant messaging and blogging to provide consistent guidance and obtain timely feedback on student engagement and motivation and to promote interaction and collaborative learning. For example, according to a study on students' opinions on selfdirected learning, social media should be extensively used to achieve a better knowledge management system whether it is a purpose directed to peer to peer, student and supervisor, or student and mentor. It is vital that educators to be trained to recognize and nurture self-directed learning by using technology and being capable of creating learning environments that support it. A teacher who encourages freedom of learning and is open to it can accelerate the transition of learning from being teachercentric to student centric. How the six roles are played eventually depends on the social setup, the attitude of the student and the willingness and enthusiasm of the teacher to engage in promoting self-learning among her students. (Source: Self-directed Learning in the Digital Age, 23 Apr 2015 http://content.mobicip.com/content/self-directedlearning-digital-age)

Conclusion

In a summary and conclusion, the use of scaffolding in learning contexts incorporates technologically based novel problems. Even in computer extended contexts, the conceptualizations of scaffolding are needed in order to gain greater insights into teaching and learning processes. This paper brings discussions and provides additional support that cognitive, affective and technical scaffolding and meta-communication have benefits for learning, and in this case students are able to support each other's learning via sharing strategies and articulating the reasons behind them to each other in

the digital age and digital learning environment. In the other words, this paper looks into the impact and the types of evidence that are being generated across initiatives, organizations and individuals in order to make a summative analysis and recommendations from the point of functional roles of scaffolding and meta-communication perspectives within the digital learning environment aspect. Finally, this paper hopes to provide some insight into the dynamics of the digital age that is a revolution as a *tsunami* that affects present applied open and distance education systems.

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PERCEPTIONS OF STUDENTS CONDUCTING PEER REVIEW USING CLOUD-BASED SOFTWARE

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Abstract

This study looks at the change in perception regarding the effect of peer feedback on writing skills using cloud-based software. Pre- and post-surveys were given. The students peer reviewed drafts of five sections of scientific reports using Google Docs. While students reported that they did not perceive their writing ability improved by being peer reviewers, they observed that having others peer review their work did improve their writing. They also indicated that they preferred to use cloud-based tools to paper, and their comfort level sharing their personal information increased. Future studies should involve digital literacy pedagogies to improve collaborative writing skills.

Introduction

Research shows that having 21st-century skills is necessary in the global shift to a knowledged-based society (Premier's Technology Council, 2010). Learning how to work collaboratively, asynchronously and synchronously with technology is a part of this skill base (Yim, Warschauer, Zheng, & Lawrence, 2014). Although little research has been done on best practices for incorporating new "Technological Literacy" and "Collaboration and Teamwork" as well as "Critical Thinking" (Premier's Technology Council, 2010, p.1), pedagogies need to be developed to keep up with the changing societal needs. Past research on literacies using web design indicate that cooperative learning is *de facto* the major approach for teaching theories (Liu, Lin, Chin, & Yuan, 2001). Warschauer and Ware (2008) report that the writing process is even more collaborative, iterative and social than in past times.

Today's digital literacies include using cloud-based software to facilitate writing exchanges among students (Warschauer, 2011). A variety of choices exist for these collaborative writers as they brainstorm, edit, comment, and publish their work using programs such as iCloud, OneDrive, or Google Docs, to name a few. With the use of online tools, students must be taught how to give effective feedback if they are to provide feedback to peers so that both parties can benefit from the collaborative approach of peer review (Zheng, Warschauer, & Farkas, 2013). However, some risk may exist that students could copy each other as a byproduct of peer reviewing an assignment that is done with other teams and not the team with which they are working. Many researchers such as Kao (2013) have had positive results for such kinds of peer assessments, though they have not looked at incorporating feedback using online environments (Liu et al., 2001).

Furthermore, students must be made aware of privacy issues as they embrace new realms of online educational tools (Freedom of Information and Protection of Privacy Act, 2016). A full understanding of privacy also affects their choices of how to securely present themselves as writers in online environments. Before students become writers and peer reviewers and post their writing online, explicit instructions on how to give feedback can level the playing field for both non-native speaking and native-speaking

partners (Yim et al., 2014; Ellis, 2008; Myhill & Jones 2007). All writers, native speaking, and non-native speaking can benefit from getting peer review. Learning how to give effective feedback can reduce the possibility of unintended plagiarism (Noel & Robert, 2004) that can happen when one student asks another student to peer review their writing, and another offers their advice. Going one step further where giving and receiving writing feedback that is anonymous online, can take peer review activities to a new level. However, using the technology to share coursework can bring up issues of plagiarism. (Freedom of Information and Protection of Privacy Act, 2016). As a result, students who are sharing their writing must agree not to copy another's work and fully understand where the nuances of plagiarism are. Therefore, reminding students of exactly what academic integrity entails (BCIT, n. d.) must be a part of the peer review process.

This paper will give background with documented research cases and references to support the hypothesis that participating in cloud-based collaborative writing activities will increase the positive attitudes towards peer review. Research questions addressed are as follows: Does participating in cloud-based, collaborative writing activities increase the percentage of students who agree that being peer reviewed, doing peer review, and using cloud-based software will improve their writing skills? Does participating in such activities change students' concerns about plagiarism? As best practices in these areas are developed and shared, cloud-based technologies can be used to their full potential (Yim et al., 2014).

Methods

Study Context

The research sites were two classrooms (called "labs") of students in the Fish, Wildlife, and Recreation Diploma Program in Renewable Resources of the Construction and Environment Department at BCIT. The 33 (16+17) adult students take four terms of Technical Communication courses during their two-year diploma program. For this study the students were in their second term of studies in winter 2016 focusing on the writing of a scientific report. At the end of the second term, students were required to write a reflection on how their communication skills had evolved since the first term. Within this group of students, one was "international," two were non-native speakers, and 30 were local students. Each student had their own laptop. Many of the students held a bachelor's degree. Due to the BCIT's requirement for Ethics Approval by the Research Ethics Board (REB) at BCIT, specific forms were required to be collected and distributed to conduct this action research project. These documents listed below correspond to the REB requirements at BCIT.

Consent for Action Research Participation

First, the students were given a Consent for Action Research Participation document outlining what would happen over the 12 weeks and outlining their participation in peer review activities, specifically writing an Introduction, Methods and Study Site, Results, Discussion, and Abstract sections of a scientific report. In the consent form, the students were informed of the following risks and benefits of participating including several opportunities for opting out. Topics covered included:

- feeling that the teacher is in a position of power and students not having an option to opt out
- privacy concerns: recommendation was to create a new account with no identifying info

- feeling they would be judged on their writing samples: the risk being circumvented through anonymity
- becoming better writers by seeing the writing of others and having their work edited
- benefitting because they had seen at least two other versions of the same assignment
- being a part of a stronger, more supportive cohort because of receiving balanced feedback

Students were able to opt out but still do peer review activities during the class. They were also given an explanation of privacy with another handout called the Student User Agreement form.

Student User Agreement Form (available at tinyurl.com/StudentUserAgreement)

The Student User Agreement form was a standardized form that Cynthia Kent, BCIT Associate Director of Privacy, Records Management, and Copyright had given to the principal researcher. The intent was that the students be informed on the privacy issues of using cloud-based software, in particular, Google Docs, which they were asked to use for their anonymous peer review activities; the form also covered consequences of not conducting oneself according to the Institute policies.

Providing Feedback with HOC and LOC Forms (available at http://uwp.duke.edu/wstudio)

For students to avoid plagiarism they need to be explicitly taught strategies for giving and asking for feedback from peers (Warschauer, 2011). To ensure students were avoiding plagiarism during peer reviews, the students were reminded of an excerpt from BCIT's Academic Integrity Policy that "Cheating, in part, is preparing work, in whole or in part, with the expectation that this work will be submitted by another student for appraisal" (BCIT, n. d., p.3). Since the ever-increasing demands of the workforce will require many kinds of collaborative writing tasks, the Higher Order Concerns (HOCs) and Lower Order Concerns (LOCs) from Duke U. (n. d.) were explicitly taught. With this leveled-playing field all the writers in the cohort could offer peer review in the same fashion without rewriting a colleague's draft. The methodologies were also advocated by Guasch, Espasa, Alvarez, and Kirschner (2013) who have coined two terms corresponding to the Duke U. styles of feedback: epistemic and suggestive (HOCs) and corrective (LOCs). Tseng and Tsai (2007, p. 1169) have also added the category of reinforcing (giving positive comments which address positive feelings and recognition and building community). A summary of the same handout from Duke University (n. d.) they had been given in autumn 2015 was re-distributed.

Perceptions Survey (available at http://tinvurl.com/PerceptionsonPeerReviewSurvey)

To get a baseline understanding of the students' perceptions before the action research

began, students were given the survey so they could record their perceptions of the peer review concept, the use of cloud-based software, and plagiarism. Seven statements covered topics such as whether they thought they and their peers were capable of doing peer review, whether cloud-based applications had value, and whether they felt concerned that their shared work could be plagiarized if the documents were shared amongst their peers. The same survey was given out at the end of the study to see which, if any, of their perceptions had changed. All students present were given the opportunity to add clarifications or subjective comments and the Likert-based scale used was as follows: Strongly Agree, Agree, Disagree, No Opinion, and It Depends. For "It Depends," anecdotal comments were possible. For analysis during the results stage, data in the Strongly Agree and Agree categories were combined and compared to responses in the Disagree category.

Statistical Analysis. The distribution of students agreeing and disagreeing with the statements before and after peer review activities was compared used a χ^2 test of independence whenever possible. When the requirements of the χ^2 test were not met, a permutation χ^2 test was used to obtain approximate P – values.

Request for Ethical Review/TCPS Tutorial (Certification) (Government of Canada, n. d.)

Part of the Ethical Review process at BCIT also includes completing a course in Research Ethics offered by the Government of Canada. Documentation of the completion of the course was attached to the ethics application. The researcher received a Certificate of Ethics (Government of Canada, n. d.).

Anonymous Peer Review

Once all of the forms had been distributed and signed, the peer review process took place for each section of the scientific report that the students wrote. As was set up by Liu et al. (2001), the cloud-based peer review system acted as an information distribution channel, a medium for peer interaction and knowledge construction, and as a storage centre which was emptied out at the end of the data collection. The following procedure describes the anonymous peer review process:

- 1. Participating students copied and pasted their writing sample to an anonymous Google Doc corresponding to a customized "TinyURL" link. The students would log out of their account once they had set up a "Share" link for another student to access the writing sample. The students selected "edit" or "comment" not "view" when setting up their shareable Google Docs, so the peer reviewer could type in their anonymous feedback.
- 2. Each student was given a checklist of the assignment rubric and space for a "compliment sandwich," i.e., what was done well, what trends for improvement were noticed, and a final strength or encouragement phrase. This feedback system would provide data for the *reinforcing* observations, the HOCs, and LOCs they had trained on. On the checklist students recorded their TinyURL so other students could access their writing sample online. No identifying information was included.
- 3. Their papers with the TinyURL link were placed on a table at the front of the class.
- 4. The TinyURL was also provided to the instructor so she could analyze the peer feedback.
- 5. Students randomly took one of the papers and navigated on their laptops to the TinyURL to the anonymous Google Doc site that corresponded to the one marked on the paper.
- 6. Students gave anonymous reinforcing and HOC and LOC feedback on the original document and then exited the document *without logging into their Google Account*. Students also used the assignment rubric to give content and style-related feedback. When necessary, students spent the first hour typing a draft for sharing, then proceeded with the anonymous peer review process as described above.

7. The process from Step 3 above was repeated so each student would get feedback from two peers for each draft.

Note: If a student had not brought a writing sample to share, they were either paired with another student, or they would work on the section of the scientific report they had not yet completed.

Results

Thirty-three students responded to the pre-survey statements on February 3, 2016. Twenty-nine students responded to the post-survey statements on April 13, and 14, 2016; the number was lower in April due to four students being absent from class when the post-survey was distributed.

Of the seven responses to the pre- and post-survey statements, most students agreed with statements 1-4, with no significant change. The results for all statements are given in Table 1.

	Before		After			
Statement	Strongly Agree or Agree	Disagree	Strongly Agree or Agree	Disagree	Increase In Percentage Who Agree	Р
1	30	0	25	0	0.00%	not applicable
2	27	1	25	2	-3.84%	0.61*
3	30	0	25	1	-3.85%	0.46*
4	30	0	27	0	0.00%	not applicable
5a	8	12	17	3	45.00%	< 0.01
6	27	0	25	6	-19.35%	0.03*
7	7	18	8	12	12.00%	0.60

Table 1. Comparison of Results for Survey Part I and Part II

* Approximate *P* values obtained with a permutation χ^2 test.

Relevant anecdotal results taken from the "It Depends" column are included in italics below.

1. "A peer in my class is capable of doing a peer review of my writing." "*The ability and commitment of each peer reviewer varied.*" and "*Peer review can help depending on the person who is editing it.*"

2. "Having an anonymous sample helps me to stay neutral with the feedback I give my peers." "*It doesn't matter to me [sic] if the sample is anonymous.*"

3. "Peer review will help me improve my learning (as opposed to editing myself)." *I* will continue to practice my writing skills, [sic] and have my work peer read until my grammar usage is improved." and "*I believe peer-review [sic] edits given throughout my COMM course is [sic] an effective mechanism to get constructive feedback. I look forward to making use of this exercise whenever the opportunity presents itself."* and "*Remembering to edit grammar mistakes and get feedback from others will allow me to maintain strong writing skills."*

4. "Knowing how to do a peer review helps me focus my comments effectively." No comments were given regarding how peer review training helped reduce plagiarism or build community.

Students were not consistently in agreement with statements 5-7.

5a. "Using a cloud-based software program like iCloud/OneDrive, Google Docs or Dropbox is better than seeing a sample on paper." The percentage of students in agreement increased from 40% to 85% (P < 0.01). Although the shift was to prefer cloud-based software, two anecdotal comments were in support of paper-based samples: *"If they need immediate feedback, paper is better."* and *"I prefer to do edits and mark up on a hard copy."* On the other hand, anecdotes which supported the significant difference in perception were as follows: *"It's much easier to share and be anonymous digitally."* and *"It's easier to read with a cloud-based sample."* The results of questions 5b incorporating **"comfort level of sharing personal information in cloud-based programs"** increased from 53% to 78% and 66% to 86% respectively for iCloud and OneDrive specifically; Google Docs and Dropbox did not change.

As for privacy perceptions of cloud-based software use, anecdotal comments are as follows: "*It depends on what kind of personal information is being shared.*" Two students stipulated the difference between where their comfort level lay: "*...depends on what personal info is shared.*" and "*...depends on the type and sensitivity of info; I'm okay with name and email in general location, maybe not deeper than that.*"

6. "My writing improves by reviewing peer samples." In the first survey, students expected that *being* a peer reviewer would improve their writing. However, after the peer review activity, only 80% of students agreed with this statement. This difference is significant (P = 0.03). No anecdotal comments were made about this statement.

7. "I am concerned about others copying my work when I share my writing with peers." The percentage of students in agreement changed from 28% to 40% for statement 7. Students became more concerned that plagiarism would be a factor in the sharing of their work, but the change was not statistically significant (P = 0.60). One anecdotal comment "It's hard to visualize your own way to do things after reading someone else's work." indicates that a student had an awareness of plagiarism, but whether the student plagiarized or not is unknown. Results show that by the post-survey, students concern that plagiarism could occur increased.

Peer Review Results Out of the potential 33 students for each part of the project were 15 samples of Introduction, 9 Methods, 7 Results, 7 Discussions, and 4 Abstracts. During the writing of the Discussion and Abstract sessions, due to Wi-Fi problems, 4 students were not able to upload their drafts of the Discussion and the Abstract to Google Docs, so laptops were exchanged instead of putting information in the cloud; anonymity was compromised.

Of all the feedback that was uploaded to Google Docs, only the following data was collected Introduction: 12; Methods: 7; Results: 5; Discussion: 3; Abstract: 5. Of those 32 writing samples, the kinds of feedback were analyzed: Reinforcing comments: 59, Epistemic and Suggestive (HOC) comments: 41; Corrective comments (LOC): 101. A possible explanation for the number of writing samples that differed from the number of students may be made clearer from comments students wrote: *"falling short in the last"*

week when the amount of due dates piled up" and "having problems in the past with procrastinating large assignments."

Unexpected Results – Teamwork While it was surprising to this researcher that sensitivity for the team was mentioned in the year-end reflection comments, according to the research, collaboration has been noted as a *de facto* result of using online tools (Warschauer & Ware, 2008). Creating supportive environments for students to feel safe to share their writing samples despite their perception of whether they are good writers or not can be helped with the anonymous process set up in this study. When a peer praised the ability of a less-than-confident student, they were markedly encouraged by the praise.

In other cases, students commented that at times, when the sample numbers were small, the anonymity of the data was not possible. Moreover, when the students were asked if they felt penalized for having to do peer review instead of preparing for a huge exam taking place the following hour, like some of their peers who had not brought a writing sample, they stated, "*No! We want to see the others' work and get feedback!*"

Other comments regarding teamwork included things like "It also created a teamwork environment, where everyone was giving each other feedback and tips on how to improve in areas where one had more difficulties. We seemed to be sharing ideas more and reflecting on how we did things properly or how things went wrong." and "For most of [sic] peer review sessions I worked with a partner. Thus, I've learned that when working with someone else, one has to be mindful of another's perspective, or another opinion which is imperative for improving teamwork skills. However, I believe the best way to improve one's current skill set is to reflect on those skills, and identify what one needs to do to achieve improvement."

Discussion

As digital natives, students today think and process information fundamentally differently from their digital immigrant predecessors (Prensky, 2001). The students in this study were open to using cloud-based tools to share their writing samples and transferred this preferred use of medium to their other "out of school literacies" (Warschauer & Ware, 2008, p. 234). Students became more comfortable using cloud-based software for their classroom activities and hopefully transferred their use into activities in other courses where the sharing of files and ideas was required.

Research on technology and literacy is intertwined with culture and society (Warschauer & Ware 2008). Millennials use and rely on technology to socialize and build their identities with little regard for the implications of sharing personal information. In the consent form, students had "personal information" defined for them so they would understand what kind of information they would be sharing in the cloud by having a Google account. The students were curious to know what constituted "personal information," but once the term was explained, students agreed to use Google Docs and most students agreed to participate in the study. Later when the data from the survey was tabulated, results showed that students had become more comfortable with two cloud-based programs like iCloud and OneDrive compared with their pre-survey answers. In their anecdotal comments they said what they were sharing "depended" on whether they were concerned about privacy issues. For written reports, if the content was not personal in nature, students could agree more that using cloud-based software

programs was effective for peer review of their technical writing. By using cloud-based software to move them beyond their experiences with social media, students can eventually apply new literacy practices in the classroom and eventually the workplace.

For the sixth statement perhaps students were not able to appreciate other subtle changes that were happening regarding their writing skills when they did not see a connection between being a peer reviewer and its effect on their writing improvement. One student, who was able to clarify what "could have happened": "*Speaking of peer editing, [sic] I think providing comments and suggestions on peers' writing, editing also improved my writing by association. I made sure to double-check my writing by following the checklist.*" Furthermore, the overall sense was that feedback was positive and supportive, but the percentage of students in agreement shifted. Shifting from 100% to 80% although significant, 80% is still high. Perhaps other factors affected the change of agreement; one student commented that by "doing peer review anonymously, the feedback cannot be discussed." Without anonymity, the HOCs and LOCs would possibly provide the opportunity to learn from the original writer. Two students indicated that sometimes some of the feedback was "wrong," which benefits neither student without further discussion.

Having students think through why they perceived that *giving* feedback did not improve their writing skills could be an activity for future classroom follow-up. Moreover, also adding a second peer review of the changes made from the first peer review feedback would be another way to follow up on the effectiveness and perception of the peer review process.

By the end of 12 weeks, some of the students' concerns about plagiarism increased. For the seventh statement in the survey one student candidly commented in the "It Depends" column that "If someone copies my work, I guess they thought it was good." and "Depending on who is reviewing and whether or not I think I have a unique perspective, (I would be concerned about others copying)." The change in agreement was not significant, but an awareness of the situation was more heightened. Given that this is a group of well-educated students with good work ethics and an understanding of plagiarism, their concern was appropriately increased, but not to a significant degree. The level of community, trust, and respect amongst the cohort would have played a role in their not plagiarizing each others' work as well.

While students felt the peer review process improved their learning in general, another explanation could be that they transferred their existing academic skills to the technical writing technique. This group of students, overall, were just strong writers. One student said, "Coming into the program, I thought I was a pretty good writer. Obtaining a BA in [department] from UBC involved writing countless papers (and many sleepless nights). I honestly didn't think there was much left for me to learn, or even improve upon in terms of my writing ability. However, I was wrong."

Many other good writers in the course were able to follow the rubric provided for the assignment and could tweak some of their HOC comments and see the benefit of getting peer review. Furthermore, adding reinforcing comments to the peer review feedback process was good for building a caring community, an essential requirement for collaborative writing as pointed out by Hull (2003), but only HOCs and LOCs truly build good writing skills *as long as the edits are made to the original copies*. Following

up on checking in on how or if students incorporated the suggested changes into their writing, would be advised.

The small number of writing samples that had been brought to class during the study may be due to time management and nothing to do with the perception of whether the students felt the peer review activities had merit or not. Students also expressed the impact of teamwork as a positive result of their peer review process. The answers to these findings are beyond the scope of the study, but could be followed up for future studies.

Not all feedback contributes to improving writing, but many researchers such as Guasch et al. (2013) and Tseng and Tsai (2007) have studied how to make the most effective peer review process. The research indicates that students appreciate feedback from the instructor *as well as* their peers. In this course students are invited to liaise with the teacher to get feedback, but this term only two students did so.

Limitations This study did not have a system to follow up as to whether the students incorporated the peer review feedback into their final drafts as other researchers did in their studies (Lui, Lin, Chiu, & Yuan, 2001). The students were expected to apply the suggested changes to their final drafts if they deemed them appropriate, correct, or helpful.

The number of contributions from the potentially 33 students for each part of the project was 15/33 Introductions, 9/33 Methods, 7/33 Results, 7/33 Discussions, and 4/33 Abstracts. While students offered their appreciation for the peer review process, the number of submissions was far below the expected number of documents for peer review affecting the ability for all participants to make informed comments on the process.

A student asked for a more "*streamlined process*" to be given to the anonymous peer review system. The system was, indeed, complex, but the creation of anonymous documents and feedback, overall, was not compromised.

A further limitation was that the students who responded to the survey were all in the same class, and so do not represent a random sample. The statistical analysis was performed as if the survey results were obtained from an independent random sample. Although the sample was not random, using such a sample for future research would be recommended.

These reported results may also possibly be biased. The survey included both Strongly Agree and Agree responses, but no category for Strongly Disagree was included with the Agree category. Furthermore, responses given as "It Depends" were omitted from the mathematical analysis, which may also have affected the results.

Conclusion

Participating in cloud-based, collaborative writing activities can increase the percentage of students who agree that doing peer review and using cloud-based software improves their writing skills. Students, however, still are aware that sharing coursework materials runs the risk of being plagiarized, but in this study, with this cohort, students were not overly concerned.

New pedagogies are being researched to add to peer review and cloud-based tools (Liu et al., 2001). In this 2016 study a positive correlation between the use and application of cloud-based software tools was found. The introduction of a cloud-based software tool extended to the students' incorporation of new technologies into their self-reported "out-of-school literacies" (Warschauer & Ware, 2008, p. 234) and their awareness of "sharing personal information."

As digital natives in the 21st century (Prensky, 2001), the students are open to innovations with technologies that help them communicate as students and also as collaborative members of the workforce and the field of research. Students can be quick and ready to take on new technology like cloud-based software. Furthermore, today's students need to be successful in the changing knowledge economy (Warschauer & Ware 2008). The students in this study, in particular because of their level or education or writing experience, perceived that they were not improving as peer reviewers, but they are connecting to a much larger set of skills which will take them into their collaborative writing careers and use of technology in the workplace to "expand educational, social and economic opportunities" (Warschauer & Ware, 2008, p. 227).

Regarding the peer review system for improving learning, had 33 samples been contributed to each of the peer review feedback sessions, the results may have been different regarding their perceptions of the impact of being a peer reviewer on writing improvement. Negative perceptions of improving writing skills as a peer reviewer could have been the reason why students did not end up bringing samples to class to review; this issue deserves further research and consideration to make definitive conclusions. Further consideration also needs to be given to the fact that no record was made as to whether students applied the suggested changes from their peers' feedback or not. Moreover, peer review is not to replace teacher evaluation, but systematic knowledgebuilding for the participants (Liu et al., 2001).

Although the change in student perception that their work could be copied was not significant, ensuring that clear expectations of campus policies for academic integrity and respect for the learning environment and acceptable use of technology are still crucial. This particular group may have felt their work would not be plagiarized. However, the potential for plagiarism exists for all students who do peer review activities on graded assignments. Depending on the group of students and their ethics can affect the outcome.

The surprising result that was not anticipated in the methodology was the students' appreciation for the teamwork experience. In their final reflections, students commented on the fact of how important it was to be *"mindful of another perspective"* which supports the "caring community" that Warschauer & Ware (2008, p. 225) suggest can be fostered by instructors being innovative and creative with their digital literacy pedagogies that go beyond reading and writing in the classroom (Kao, 2013). Cooperative learning is the standardized approach for worldwide web teaching theories, and while taken for granted by the researcher, we must be reminded how important teamwork is in achieving collaborative writing success (Liu et al., 2001).

This study has demonstrated that cloud-based software is an effective tool for digital natives who indicate they prefer the tool to paper-based peer review media. Students also reported that they transferred the comfort with Google Docs to other cloud-based

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software for other "out of school literacies." While students agreed less that being a peer reviewer improves their writing, their agreement about benefits of peer writing overall was still high – the students knew that being peer reviewed improves writing and learning. To address the finding that students did not see how being a peer reviewer could benefit their writing skills, in future, students can be asked in a reflection assignment about how being a peer reviewer may help them become a better writer. Metacognition activities can be presented to have students reflect more on whether being a peer reviewer can help or not. In the post-survey students indicated that their concern about plagiarism increased, which reminds us how important having discussions on the topic of what plagiarism is and how not to plagiarize when students are doing peer review activities.

Implications

As innovators or *early adopters* of technology, educators need to keep striving to adapt and find new ways to find best practices for uses of Information Computer Technology (ICT). Success in schools can stem from understanding the importance of the knowledge economy which helps to promote and expand 21st-century literacies (Guasch et al., 2013). Students who understand the benefits of peer review for the purpose of writing improvements can spend time when an instructor brings metacognition to the classroom to get students aware of both being a peer reviewer and doing peer review. To address students' concerns about plagiarism, knowing what does and does not constitute as plagiarism must be taught. Perhaps peer review activities can be done with practice exercises instead of assignments that are worth marks. The process can be the same, but the assignments which are for higher stakes can be given feedback by the instructor instead of by peers.

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EVALUATING THE IMPACT OF SOCIO-ECONOMIC AND DEMOGRAPHIC FACTORS ON SELECTED ASPECTS OF E-LEARNING IN PUBLIC ADMINISTRATION EDUCATION

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Abstract

Nowadays blended learning is very popular in higher education. Enrolled in e-courses, students form opinions on different aspects of e-learning. In our study, we focused on assessing such aspects from the students' perspective and explored differences between subgroups, based on socio-demographic characteristics of students in public administration programmes. The empirical results show that students' attitudes to blended learning increase significantly by year of study and decrease according to the amount of other activities. In addition, the results indicate that the main challenge of the faculty management and teachers is to increase the engagement of first-year students regarding the work in e-courses.

Introduction

The growth of information and communication technology (ICT) is bringing rapid and significant changes to the development of teaching and learning techniques. E-learning is emerging as the new paradigm of modern education (Sun, Tsai, Finger, Chen, & Yeh, 2008). The rise in the usage of e-learning in the last two decades is due to the tougher competition between higher education institutions to attract students and meet their educational needs and goals (Clark & Meyer, 2011) and to support both face-to-face and remote course delivery without the constraints of time and distance (Park, 2009).

Despite the popularity of online education, attrition remains a problem faced by many institutions (Hart, 2012; Saba, 2012; Upadhyaya & Mallik, 2013). The effectiveness of e-learning systems (Hart, 2012; Hassanzadeh, Kanaani, & Elahi, 2012; Islam, Rahim, Liang, & Momtaz, 2011; Mbarek & Zaddem, 2013) and students' perceived satisfaction (Al-Adwan, Al-Adwan, & Smedley, 2013; Joo, Joung, & Son, 2014; Kassab, Al-Shafei, Salem, & Otoom, 2015; Liaw, 2007; Lim, Ayesh, & Chee, 2013; Ozkan & Koseler, 2009; Sun et al., 2008) have been important subjects of research in the last few decades. Many factors influence the effectiveness of e-learning, with some being connected with technology/technics and others with people. Upadhyaya and Mallik (2013) claim that elearning involves interaction between people and processes, meaning that it has to be treated as a socio-technical system rather than a social system only considering the people aspect (e.g., students, teachers and other stakeholders) or a technical system only considering the standards and processes aspect (e.g., course content, technology, Learning Management System (LMS), content management tools). E-learning is a complex process that depends not only on these aspects in isolation, but also the interaction among them. A successful e-learning system must at least be designed with good and adequate program content, which is presented well and can be accessed easily, and allows high user participation and involvement in the virtual learning environment (Lim et al., 2013). A web-based learning system is considered to be successful if it can replicate classroom experience and consider the students' needs (Sanchez-Franco, 2010). If students refuse to use the system, its benefits will not be fully exploited

(Tarhini, Hone, & Liu, 2013). Additionally, although the Internet may be considered a global technology, the efficiency of e-learning tools should be measured locally as users typically work in local/national contexts (Teo, 2011).

Besides understanding the students' psychological aspects of learning in blended learning, it is very important to monitor and understand how students themselves perceive different aspects of e-courses and how they feel when using teaching materials and learning in an e-course. As the latter is designed by a teacher, this kind of assessment could be understood as a student evaluation of teaching (SET). SET is important for two primary reasons. First, student evaluation provides data used for managerial decisions such as tenure, promotion, and salary increases. Second, teaching evaluations provide feedback to help teachers improve their future teaching performance (Loveland, 2007; Sheehan & DuPrey, 1999).

The rapid growth in the number of online classes poses some challenges for academic management. They include difficulties hiring teachers with online teaching interests and experience, increased costs associated with technology, training and faculty incentives, and problems associated with the comparison of traditional and online teaching in terms of workload, compensation and evaluation (Loveland, 2007). In any case, teachers should themselves be interested in the feedback from students – in order to improve the e-courses and students' engagement within them.

When students are provided with the same LMS and learn in the same e-courses, not everyone has the same perception of a specific aspect of work in the e-course and a general impression about it. It is therefore important to understand that variations between genders, location of students' homes, years of study, occupation with other activities, participation in different programmes and students' high school backgrounds exist and should not be ignored when developing e-courses. Lim et al. (2013) offered similar reasoning where the focus was on students' perceptions of LMS design and the socio-demographic factors, such as role, gender, experience and age, influencing those perceptions and by Wu and Liu (2013) in whose research there were differences in the satisfaction with blended learning between postgraduate and undergraduate students.

In our study, we analysed the students' points of view on different aspects of the ecourses in which they were enrolled. We examined the results, received from students of two undergraduate programmes at the University of Ljubljana, Faculty of Public Administration, where LMS Moodle is used for e-learning, and linked them with the socio-demographic characteristics of the surveyed students. The latter were acquired from the student databases.

The purpose of the paper is to present the analysis of the socio-demographic factors influencing students' assessment of aspects of each e-course. The paper explains which socio-demographic factors influence the students' perceptions of e-courses and discusses the variances between the different subgroups of students.

The paper is structured as follows: after the introduction, which includes defining the problem, the purpose and structure of the paper as well as a brief literature review on different aspects of blended learning and factors affecting them, the results of an empirical study are presented. At the end, conclusions are offered based on the
examined data. They are accompanied by the limitations of the presented study and the plans for our future research.

Empirical Study

In our study, we analysed how the assessment of different aspects of an e-course varies between assorted subgroups of students. For this reason, we developed a questionnaire and asked students to participate in the e-survey. In this section, we describe the methodology we used and the empirical findings.

Data and Methodology

The research was conducted among students from the University of Ljubljana, Faculty of Public Administration. We limited our survey to obligatory e-courses for undergraduate students, where blended learning is mandatory. Each student evaluated e-courses, in which they were enrolled in one semester of an academic year. Blended learning at the faculty is implemented with LMS Moodle (Umek, Aristovnik, Tomaževič, & Keržič, 2015).

Our survey was participated in by 315 students, with each student evaluating 3 to 5 different e-courses. Altogether we recorded 1,456 e-course evaluations (data instances). Due to missing values, we removed 373 instances from our initial data set and reduced the sample size to 1,083. Each instance in the final data set represents a student evaluating one e-course (see Table 1).

Table 1

Statements from the Questionnaire Survey

Abb.	Statement about e-course
EC1	The virtual classroom of the course is organized transparently.
EC2	The goals (workload demands, grading) of this e-course were clearly stated at the beginning of the semester.
EC3	This e-course offers a variety of ways of assessing my learning (quizzes, written work, forums, files,)
EC4	I receive the teacher's comment/feedback on an assignment in less than 7 days.
EC5	I prefer fewer lectures in the traditional way (face-to-face) and more learning material processed in the e-course.
EC6	More course exercises could be carried out in the e-course instead of in the classroom.
GI1	The general impression of the e-course is good.
GI2	Study material and tasks of the e-course are presented in a clear and understandable way.
GI3	Finding certain activities in the e-course is simple.
GI4	The prepared learning material and tasks are consistent with the lectures in the classroom and supplement them.
GI5	The prepared material and assignments supplement the tutorial in the classroom.
GI6	Learning materials and activities in the e-course helped me to effectively study this subject matter.
GI7	The teacher gives me feedback/a response on my submissions (assignment, forum posts).
Source	: Survey, 2016.

The questionnaire consisted of 13 statements describing the virtual classroom of the corresponding course: aspects of the e-course (EC) and the general impression (GI).

Students evaluated the e-courses in which they were enrolled. The questionnaire consisted of two parts: an evaluation of each e-course (statements EC1–EC6) and students' personal impressions about an e-course (statements GI1–GI7). Students expressed their opinions regarding the statements on a seven-point scale from "totally disagree" (value 1) to "totally agree" (value 7), with an additional possibility "I do not want to answer/no experience."

After receiving the answers from the survey, we upgraded the analysis with data on the students' socio-demographic characteristics, obtained from the students' information database maintained by the faculty, namely gender, high school final grade, region of Slovenia where the students live, year of study, and study programme, In the survey itself we also asked them whether they are occupied with any other activities besides their study. In the paper, we treat the socio-demographic variables as factors, which determine different subgroups.

The main goal of the study was to compare how the means of the variables, i.e., EC1–GI7, vary between the subgroups of students. For each variable from Table 1 and for each socio-demographic factor we tested whether the means differ significantly among the subgroups defined by the factor. We computed p-values using a t-test (for factors with two distinct values, such as gender) or an analysis of variance ANOVA (for factors with several values, such as year of study: first, second, third). Since we tested 78 hypotheses (13 statements * 6 factors), we adjusted the p-values using a Bonferroni correction.

Empirical Results

Table 2 presents the computed p-values for each pair of a socio-demographic factors and a statement from the questionnaire (EC1–GI7). For clarity, we do not show the original p-values. Moreover, we do not report the mean values for the subgroups since several factors have many possible values. The content in the cells indicates the magnitude of the p-value, classified into three categories presented with a different number of stars.

Table 2

		Statement											
Factor	EC1	EC2	EC3	EC4	EC5	EC6	GI1	GI2	GI3	GI4	GI5	GI6	GI7
Gender									**				
High school final grade													
Region						**	**						
Other activities										**	**		
Year of study	**	**	**				**	**	**	**	**	**	**
Study programme			**				*			**	**		
Legend:													
Empty co * **	ell	Bonfe 0.05 < 0.01 <	erroni < α <= < α <=	adjus = 0.1 = 0.05	ted α	> 0.1							

Significant Differences Between the Subgroups

Source: Survey, 2016.

The results in Table 2 indicate there is just one aspect of blended learning where male and female students differ significantly. It is the aspect GI3 ("simplicity of finding certain activities in the e-course"). Female students evaluated it on average with 4.55 (on a seven-point scale), which is significantly more than 4.04 for their male university colleagues. On the other hand, we found no significant differences for the factor "high school final grade." This means that the students' background does not play an important role when assessing aspects of blended learning.

Our study revealed two aspects, namely EC6 and GI1 (e-courses instead of a face-toface tutorial and the general impression), with significant differences between the regions of Slovenia in which students live. The results showed that students who live further away from the university campus evaluated aspects EC6 and GI1 significantly higher compared to students from the Ljubljana region (where the faculty is located). This fact is not a surprise since it can be expected that those who live far away prefer to complete their duties in the e-course rather than having to commute to the faculty.

The assessment of aspects GI3 and GI4 (reflecting the general impression and the supplemental aspect of face-to-face lectures) differs significantly between the groups of students with different time spent for other activities besides their study (students' work, sports training, etc.). The results of our study showed that the assessed general impression on average decreases with time spent on other activities – from 6.39 for students with no activities to 5.67 for students with more than 6 hours of other activities per day. We found a similar decrease for supplementing face-to-face lectures (a drop from 6.28 to 5.71).

The factor "year of study" is associated with the most significant findings. We found significant differences in 10 out of 13 aspects analysed. In all cases, students in the first year of study gave on average the lowest scores to each aspect while in the third year the scores were the highest. The aspect with the lowest p-value (4.9E-12) is EC1 (structure of the e-course) where the mean value rose from 5.52 (first year) to 6.02 (second year) to 6.17 (third year). This means that from the students' perspective, the e-courses in higher years of study are better organized and structured.

The last row in Table 2 indicates four aspects EC3 and GI1 (for adjusted $\alpha < 0.1$), GI4 and GI5 (variety of different contents, the general impression, supplement to lectures and tutorials) with significant differences between students of the professional study programme (PS) and the university programme (UN). In all cases, the mean value was higher for the PS students.

Looking at the results from a different perspective, we found two aspects with no significant differences in the assessment by various subgroups of students. These aspects are EC4 (teachers' feedback) and EC5 (preference for e-courses over face-to-face lectures). If we ignored the most influential factor (year of study), we could treat aspects EC1, EC2, GI2, GI6 and GI7 as non-significant.

Conclusion

The main goal of the paper was to present an analysis of the factors influencing the assessment of various aspects of blended learning. We examined the results, received from students of University of Ljubljana, Faculty of Public Administration, where LMS

Moodle is used for e-learning. The paper's primary contribution was to identify differences in the assessment of the aspects between various subgroups of students.

Our study revealed that students' attitudes to blended learning significantly increases with the year of study and decreases by the amount of other activities (e.g., students' work, sports - training). We found some other specific significant differences. Female students find certain activities in an e-course easier than their male university colleagues. Students who live further away from the university centre evaluated ecourses higher than students from the Ljubljana region. Their opinions also differ regarding the impression of an e-course. We found that a variety of different contents, the general impression, being supplemental to lectures and tutorials are higher for students of the professional study programme than those in the university programme. Although our study revealed several interesting subgroups, we failed to find any significant differences between subgroups of students based on their high school final grade.

In this study, we focused on students' perspectives of blended learning, while the teachers' perspectives were ignored (Boling, Hough, Krinsky, Saleem, & Stevens, 2012; Friesen, 2012). To overcome this limitation, we plan to develop a new survey. We will ask teachers about their views on blended learning (time spent on preparation of an e-course, time spent in the e-course, communication with students, preferences -- e-courses vs. face-to-face courses -- etc.). After receiving such data, we will compare the results of the presented study with the results of our new survey. Moreover, one of our recent studies showed a significant increase in students' performance in the period in which Moodle LMS was introduced. Therefore, in our future research we plan to acquire the data on student's performance and identify how selected aspects relate to a better performance.

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LOGISTICS AND TIME EFFICIENCY OF MICRO EXAMS

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Abstract

Micro Exams (*ME*) are short exams composed of a few multiple choice questions, provided during lectures, exercises, and laboratories in order to actively involve the students, collect feedback from students, and to monitor how they follow the educator, as suggested by the Active Learning concept. Students can answer *ME* questions by writing on plain paper, selecting the answer on a multiple choice form, using clickers, or other techniques. Proper *ME* logistics must have minimal non-educational time overhead both for the educator and for the students. The time efficiency of a number of *ME* techniques was evaluated in several courses.

Introduction

Micro Exams (ME) are short exams (tests) provided during lectures, exercises, and laboratories to actively involve the students in the learning process. Another purpose of using ME is to obtain immediate feedback from the students during the lesson, thereby giving the educator a real-time picture of how they are following the studied material. In a modern class ME questions are best presented to the students using a projector during the lesson, at any point the educator decides appropriate. There are different methods for the students to answer such ME questions: writing on plain paper, selecting the answer on a specially prepared Multiple Choice Form (MCF), using clickers, or other Instant Feedback Techniques (IFT).

Many educators (Haynie, 1994; Funk & Dickson, 2011; Kosolapov & Sabag, 2012) studied the pedagogical efficiency of short exams (referred to as *ME* in this contribution). According to the authors' opinion, providing *ME* during the lessons is a useful pedagogical technique, providing real-time feedback to the students about their proficiency in the studied material. Additionally, the educator can evaluate the clarity of the lectures, the teaching methods, and other learning materials; and, if the *ME* results are poor, the educator can provide relevant clarifications to the materials presented to the students.

In recent years a number of combinations of *ME* techniques and grading techniques were tested in the Electronics Department of the ORT Braude Academic College of Engineering.

The goal of the current contribution is to compare the time efficiency of the different ME techniques from the educator's point of view, as well as from the students' point of view. It is reasonable that good ME logistics would have minimal non-pedagogical time overhead for both educator and students. While the time spent by the educator to prepare questions for ME and analyze their results can be considered an important and valuable educational task, the preparation time for the ME (e.g., time required to distribute and collect the ME forms and pre-process results of the ME) can be considered as burden, and must be minimized. From the students' point of view, the time required to answer ME questions and time spent to understand errors in ME can be

considered as valuable learning time, whereas the time required to provide the answers within the framework of selected *ME* techniques and transfer those answers to the educator must be considered as logistic overhead. The technical aspects of some *ME* techniques and systems used in this contribution were described earlier (Kosolapov, Sabag, & Gershikov, 2014; Gershikov & Kosolapov, 2015).

The terms and symbols are defined in Table 1. A number of combinations $\{ME \ Technique - Grading Technique\}$ used in real classes are specified in Table 2. Table 3 contains a list of courses used in the current research.

In this paper, logistics aspects of some *ME* techniques used by the authors in the recent years are described. More specifically, parameters and time efficiency of a number of *ME* techniques were evaluated in a number of courses.

The results are summarized in the following tables and exemplary formulae. Using those tables and formulae the educator can evaluate the time efficiency of the specific *ME* technique in specific cases. Notation T[x] specifies the time needed to execute a step having index X as specified in Table 4.

ME Techniques and Logistic Steps

Practical execution of ME consists of a number of steps. Some steps can be considered as having educational value for the educator and/or for the students (marked as EV), whereas other steps must be considered as logistic overhead (marked as LO) to be minimized.

In this contribution we consider the case where the educator provides all logistic steps without assistance from administrative staff (for example, the educator manually prints *MCF* using a PC and a printer). The result times are calculated as the time required for one semester.

Preparation of Micro Exam Questions and Answers

For all techniques used, the educator prepares ME questions and answers and presents the questions to the students during the lesson using a computer projector. In most cases, one slide contains one MEQ. For the educator, the time required to prepare MEQ(T[1] in Table 4) and the time required to generate the answer to MEQ T[2] must be considered as EV. However, the time required to prepare question slides T[3] and the time required to prepare answer slides T[4] must be considered as LO for the educator.

Table 1

Symbol	Meaning	Values Range
ME	Micro Exam: short exam containing a small number of questions	-
MEQ	Micro Exam Question	-
MEQs	Micro Exam Questions	-
MEA	Answer to Micro Exam Question	-
MEAs	Answers to Micro Exam Questions	-

Definitions, Parameters, and Values Range (When Applicable)

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Symbol	Meaning	Values Range
MCF	Multiple Choice Form	-
MCL	Multiple Choice Label	-
Nme	Number of Micro Exams during the semester	5-10
Nq	Number of questions in the typical Micro Exams	3-5
Ns	Number of students in the class/laboratory	10-60
EV	Logistic step with Educational Value	Yes-No
LO	Logistics step considered as Logistic Overhead	Yes-No
Арр	Students answer <i>ME</i> questions by manually writing pairs {number of question – selected answer} on plain paper	-
Amcf	Students answer <i>ME</i> questions by blackening relevant rectangles on specially prepared multiple choice forms (<i>MCF</i>) printed on a plain paper	-
Amcl	Students answer <i>ME</i> questions by raising properly oriented specially prepared labels (<i>MCL</i>) printed on thick paper and folded in a particular way	-
MAN	Manual procedure	-
HAS	Human Assisted Software	-
AS	Automated Software	-
SID	Short student ID. May be student' number in the class list or any other number unique in the class	0-100
<i>T[X]</i>	Time in minutes required for the execution of a specific step. X: index in the Table 4. This time is multiplied by the relevant factor specified in the Table 4	0-60

Table 1. Definitions, Parameters, and Values Range (Cont.)

ME Techniques – Short Description

In our research a number of ME techniques were used.

App. Students answer *ME* questions by manually writing pairs {*number of question* – *selected answer*} on plain paper, and at the end of the lesson they put their papers on the lecturer's table. This option, obviously, requires no equipment: considering the diversity of the students' handwriting styles, the educator is forced to validate the answers and calculate the grades manually. However, a simple software utility can be instrumental in speeding up the entry of answers into a PC, tablet, or smartphone; still, the time required to enter the answers is, obviously, *LO*. If the software utility can create an Excel file, automatic calculation of grades and generation of a report is trivial and requires nearly zero time.

Amcf. Traditionally, MCQs are answered using specially designed forms, which are later scanned. While scanning by using high resolution opto-mechanical scanners is extremely reliable, it is not suited for the *ME* concept: opto-mechanical scanners are slow, and, additionally, opto-mechanical scanners are not available in class. Camerabased acquisition of *MCF* and algorithms of reliable processing used in this research were described earlier (Kosolapov, 2015). In the simplest logistics, the required amount of MCFs can be printed using an ordinary PC printer. Using a stand (see Figure 1) can significantly speed up *MCF* collection and acquisition.

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Figure 1. Camera-based FFS. (Kosolapov et al., 2014).

1 - MCF printed on plain paper positioned on the simple stand (2).

3 – Smartphone high-resolution camera ready to grab the image of the MCF.

4 – Image of the *MCF* on the screen of the smartphone is geometrically distorted.

To compensate for geometrical distortions, a plurality of markers (5) is added to the MCF. MCF has a region (6) dedicated to specifying the last five digits of the students' SID. 7 – Region dedicated to entering up to 30 MEAs.

Amcl. Students answer *MEQ* by raising in a proper orientation specially prepared labels (printed on a thick paper and folded in a special way) (see Figure 2). The logistic advantage of this approach is that all the answers are grabbed practically in zero time -- in the time required to take a photo of the class. If automatic grading software is sufficiently reliable, the time efficiency of this approach is very high for students and for the educator.

Unfortunately, this approach becomes problematic in bigger classes because nearer students hide the labels of the students in the back rows. Practically speaking, this approach is better suited for small classes up to 20 students.



Figure 2. Camera-based IFS (Kosolapov et al., 2014).

Table 2

ME Technique	Grading Technique					
	Manual	Human Assisted Software	Automatic Software			
Арр	App/MAN	App/HAS	-			
Amcf	-	Amcf /HAS	Amcf/AS			
Amcl	-	Amcl /HAS	Amcl /AS			

Combinations of ME Technique – Grading Technique Used in Real Classes

ME were part of the syllabus for the following courses: Introduction to Analog Electronics, Analog Electronics, Theory of Analog Electronics, and Image Processing (see Table 3).

Results

Table 4 summarizes the data required to evaluate the total time required to provide selected numbers of *ME* during semester. Additionally, the data in this table can be used to evaluate the time efficiency of the selected *ME* technique by comparing the time required for *educational tasks* with *logistic overhead*.

ET stands for the educator time (in minutes) required to execute a specific step. EF stands for the factor to be used to calculate the educator time required to execute the selected task during one semester. For example: T[1] is the time required to generate one ME question. This time is estimated as 15 minutes, taking into account that the questions are modified to some extent every semester. To calculate the time needed to prepare all ME questions and answers for one semester (*Taq*), one can use this obvious formula:

Taq = (T[1] + T[2] + T[3] + T[4]) * (Nm*Nq)

Table 3

Name of the Course	Year/Semester	ME Techniques
Introduction to Electronics	2011/spr	App/MAN, App/HAS, Amcf
(lectures)		/HAS, Amcl /AS
Analog Electronics (lectures)	2011/spr	App/MAN, App/HAS, Amcf
	2011/au	/HAS, Amcl /AS
Theory of Analog Electronics	2011/au	App/MAN, App/HAS, Amcf
		/HAS, Amcl /HAS Amcf /AS,
	2015/au	Amcl /AS
Image Processing	2012/au	App/MAN, App/HAS, Amcf
(lectures & exercises)		/HAS, Amcl /AS Amcf /AS,
	2015/au	Amcl /AS
Image Processing (laboratories)	2012/au	App/MAN, App/HAS, Amcf
		/HAS, Amcl /AS
	2015/au	Amcf/AS, Amcl/AS

In-Class Use of the Different ME Techniques in the Electronics Department of ORT Braude Academic College of Engineering

For example, if the number of Micro Exams in one semester (Nme) is ten, and number of questions in one ME(Nq) is five, one can evaluate Taq as 2000 minutes (about 33 hours of work per semester).

EM defines the educator mode as educational value (*EV*) or logistic overhead (*LO*). One can evaluate the time required to execute all the tasks relevant to the preparation of the questions and answers during one semester and having EV as:

 $Taq_ev = (T[1]+T[2]) * (Nm*Nq) \sim 1500 \text{ minutes} \sim 25 \text{ hours}$

Hence, the time efficiency of the preparation of ME questions and answers as a percentage is:

100* (Taq_ev / Tac) ~ 75%.

ST, SF, and SM are acronyms for student time (required to execute a specific ME step), student factor, and student mode correspondently.

In a typical case students are not expected to prepare questions and answers for their exams; hence the student items 1-4 in Table 4 are marked as 0 or as "-" (not relevant). However, answering MEQ is EV for the student and LO for the educator.

Figure 3 presents the total educator time required to implement a specific *ME* technique as a function of an Ns. All the technologies have significant "preparation" overhead, so that if the educator can use questions and answers prepared by a third party, the total educator time required to provide *ME* drops significantly.

Data presented in Figure 3 clearly shows some *ME* techniques better suited for a small class with fewer students (Ns), whereas other *ME* techniques are better suited for a big class (having larger number of students *Ns*). For example, the case when students answer *MEQ* by manually writing pairs {*number of question – selected answer*} on a plain paper and when the educator manually keys in those pairs using a mouse (or touch screen) controlled software utility (simple and even primitive *App/HAS* technique – see line 4 on Figure 3) can be considered as the most time-effective techniques for small classes of roughly ten students. It is clear, however, that reliability of manual numbers' input is reasonable only for a really small number of students in the class, so that using properly implemented *AS* would be preferable in the real class even if time-efficiency of *HAS* is slightly better than time-efficiency of *AS*.

As for bigger classes (more than 15 students), techniques that use *AS* have better timeefficiency than those using *HAS* (compare lines 3 and 4 to lines 4, 5 and 6 in Figure 3).

One can see that time-efficiency of the *Amcl/As* (line 3 on the Figure 3) is less dependent on *Ns* and, thus, is the most time-effective technique of the techniques tested in this contribution. Unfortunately, as it was mentioned before, *Amcl/As* in the current implementation is limited to small classes of 20 students.

Table 5 summarizes times and time efficiency for a number of cases. Time efficiency is calculated as a ratio of the sum of the time for the steps having *EV*, divided by the total time required to execute all the steps for the selected *ME* technique.

Discussion

While we consider using Micro Exams as an important pedagogical tool, the total time required for *ME* arrangements and time efficiency of the Micro Exams logistics must be taken into account when selecting the number of exams, the number of questions in

each exam, and the time allocated to answer those questions. A low number of exams and questions might not provide reliable feedback. A high number of exams and questions may require too much time. Our selection of between five and ten Micro Exams, each having about five questions, seems reasonable for our students and our courses; however, other educators may select other parameters.

Conclusions

The data in Table 4 enables estimating the time required to prepare and provide a series of ME. Our conclusion is that even in the current implementation, Amcf is mature enough and time-efficient enough to be used with HAS in a small class. Amcl with a mechanical stand is close to be considered as mature enough and time effective enough for big classes up to 60 students. Surprisingly, the "primitive App/HAS technique" when students answer MEQ by manually writing pairs {number of question – selected answer} on a plain paper and when the educator manually keys in those pairs using a mouse (or touch) controlled software utility, is reliable enough and time effective enough to be recommended for small classes of roughly ten students.

Table 4

Parameters of Logistic Steps

#	Logistic step	ЕТ	EF	EM	ST	SF	SM
1	Generate MEQ	15	Nme*Nq	EV	0	0	-
2	Generate MEA	15	Nme*Nq	EV	0	0	-
3	Prepare slide with MEQ	5	Nme*Nq	LO	0	0	-
4	Prepare slide with MEA	5	Nme*Nq	LO	0	0	-
5	Install, register, and test software utilities	60	1	LO	0	0	-
6	Print MCF	0.3	Nme*Ns	LO	0	0	-
7	Prepare MCL	1	Ns	LO	0	0	-
8	Deploy MSF stand	2	Nme	LO	0	0	-
9	Distribute plain paper or MCF	0.15	Nme*Ns	LO	0.1	Nme*	LO
	to student				5	Ns	
10	Distribute numbered <i>MCL</i> to student by <i>SID</i>	0.5	Ns	LO	0.5	Ns	LO
11	Time allocated for students to read and answer <i>MEQ</i>	3	Nme*Nq	LO	3	Nme* Nq	EV
12	Educator grabs image of the raised <i>MCL</i>	0.5	Nme*Nq	LO	0.5	Nme* Nq	LO
13	Student put his/her paper or <i>MCF</i> on the educator's table	0.1	Nme*Ns	LO	0.1	Nme* Ns	LO
14	Educator validates student answer manually	0.15	Nme*Nq *Ns	LO	0	0	-
15	Educator calculates student grade manually	0.15	Nme*Nq *Ns	LO	0	0	-
16	Educator enters student answer manually in the software grading utility	0.15	Nme*Nq *Ns	LO	0	0	-
17	Student puts <i>MCF</i> on the stand for acquisition	0.1	Nme*Ns	LO	0.0 6	Nme *Ns	LO
18	MCF grading by HAS	0.01	Nme*Nq *Ns	LO	0	0	-



Figure 3. Total time (in minutes) required for the educator to implement all the steps as a function of the number of students in the class Ns for: 1 - App/MAN; 2 - Amcf/AS; 3 - Amcl / AS; 4 - App/HAS; 5 - Amcf/HAS; 6 - Amcl/HAS.

Table 5

Total Time of Steps having "Education Value" (EV Time), Total Time Required to Execute All the Steps, Time Efficiency in %. Nme=10; Nq=5; Ns = 25

<i>ME</i> Technique	<i>EV</i> Time (hours)	Total Time (hours)	Time Efficiency
App/MAN	25	50	50 %
Amcf/AS	25	41	60 %
Amcl/AS	25	38	62 %
Amcf/AS for students	2.5	3.12	80 %

Future Improvements

More research is required to improve the automatic software reliability and time required to process a large number of MCF and MCL.

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BORN FLIPPED – BLENDED LEARNING CLASSROOMS FOR AN ENTIRE BUSINESS PROGRAM

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Abstract

This paper presents a descriptive multi-case study of an undergraduate program that was 'born flipped': where every course in the program is taught in flipped classroom mode. Four separate accounts from a range of disciplines are presented, including marketing, management, economics and accounting. The Four Pillars of **F-L-I-P** is used as a framework for discussion. This study concludes with thoughts on the potential impact of flipped classrooms within higher education, and recommendations for this model of education.

Introduction

As educators we are always looking for ways to engage our students, both inside and outside of the classroom. Though we despair about attendance and complain about millennials and their obsession with their phones and electronic devices, finding ways to engage students is not a new concept. Research in the 1970s notes that a decade earlier the critical focus was "more pupil talk, less teacher lecturing, and more higher-order questions" (Rosenshine & Berliner, 1978, p. 4) and considered the balance between content covered and student attention and engagement. This research suggested that engaging students in relevant content and keeping them focused on curriculum material is essential (Rosenshine & Berliner, 1978).

More recently we have seen technology emerge in development of the online classrooms to engage the students in relevant content. Recorded full lectures delivered online, the rise of MOOCS and online assessments, and YouTube channels such as the Khan Academy have been both embraced and criticised by academics and practitioners alike. While some courses seem to lend themselves more than others to automated assessments (for example: those in the STEM disciples of Science, Technology, Engineering and Maths) the move away from using technology as merely a repository cannot be ignored. With the higher education sector moving more towards online delivery in order to be more responsive to student demands, one might question whether the move away from face-to-face interaction is increasing student engagement with the learning process. One movement that is said to encourage flexible, active learning, and increase student engagement is the flipped classroom model.

Blended Learning: The Flipped Classroom

While there is some debate as to what exactly constitutes a flipped classroom, essentially it "delivers the content to students outside of the classroom using taped lectures, videos, or other pieces of technology" (Vaughan, 2014, p. 27). A scoping review of flipped classrooms suggests that the "core features of the flipped learning approach include: content in advance (generally the pre-recorded lecture), educator

awareness of students understanding, and higher-order learning during class time" (O'Flaherty & Phillips, 2015, p. 95). Therefore, a flipped classroom takes what was traditionally content covered in the lecture and translates that into online materials for students to undertake in their own time, including pre-recorded lectures, podcasts/vodcasts, screencasts, and/or interactive videos.

A flipped classroom does not just move the lecture and content online. While the content is delivered online, the key learning comes from what happens in the classrooms when the content is already pre-learned. The tutorials (or workshops) aim to focus on the application of the content that the students pre-learned, and filling in any knowledge gaps or misconceptions in the content. There are a myriad of approaches to learning in this context (for examples see O'Flaherty & Phillips, 2015) with a focus on engaging the students in the materials. In this manner, flipped mode teaching is different to online learning as the student interaction and application happens face-to-face back in the classroom, rather than on an online discussion board or similar.

However, the purpose of a flipped classroom is not only to change the mode around: the key purpose is to create flipped learning. This is a "pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter" (FLN & Sophia, 2014). When comparing a traditional lecture to a flipped classroom, research has suggested that students have higher satisfaction with their learning in a flipped classroom environment (Butt, 2014; Hung, 2015).

With the growing number of absences in the lecture theatre, this approach would seem to make sense on a number of levels. From the student perspective, it allows them to virtually attend the lecture at a time that is suitable to them and their learning styles. It also gives them ownership of their own learning, at least in part, as they control how and when they access the content. From a lecturer perspective, it allows them to focus on the deliverable materials in the online lecture. From a university perspective, it allows a more efficient allocation of resources such as classrooms that spend more time than not half (or more) empty. Yet flipped teaching is not without its criticisms, such as lack of student interest with on-line lecturers versus live lectures (Perry, 2012), lack of student preparation, and lack of explanation of this teaching mode, resulting in student confusion. But what if students were never exposed to the traditional lecture/tutorial format: would they naturally evolve to be flipped learners? Another issue with flipped classrooms includes pushback from academics who are resistant to change (NMC, 2015), or who want to flip their classroom but work within a corporate culture resistant to change (White et al., 2015). How does the lecturer transition from the 'sage on the stage' to that of a mentor or coach?

The purpose of this study is to present an analysis from four participant-observers who deliver introductory units in Marketing, Management, Accounting, and Economics within a business program in Australia. This study investigates the utility of not just increasing use of blended learning, but using redesigned learning spaces to create an entirely blended, or flipped, business program. This study considers the importance of the development of flipped classrooms to the evolution of teaching, learning, and creative inquiry within higher education. The Four Pillars of **F-L-I-P** is used as a

framework for analysis and discussion. In the analysis, the Flexible Environment is discussed broadly across the program as a whole. Following that, each of the four case studies analyses their specific Learning Culture, Intentional Content and Professional Educator aspects. The cases chosen are all core units and have no pre-requisite units of study before they are undertaken.

Results: The Four Pillars of F-L-I-P

The Flexible Environment deals with the physical space that the students learn in to support their independent work and/or group learning activities (FLN, 2014). The facilities used for the scope of this analysis were purpose built for this program (MU, 2015) and the design is noted as challenging "the preconceptions of traditional tertiary learning spaces through innovative space planning and visionary design solutions" (IDEA, 2016). The workshop spaces are designed to be flexible, this includes tables and chairs with wheels that allow students to connect tables together for group work, and separate for individual work. Movable whiteboards also allow students to create their own learning spaces in this flexible environment (for images see: Shaw, 2016). The open and flat floor space allows the lecturer to continually move about the workspace, monitoring students and giving feedback as necessary. However, it is not enough just to create a flexible environment. In the flipped classroom, workshop time should be dedicated to exploring the pre-learned topics in more depth.

The next sections will explore the three remaining pillars of F-L-I-P. Each of the three pillars will include four first-person descriptions and reflections by the authors. The subheadings that follow attribute the personal descriptions and reflections of the specific author.

Learning Culture

Case one: Marketing (account by Tiffany Winchester). Shifting the learning culture to a flipped approach meant for me less talking and more supporting and guiding in order to flip the learning. In this, my mantra has been to "let them teach each other." Scaffolding the learning activities is key in this environment. The students begin each workshop with a group Immediate Feedback Activity (IFA) consisting of ten multiple choice questions based on the pre-workshop material. In this format they engage in activities where they are able to learn from each other, allowing me to see any gaps in their learning before moving forwards. Next the students extend their learning in a range of application activities that are then presented back to the class for feedback and debate. Once any gaps or misconceptions in the concepts have been clarified, the students are presented with a case study to work through. This may include a guest speaker from industry to allow the students to network as well as learn about a real world example.

While this approach seemed to work well, there were still issues of students not fully engaging in the materials or the discussions. Another common issue was non-attendance in the workshops. While the IFAs should encourage students to undertake the pre-class work, and the in-workshop assessment should motivate attendance, this does not guarantee either will happen. When the learning is shifted from the teacher to the student, attendance and participation are of paramount importance, more so, I would argue, than a traditional lecture/tutorial.

Case two: Management (account by Bruce Johnstone). I designed workshops with the intention of providing enquiry-based and team based learning. Each workshop had its own learning objectives and an illustrative case study with a series of questions for group discussion. While I consciously avoided turning the workshops into lectures, I realised it was valuable to seize opportunities during group discussions to deliver learning soundbites of theory and practical knowledge.

From past experience, I thought it important to divide workshop groups into teams that would blend international and domestic students, and evenly distribute males and females. To achieve this I created seating plans, and then asked the members of each newly formed group to come up with their own team name. During workshops, students worked in their teams, applying theory to answer questions based on a case study. I would move between teams seeking to guide and stimulate discussion. The teams would then each present their findings to the group. This gave me the opportunity to comment briefly on each presentation, delivering a learning soundbite when appropriate.

Case three: Accounting (account by David Teh). The design of the workshops provided the students with an opportunity in enhancing their learning experience through: (1) peer-to-peer learning, and (2) problem based learning (Savery & Duffy, 1995). Students engaged in various activities where they were able to learn from one another, within and amongst the team. Sometimes I sat down to listen to students' discussion without any direct participation from me, only intervening when students asked for assistance. I tried to be careful not to give the students any direct answers but prompt the students to reflect on what they had learnt and think about how they can apply those key concepts in answering the questions. I believe this emphasised critical thinking and confidence: developing students' ability to think between the theory and real-life situation and apply the theory to answer or solve real-life business problems.

Industry business practitioners were also invited to share their experiences and knowledge in their chosen field with the students. This was to provide insights to the students that allow them to think about how they can apply the theoretical work in the 'real' business world. I also used a reflective journal as part of an informal assessment to enable students to think and reflect on their learning and plan for future development.

Case four: Economics (account by David Treisman). Problem solving is the mainstay of applied economics and the divide between skills and application is particularly acute in terms of rhetoric. To ensure a successful combination of the flipped mechanism with a constructivist workshop, a technique was needed to stimulate the desire by students to engage in such a developmental process. The simplest solution was to get the students to invest in their learning in a manner that was personally meaningful. Selecting a series of traditional and non-traditional real world topics for discussion achieved this during the class.

For example, when monopolistic competition was presented, students analysed and debated the role of product differentiation in their favourite brand of mobile phone. Students were encouraged to question their own consumption. On balance, I would argue that using topics with personal meaning is essential to any flipped classroom. Once the students had invested in their learning, the development of their problem solving skills became self-perpetuating. During the last two weeks of the teaching block, approximately 10% of the students enthusiastically reported their surprise and

delight in reading the financial press and being able to question and apply sound economic analysis to the issues at hand. This was personally one of the more rewarding moments in the flipped classroom and was the point at which I realised of how successful the approach was in shaping the learning culture of the students.

Intentional Content

Case one: Marketing (account by Tiffany Winchester). Moving from lectures, or seminars, to designing video content for students was more difficult than I originally assumed. One challenge was that the timeframe for developing the content more than a traditional lecture (in some cases one-two weeks of development for one week's lesson). Another challenge was in trying to find the balance between what I needed to cover with pre-workshop content versus what I should cover directly in the workshop. While it is natural in a traditional lecture or seminar to cover the theory and then use multiple examples to make the content relevant to a wide range of students, this is actually less effective in flipped mode. The more examples discussed, the longer the video, and the less likely the student will continue watching. The rule of thumb with video recordings is around six minutes (Hazlett, 2013; Morrison, 2014), which required me to break the material down into smaller pieces.

To maximise video engagement time, I focused on what content must be covered in lecture-style videos (for example styles see Morrison, 2014) then used quiz questions after each video to check understanding. Workshop time was then used to present one or two examples before allowing them to choose their own examples. This allowed the students to be more responsible for their own learning as well as to explore the materials on their own using their own contexts. As noted previously in the Economics reflection, this allowed students to explore the topic in a way that might be more personally meaningful to them, encouraging self-reflection and deeper learning.

Case two: Management (account by Bruce Johnstone). My initial approach to creating online material was to simply create online condensed versions of lectures using Adobe Presenter. The Open University Australia (OUA) consultants and eLearning team members who reviewed my online lessons advised me to make them simpler and shorter. But it seemed to me that that I was presenting complex ideas, and these lessons needed to be sufficiently challenging for people studying at university level. I worried that replacing lectures with simpler and shorter online lessons represented a dumbing down of university teaching.

How we construct learning in a digital world is not that different to how we consume online entertainment. We follow our interests and we click to view. Free to air media tends to be presented to us in 30 to 60 minute programs, broken down into small attention-sized bites interspersed by commercials. Online learning resources also have to be broken down to be more engaging and interactive. Students needed to be able to consume them at their own pace, and at a time and place that suited them via laptop, tablet to smartphone. To achieve this I decided to break down the material for a weekly topic into a series of sub-topics, each with its own presentation. I also made an effort to effectively combine characters, graphics and text in each presentation with animation, narrated audio and full text. Students value their time, and using bite-sized materials (which students will often watch at 1.5 normal speed) may help to create that value without losing academic rigour. **Case three: Accounting (account by David Teh).** Pre-class workshop video recordings were curated and created to cover the weekly fundamental key concepts using three to five videos with a timeframe of five to seven minutes each. I also thought that working with qualified learning designers could be useful, supported by appropriate teaching pedagogy and use of technology.

Workshop A was designed to continue to build on those key concepts in pre-class workshop videos with an emphasis on the balancing of theory and application, supported by examples. Workshop B was considered by the students to be the most interesting session as students worked as an accountant or business analyst to solve real business problems, using case studies designed with relevance to the particular topic for that week.

Case four: Economics (account by David Treisman). Flipping the economics unit utilised a thematic approach to seamlessly scaffold the learning experience. Each theme would begin with an introductory video in which a topic or series of topics were introduced in a non-technical or anecdotal manner and culminated in a series of questions that the students needed to explore. These same questions were then used as the means with which to scaffold the learning during class time. This progressively intensified the student-centred learning across the full learning spectrum from the abstract theoretical to real world problem solving. This required following a sequence of largely team/group based peer assisted learning exercises as follows: pre-class material, group work theory exercises, group work application of theory, group work real world problem solving, debate and discussion.

Scaffolding does work for a flipped classroom. However, I found the educator faces a significant challenge: the associated self-directed group work often resulted in a multi-track classroom in which some students were acquiring knowledge/completing tasks at different speeds. This, in turn, added further to my responsibilities and required delicate application of diplomatic skills in order to maintain harmony among the student body, while simultaneously identifying methods to accelerate the learning experience. This personally became a tedious process a few weeks into the trimester and often made me feel more like an apologetic fire fighter than a lecturer.

Professional Educator

Case one: Marketing (account by Tiffany Winchester). Moving from the 'sage on the stage' to a motivating coach was, and still is, a challenge in flipped classrooms. One concept that I keep in the back of my mind is that for flipped learning to take place, I need to speak less than my students do. For the first few weeks of each semester, setting up this culture in the workshop is a key focus. This meant moving around between the groups, encouraging all students to participate in discussions, including those whose natural inclination is listening, rather than active participation. Often I would sit down at the tables with my students and listen in on the conversation without interrupting, and intervening when they needed the assistance (similar to the approach taken in Accounting). The IFAs as mentioned earlier gave me a good indication each week as to which groups were struggling with the concepts, so I could spend more time with those groups. In some workshops where the students were not as prepared as they needed to be it was a struggle not to 'lecture' and instead just to guide students towards their own answers.

Case two: Management (account by Bruce Johnstone). An implication for professional practice is that the ability to produce good quality online material is likely to be a routine requirement for university lecturers. Like me, they will have to make a transition from a traditional lecture mind-set in finding ways to replace lectures with a more learner-centred approach. In practical terms this may mean educators may be called on to improve their skills in using media technology and presenting for video and audio. Honing design skills and the ability to break down the key critical content previously contained in lectures into learning bites, and create learning resources that flip the classroom and put the learner at the centre.

Case three: Accounting (account by David Teh). From my experience, to make the flipped classroom more effective and enhance flipping learning, the mindset and practice of professional educators has to change. I view my role more as a facilitator rather than a lecturer in the workshop settings. Professional educators have become more than just lecturers and subject matter experts: they are facilitators who communicate and engage with students to support the students' learning and professional development.

Case four: Economics (account by David Treisman). I would argue that facilitating a flipped classroom is much more effort that traditional lecturing. Aside from the known increase in preparation work, the usually hidden effort stems from the flip-flop nature of running a flipped classroom. Regularly I would deal with a mundane query from a student only to instantaneously have to change track in order to address a spectacular query from the same/next student. Such sudden reversals simultaneously tested my temperament as an educator and my personal confidence in my knowledge of the theory and practice of my specialised field of study. This makes for a very dynamic lecturing experience and was, at first, quite a shock. In my view, the flipped classroom can be quite a challenge for the uninitiated, and may not be appropriate for all lecturers.

Discussion and Future Research

The purpose of this descriptive multi-case study was to present insights from four participant-observers within a business program in Australia. From the descriptions and reflections two themes are discussed: skill change required of the professional educator, and striking the balance between 'sage' and 'guide.'

Whereas traditional lecturers use their research and teaching experience to direct the learning, flipped classroom lecturers need to use their research, teaching and practical application experience to obliquely direct learning. This is reflected in the breaking down and recomposition of tasks in a fashion that can support flipped learning in the pre-class material and the role of authority figure performed by lecturers during class time. Therefore, this model of education may require professional educators with a different skill set than the traditional lecture/tutorial format. Replacing lecture preparation with developing online material was perhaps the most challenging. Educators, who might typically devote a day's work to preparing to deliver a traditional lecture, may find themselves allocating a full week to the production of a web package to replace that lecture. Skills needed include, but are not limited to, video presentation, recording narration, content development skills and more advanced skills in using Learning Management Systems such as Moodle or Blackboard. The need to develop new media presentation and technical skills, took the authors out of their comfort zone as university lecturers.

The flipped model extends the student-centred learning concept in which the educator moves from a director of learning to a facilitator of learning. This is characterised as moving from the sage on the stage to the guide on the side. In practice, strict adherence to the conceptualisation of the standard flipped model rarely occurred. The authors have all found themselves required to act as sages, at least to some extent. They were called on to answer questions within workshops to establish as well as extend the student learning. Therefore, while flipped classrooms have the potential to transform higher education, more often than not the role of the lecturer in the flipped classroom was that of sage on the side, rather than a guide on the side. The art of facilitating in a flipped classroom is finding the balance between being a sage without a stage while still being a guide at the core of student-centred learning experiences.

This study provided initial insights from the professional educator perspective from the early days of a flipped program. Future research should consider the impact from the student perspective: how did it affect student performance, satisfaction, and attitude towards the flipped approach. Further research considering teacher satisfaction, impact and adaptations to the workload, and the barriers/enablers that might be encountered would also be valuable to this emerging area of study within higher education.

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A **FLIPPED CLASSROOM** IN ENGINEERING EDUCATION – STUDENT PERCEPTION AND EFFECT ON LEARNING

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Abstract

This study examines a module taught on an engineering programme using a *flipped* approach, to students who otherwise were taught using a traditional lecture-seminar model. Students' perceptions of the module and their own evaluation of their use of learning materials were examined, using questionnaires and interviews. Results indicated a high level of engagement, but lower usage of the theory based learning materials, with preference for practical materials. A slight increase in GPA for the flipped classroom cohort was not statistically significant, and the proportion of high achieving students did not change. However, the module reduced the failure rate to zero, indicating that this approach particularly benefits weaker students, while not reducing the performance of abler students.

Keywords: Flipped Classroom, Engineering, Digital Native, Net Generation.

Introduction

In many engineering subjects the delivery patterns of degree courses have remained fundamentally the same over the past two or three decades, based on a lecture-seminar pattern, in which core information is 'delivered' by a lecturer, and which uses predominantly written supporting materials in order to scaffold understanding of this material.

In the same period, the nature of engineering education has changed. From being largely calculation based, in which the core skillset was the ability to undertake mathematical calculations, a significant proportion of engineering education now focuses on practical application of knowledge, using software packages for calculation, simulation and modelling in areas from acoustical engineering and architecture, to computer games programming (Barlow & Lancastle, 2009).

This requires courses to allocate a significant amount of time to the teaching of the software packages themselves, reducing time spent in actually applying the software to solving problems. This is exacerbated by a traditional lecture-seminar delivery pattern, where there is relatively little time spent on the practical aspects of a course, which tend to be allocated to private study. With lecture led delivery, some students will struggle to maintain the presentation's pace, while others find it too slow, resulting in frustration for both groups, and potentially reducing engagement and progress (Taber, 2000).

The flipped classroom model makes use of independent learning time for students to learn *knowledge based* materials, enabling classroom time to be devoted to more detailed examination of the topic – through seminars, practical tasks and experiential learning. There are several studies that report positively on its implementation in terms of student engagement.

However, over this time, the technology supporting flipped classroom has changed, and there is also a considerable amount of literature that examines the changing study patterns of students in the *net generation* (Tapscott, 1998). There are therefore questions regarding how current students perceive and respond to a flipped classroom. In particular, do students actually utilise the flipped classroom resources in the manner in which the lecturer anticipates? This paper examines the implementation of a flipped classroom approach on a module delivered to two engineering courses that otherwise had a 'traditional' delivery pattern and compares academic results to the previous cohort of the same module, which was delivered in a traditional manner.

Background

The flipped classroom is a pedagogical model in which the lecture and coursework materials are reversed (Mazur, 2009). With the availability of internet delivery platforms including Virtual Learning Environments (VLEs) and Social Media video sites such as YouTube and Vimeo, contemporary flipped classroom approaches tend to focus on the use of video to provide lecture materials, with classroom time being used for quizzes, discussions or practical work. This allows students to cover theoretical material and practical tutorials at their own pace, to catch up easily on missed work, and to review materials. It further allows the maximising of access to specialist facilities.

Although there is a growing body of practice of lecturers and institutions using the approach, there is still a limited amount of research examining how well flipped classrooms actually work and in what way students engage with the materials that form the basis of the flipped classroom (Goodwin & Miller, 2013), and there is limited academic literature on quantitative analysis of the effectiveness of the flipped classroom. Much existing research has focused on student enjoyment/engagement with materials (e.g., Bergman & Sams, 2012) and increased student-teaching interaction (Greenberg, Medlock, & Stephens, 2011).

One of the key concepts of the flipped classroom is that of connecting with students who are from the *net generation* (Tapscott, 1998), also referred to as *digital natives* (Prensky, 2001a). These students were born between the late 1970s and the year 2000, and have had the majority of their education since the advent of the Internet. Digital natives are considered to be digitally literate, able to use devices and find information on the Internet with ease (Oblinger & Oblinger, 2005), with a high ability to read visual images, and to be able to shift attention rapidly from one task to another. They thrive on use of graphics rather than text, need immediate gratification for information requirements and like to parallel process and multitask (Prensky, 2001b).

Exponents of the concept of the net generation have also identified that this group are *experiential learners*, who learn by doing, rather than being told what to do (Tapscott, 1998). Several authors claim that this group expect technology to be integral into their educational experience (e.g., Oblinger & Oblinger, 2005; Prensky, 2001a; Tapscott, 1998). Prensky goes so far as to say that the brains of digital natives are different to those of previous generations, primarily driven by changes in technology (Jones & Shao, 2011).

The flipped classroom is seen by many as an approach that "speaks the language of today's students" (Bergmann & Sams 2012, p. 20), addressing the needs of the digital native. However, some researchers have cast doubt on this concept. A large scale

literature review by the UK Higher Education Academy found, "There is no obvious or consistent demand from students for changes to pedagogy at university," (Jones & Shao, 2011, p. 2), while Kennedy, Judd, Dalgarno, and Waycott (2010) found that a lot of understanding of the net generation is based on anecdotal evidence or untested assumptions, and this generation has "instead shown to possess a diverse range of technology skills and preferences" (p. 332). Calderwood, Ackerman, and Conklin (2014) also found that task switching was linked to a negative effect on performance in homework.

Method

The module used teaches the design and integration of sound for video games to finalyear undergraduate students and is taught to multiple groups from different subject specialisms. The module has core elements of fundamental theory, as well as a significant element of learning how to apply these to the development of computer games using specific software packages. The mixed cohort of the group meant that students had different levels of prior experience, with some highly experienced in audio, but not software development, and others with experience in software development but with little audio knowledge.

The course delivery model had previously been based on a two-hour per week seminar, in which the first hour was lecture-based, predominantly focusing on theory, while the second hour was tutorial, with practical demonstrations by the lecturer and teaching assistant as well as some student time to work on practical exercises.



Figure 1. A video lecture on the virtual learning environment.

The delivery pattern was redeveloped to remove the lecture element and to deliver all lecture material through video via the university's Moodle-based VLE. Each week throughout the course, a number of learning materials were provided in advance of the class, including two to three original videos of around 7-10 minutes each (recorded by the lecturer), covering theoretical and software based (practical) learning material (Figure 1) as well as assets that they would need to use to complete the tasks in the classroom sessions. Both written and video tutorials were provided for each subject covered, allowing students the choice of which material they preferred to use.

The two-hour weekly seminar was retained, but class time was used for independent learning, with students able to apply the material covered to practical learning tasks. This was supported by a lecturer and a teaching assistant, who were able to provide student support in the classroom on a 1:1 basis.

Assessment of the module was based on two practical assignments, in which students were required to plan and undertake the audio implementation for a level of a video game developed specifically for the assessment. Students were required to provide full documentation and a technical report that explained the underpinning theory behind their approach to the development. The same assessment brief (though with some minor variations in the game developed for the assessment) was used for both the previous cohort and the *flipped classroom* cohort.

Theoretical Framework

The justification for the flipped classroom approach was focused not on reducing costly classroom time delivering material best placed in lectures, but on applying a more student-centred approach to learning. Whilst there were elements of underpinning theory, the module had a number of quite practical learning outcomes, and the students were expected to develop a set of practical skills. Many of the students started the module with poor independent learning habits, a highly strategic approach to study and assessment, and limited intrinsic motivation, while the different specialisms within the cohort meant that different paces of learning were inevitable on any topic.

Like many students, the group had responded well in the past to problem-based and experiential learning activities. Problem-based learning centres around the development of skills, upon which it has been shown to have a positive effect (Dochy, Segers, Van den Bossche, & Gijbels, 2003). It can be described as having goals that include developing effective problem-solving skills, self-directed learning skills and intrinsic motivation (Hmelo-Silver, 2004).

However, it has been shown that effective problem-based learning is often collaborative or cooperative (Prince, 2004) and less appropriate for the solo-learner. Also, the effect of problem-based learning on knowledge is less clear, and has even been shown to be negative in some cases (Gijbels, Dochy, Van den Bossche, &Segers, 2005), which could be a significant issue for students with weak theoretical foundations.

It has been shown that curiosity is stimulated when students are aware of manageable gaps in their knowledge, and that curiosity has a direct impact upon intrinsic motivation (Loewenstein, 1994). An earlier study on similar students showed that knowledge gaps that are too great may demotivate students, as they will be deterred from attempting to gain a new learning level if they perceive that new level to be unattainable. Conversely, if the gap is too small, students exhibit little enthusiasm for the task as their curiosity isn't sufficiently stimulated (Lancastle, 2012).

Data Collection

This study used a mixed methodology in order to assess both quantitative and qualitative data regarding student perceptions and use of learning materials. Students were asked to complete an anonymised 7-point online questionnaire mid-way through the unit, which addressed some basic points of usage and student perceptions of their

own learning using Likert scales. From a cohort of 42 students, 19 completed this questionnaire.

At the end of the unit, students were then asked to complete a 31-point online questionnaire, which was embedded into the module's VLE page. This considered their subjective response to the learning materials, their preference for video- or text-based learning materials, their use of learning materials, including number of times accessed, pattern and reasons for use, and their use of video feedback. Some open text questions were also included to allow students to express more detailed feedback regarding the unit materials and approach. Ten students of a cohort of 42 completed this questionnaire. Students who responded to the final questionnaire were then followed up with a short semi-structured interview in order to allow them to further discuss their perceptions of the unit and the use of material and to express this in their own words.

Quantitative data on grade performance was also collected from both the previous cohort, which had followed the traditional course delivery pattern, and the current cohort who had used the flipped classroom approach, for comparison on the effect of performance on grades.

Results

Both the mid-unit questionnaire results (Figure 2) and the end of unit questionnaire results (Figure 3) in this study reported increased satisfaction, with the majority of students expressing preference for the video based learning materials and high levels of engagement compared to traditional models of delivery.



Figure 2. Mid-unit perspectives of learning materials.

Ninety percent of respondents of the mid-unit questionnaire judged the videos 'helpful' or 'very helpful' in their learning (Figure 2); 68% reported preference for learning independently using guidance material; and 45% prefer asking questions and getting one-on-one support. By contrast, only 32% reported a preference for learning by lecturer demonstration.

The end of unit questionnaire had a similar response, with 70% of respondents accessing the learning materials at least 3-4 times per week, and 50% viewing video materials before the session "most weeks." One hundred percent of respondents rated the video tutorials as 'helpful' or 'very helpful.' Seventy percent of the respondents rated the unit structure as making their learning easier, with the remainder neutral (Figure 4).

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Figure 3. Mid-unit perspectives of learning preferences.

There was also positive feedback on the usefulness of videos from a revision perspective, and the ability to catch up on missed work:

"The videos were a huge improvement; as they could be revised word-for-word whenever needed, they allowed me to have an understanding ahead of lesson." Student B response





This is in line with positive levels of engagement in other studies of flipped classroom implementation (Johnson, 2013). However, the end of unit questionnaire did identify some significant differences between the students' interaction with the theory-based and practical demonstration video elements of the module (Figure 5).



ℵ Never 🖈 Once 🏢 Twice _= 3 times 🖉 More than 3 times

Figure 5. Viewing patterns for 'theory' and 'practical' study materials.

The students applied a very different viewing pattern to the theory-based and practical demonstration videos: 60% of students watched the theory-based videos only once or not at all, compared with 80% watching the practical videos twice or more (Figure 6). Indeed, when questioned about this in the interviews, students indicated that they interpreted the question to mean separate occasions and that they actually often viewed the practical videos several times within each session.

"The video tutorials meant that the lecture itself could be understood in more detail and aided with notes and revision." Student C response.

In the interviews, students were asked why they were less likely to view the theorybased videos more than once. All said that they viewed these out of class and felt under less pressure to understand the contents. They suggested that there was little point revisiting the videos if they didn't understand particular points as these out-of-class elements cannot be interactive. A few students indicated that they preferred traditional lectures for this reason, with one suggesting that students prefer to be able to take their own written notes.

The students were also asked *when* they were most likely to watch the theory videos. The most popular response to this was shortly before the associated practical session, often late at night. All claimed time pressures prevented them doing it earlier, though they found it difficult to justify this. When asked *where* they were most likely to watch the videos, there was a variety of responses, though no students specifically chose a quiet environment traditionally associated with study.

Whilst it has been argued that the flipped approach enhances student engagement (e.g., Gilboy, Heinerichs, & Pazzaglia, 2015), it is also possible that some students decline to participate in flipped classroom activities if they perceive that studying alone will be equally efficient in terms of learning (White, McCollum, Bradley, Roy, Yoon, Martindale, & Worden, 2015). There was evidence of this both in the questionnaire and interviews:

"On days that I was absent I was able to take the lesson from home exactly as I would have done in class." Student B response

When asked in interviews if access to the videos made them any more likely to miss classes all the students were quick to respond "no," but that it made them less concerned about their absence as the materials were easier to understand in isolation than a set of notes or presentation slides. Student attendance records showed no difference in attendance pattern between this module and others for the same group of students. However, all the students admitted that they were more likely to miss a theory class having viewed the video, even if they hadn't fully understood all of its contents.

Several students believe that they "learn better" doing practical applications, and this appeared to predispose them to undertaking the practical task as the starting point for their learning. Although the course was designed for them to view material in advance of the class, they were less likely to do so, preferring to watch sections as they performed tasks.

"I learn better practically, and it made it much more easier (sic) to use UE4 than it would be if the videos weren't available." Student D response There was a positive perception of the ability of the video materials to help students focus on the task:

"The tutorials were really helpful and really helped me learn. I liked being able to try as I learnt." Student F response.

"It's a lot more engaging, hence you are more motivated to keep focused during class-time." Student A response.

Many students claimed that use of video tutorials helped them to pace their activity to suit their rate of learning. When asked to describe a typical viewing pattern, one typical response was to watch a 30-60 second segment and then undertake that element of the practical task. Other students would watch the whole video through at the beginning of the session before repeating it in this segmented form. Around half only viewed the videos section-by-section as they completed the task. The different viewing patterns support the concept that the flipped classroom approach helps students to effectively utilise their own learning style, rather than the "one size fits all" approach of lectures. When asked if they would review the video after the session, most students (78%) said that they would do so but only when preparing work for assessment.

Feedback from the students on their experience of the unit was almost universally positive. However, there was some evidence that the students were also slow to adapt to the different pedagogy of the flipped classroom. Some students expressed a desire to be able to interact with the tutor, asking questions where necessary, like they might in a traditional classroom environment.

Grade Analysis

Grades (normalised to percentage of group) were assessed for the previous cohort, which had used a *traditional* delivery and the current cohort, which had used the *flipped* delivery. For both groups the assessment brief was identical; although there were slight differences in the game level developed for each assessment, the underlying tasks were the same, as were the assessment criteria. A summary of grade average is shown in Figure 6 (A-D are pass grades; F grades are fail).





The overall grade point average increased from 57% (standard deviation 15.3) to 58.5% (standard deviation 12.8) from the 2014 to the 2015 cohort. However, a two-tailed t-test indicates that this difference is not significant (p=0.66). The overall grade performance was very similar, and there was no significant variation in the proportion of students obtaining top grades. One key area of improvement, however, was at the lower end of the scale, as under the flipped classroom model there were no fail grades, compared to 6% of the previous cohort.

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Discussion

While this study echoes the results of others in terms of increased student engagement and student satisfaction, there is no evidence from this study that the use of a flipped classroom approach has a significant impact on the level of student grades, or that it enhances higher-order cognitive learning. However, it appears to have had a positive effect on the lower end of the grade spectrum by reducing the number of students failing. This may indicate that the advantages of the flipped classroom are not in an improvement of learning overall, but are based on increased engagement, the ability to self-pace and enabling students to choose their preferred approach to learning.

These advantages do not have a significant positive effect on abler students, who are able to process information at higher speed, and who therefore are also able to learn effectively from more traditional delivery patterns. However, the results suggest that the flipped classroom particularly benefits students who struggle with traditional lectures, and who may otherwise fall behind. The flipped classroom enables them to learn at their own pace, retaining motivation and enabling weaker students to achieve a pass grade, while at the same time not disadvantaging the abler students.

The study identified some issues with the use of video to deliver the important underlying theory. There is a lack of accountability for students to complete the out-ofclass activities in their own time. Unlike traditional delivery methods, there is also no control over the conditions under which the students view the videos. There was some evidence that their choices may not be particularly conducive to effective learning. In many cases they were choosing to view the videos very close to the practical session, allowing very little assimilation time, which may have had an impact on the effectiveness of their learning. As the numbers of students in the study was small this is by no means conclusive, but it is an area for future consideration as the module develops.

The students were using the videos to validate their work, checking their work against that of the tutor, exhibiting a well-proven master-apprentice model that is successful in training. There was little evidence of the students testing concepts that they have developed upon reflection of their experiences, preferring simply to compare their results with those of their tutor. This suggests tactical, behaviourist learning designed to get through the work quickly, rather than the construction of deeper understanding desirable at this level.

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IMPACT ON STUDENT MOTIVATION OF INTEGRATING GOOGLE DOCS WITHIN A REMEDIAL ENGLISH WRITING CLASS

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Abstract

Integrating Communication Technology is invading the classroom in the new education era. New teaching approaches, especially those focusing on constructivism, stress the positive impact technology has on student motivation, which in return enhances their achievements and abilities. This inquiry, a qualitative research study conducted in a private university in Lebanon, deals with the integration of Google Docs in an English writing class. The results show that, by introducing Google Docs, there was great impact on the students' motivation, writing skills, and attitude towards the English language in general. Students using Google Docs gained higher confidence and scores when they started reading the teacher's feedback on the Docs and working accordingly and had positive attitudes towards the collaborative writing process that used Google Docs.

Background of the Study and a Brief Literature Review

As strain increases in the private and public higher educational sectors in Lebanon, several nonprofit organizations have expanded access to education to enhance the education system and support the sectors with Integrating Communication Technology equipment. However, there are very few studies in Lebanon on whether teachers are integrating computer technology in the classroom and whether the students are benefiting and being motivated in the new learning process.

During the last few years, the use of online collaborative writing tools has been integrated within educational settings. Research shows that the advantages of such tools, specifically in higher education settings, include enhancing the learning process and motivation of the students. Thus, classrooms that lack technology are considered to be boring and classified as being old school. Undergraduate students in one of the private Lebanese universities are required to take remedial courses in English if they do not score a specific average in their entrance exam. Each course consists of essay writing, and the indications are that students often feel unmotivated because of the repetitive teaching methodologies the English teachers adopt while explaining the writing steps.

Among several technologies available at present, Google Docs is a tool used in the learning process, which enhances applying the student centered approach in an environment full of collaboration and motivation. According to Suwantarathip and Wichadee (2014), when the documents are shared in classrooms and commented on collaboratively, students have the chance to work on the feedback provided by their teacher or their classmates directly. When doing so, connections between the students' prior knowledge, personal experience, and course content are reflected. Cattafi and Metzner (2007, p.18) argue that collaborative tools can serve as a *knowledge platform*

where the members (teachers and students) can share their knowledge with each other and post information, work together, and critically discuss feedback issues. Students can work in the classroom or from home since Google Docs is stored online. This is a fact that increases their motivation. Comments in Google Docs appear as they do in any other application for chatting; thus, the students are encouraged to reply to their teachers' comments and discuss with them points related to their writings. Ghosn Chelala and Al-Chibani, (2013) explain that it is very important to find an effective approach for providing feedback on students' writing, which on the long run enhances the students' motivation and becomes challenging.

In many cases, some of the students barely read the teacher's comments and feedback upon receiving their graded and corrected papers. However, Google Docs gives these students the opportunity to read the teacher's comments clearly and reply to him/her on the spot if they have problems analyzing them. In the collaboration among students and the teacher creativity plays a role, and the students find it interesting (Suwantarathip & Wichadee, 2014). Lamb and Johnson (2010) believe that using Google Docs in order to provide students with feedback and work with them collaboratively allows the students and the teacher to think, create, and share at the same time as addressing subject areas in the classroom. When it comes to motivation, students seem to be satisfied when they work collaboratively with someone else from the classroom, especially when it is the teacher. Their learning motivation improves respectively (Kowal & Swain, 1994; Swain & Lapkin, 1998). Pea and Kurland (1987) emphasize that a personalized and more readily available feedback through technology is also not new as is using such technologies to help introduce new strategies and enable the writers to enhance their strategies. Thus, In general, the use of digital computing and networking tools is in line with student preferences (Ghosn Chelala & Al-Chibani, 2012; Al Chibani, 2011). This study moves from individual learning to web-based applications.

It is not negotiable that the importance of feedback on student outcomes is part of the learning process. Yet, it is very important to choose the best and most reliable approach. Instructors always search for new approaches for providing feedback on students writing assignment in their English writing class (Ghosn Chelala & Al-Chibani, 2012). Writing has become one of the most important tasks people rely on while communicating with each other whatever the need is, email, letters, memos, or academic essay. Writing requires steps to be followed, and writers can always benefit from readers' feedback no matter what the strategy used was (Al Chibani, 2014). English achievement is important to be taken into consideration because research has verified that success in English classes helps students in their future studies and future academic life (Al Chibani, 2014; Dillon, Patthey-Chavez, & Speigel, 2000).

There are several feedback procedures. Some instructors used the traditional ways of scoring such as rubrics and keywords and others moved to a non-traditional approach such the use of the screen-capture and audio recording software (Ghosn Chelala & Al-Chibani, 2012). Yet, other instructors that are more aware of new technology and are motivated to integrate communication technology in their English classroom, started using a new tool in technology - Google Docs.

Thus, among several technologies, Google Docs is a tool used in the learning process, which enhances applying the student centered approach in an environment full of collaboration and motivation.

Thus, this study moves from individual learning to web-based applications. Since very little research has been carried out in Lebanon concerning this issue, the researcher sought to be able to draw conclusions from examining undergraduate students' reflections and reactions as a result of using Google Docs for collaborative writing in a remedial English course and to investigate their attitudes towards collaborative writing activity using Google Docs.

The Study

The purpose of the study was to promote integrating communication technology, mainly Google Docs, in the remedial writing English language classes in order to enhance the students' motivation and encourage them to attend more of these kind of classes and take them more seriously.

Objectives of the Study

- 1. To examine the undergraduate students' reflections and reactions, as part of interacting with the instructor's' feedback, towards integrating the Google Docs in their writing sessions
- 2. To investigate the impact of Integrating Information Communication Technology on undergraduate students' motivations.

Research Questions

- 1. Was there an enhancement in undergraduate student motivation to attend English remedial writing classes which integrate technology such as Google Docs in the writing reflections?
- 2. How did the undergraduate students reflect on collaborative writing activities using Google Docs?
- 3. Was there any difference between the undergraduate student reactions and reflections at the beginning of the semester and at the end of it?

Research Design

This was a qualitative case study.

Participants of the study. The study was carried out in a private university in Lebanon. Two sessions (60 minutes each) were designed to introduce the students to Google Drive and Google Docs and how they work. One-to-one work was conducted in order to make sure that the students knew how to work with the new teaching tool.

Twenty five undergraduate students had to work closely with the researcher throughout the semester where they had to submit their writing journal on the Google Docs account the researcher had created and shared with them. Reflections on the writing were carried out collaboratively by the researcher, teachers, and students. Continuous collaboration was conducted where feedback was given online via the Google Docs the students had to work with.

The choice of participants was a convenience sample, and this was done for two reasons. Firstly, the participants were directly accessible to the researcher, and they were his students. Secondly, the undergraduate students were expected to fill out several
semi-structured interview questions twice: once at the beginning of the semester and again at the end of it.

Instruments used to collect the data. Two semi-structured questionnaires were to be filled by each student on Google forms. Both questionnaires were in the form of a semi-structured interview in which the students had to answer the questions in about 100 to 150 words per question.

The first questionnaire's questions concentrated on how much students liked to integrate technology into their writing classes and how much they knew about Google docs. The questions were: (1) Do you use Gmail? (2) Do you have Gmail account? (3) Have you used Google Docs to complete a course assignment? and (4) Did you find Google Docs helpful?

The second questionnaire contained questions stressing on collecting as many responses as possible that answered the three research questions. The questions were: (1) Was it easy to use Google Docs throughout the semester in group work? (2) Was it effective to use Google Docs throughout the semester in group work? (3) Was Google Docs easier to use than traditional tools such as paper and pen? (4) Did you like the teachers' comments on the essay? In what way? (5) Did you benefit more from the comments on the writing provided by the teacher using Google Docs than the traditional method? and (6) Do you suggest any further comment?

Data Analysis

Procedure of data analysis. After collecting the data from both Google forms, the semi structured interviews were grouped under each research questions and were cross-analyzed in a narrative diary form. The interviews were coded and common answers were highlighted in order to be analyzed and in order for conclusions to be drawn from them.

Findings

Research question 1. Was there an enhancement in undergraduate student motivation to attend English remedial writing classes which integrate technology such as Google Docs in the writing reflections?

The results of the findings show that introducing Google Docs within the writing process as a means of communication between the teacher and the student had a great impact on the students' motivation, writing skills, and attitude towards the English language in general. Students using Google Docs gained much confidence and higher scores when they started reading the teacher's feedback and working accordingly. In addition, students reported that they had positive attitudes towards the collaborative writing process using Google Docs, and nearly all of them agreed that this learning tool is easy to use.

These are two examples of student feedback.

Student a: "When the teacher first introduced Google Docs, I was not familiar with it. I started teaching myself how to open the document and how to type on it directly. Later on, I started getting more excited to read the teacher's comment on the document directly and responding to it on the spot. Sometimes the teacher used to comment directly on the essay and this made it a kind of chatting which we all liked."

Student b: "Even though we had trouble at the beginning to learn how to use the Docs, it became fun every time we used it to comment on each other's text on the Docs and fix our mistakes."

Research question 2. How did the undergraduate students reflect on collaborative writing activities using Google Docs?

The majority of students showed interest in working collaboratively using Google Docs. Due to integrating this technology within the classroom, as well as PowerPoint and Prezi, the students were more interested and cared to work better and more. They agreed that being made to open Google Docs and read the teacher's comments allowed them to read carefully the comments and correct their writing, which was the opposite of what they used to do when using pen and paper.

Student c, for example, said: "Last semester, when the teacher used to return our essay writings, I used not to bother about it and read her comments. She used abbreviations that I did not understand. However, this semester, I made sure to read carefully the clear comments the teacher was providing for me in writing via Google Docs, especially since I had the ability to go back to the chat or conversation history saved in Google Docs and see my changes."

Moreover, the findings show positive attitudes students had towards collaboration on writing assignments out of class using Google Docs. All but one of the students, agreed that using Google Docs simplified their writing process and helped them make progress throughout the semester.

Student d said: "My grades are much better than last semester and now I know my mistakes more." This is probably because Google Docs makes collaboration easier.

The last question of the post-evaluation form asked for further comment. There were suggestions that the adoption of such technology as Google Docs and Google forms in other courses might increase the learning process. In addition to that, almost 85% of the students liked the concept of sharing ideas with other students using such a tool that promotes collaborative learning. Importantly, 78% of the students suggested that the teacher should take more time to explain and help students work with Google Docs, especially if they are clearly not used to the technology.

Student e wrote: "At the beginning, it was hard for me to learn how to upload the essay, but later on I had to ask my classmates and it worked out well. This made me stressed."

Research question 3. Was there any difference between the undergraduate student reactions and reflections at the beginning of the semester and at the end of it?

In this study, Google Docs was seen as an easily used medium for activity which increased the students' learning motivation and made them happy to read the teacher's feedback. From the 25 who participated in the study 72% showed interest and agreed that they were familiar with Google Docs as a content management tool (in much the same way that they would normally use a USB stick), but not as a tool for collaborative writing. However, by the end of the semester, their feedback changed and they showed more interest in integrating such tools in the learning process.

Discussion

The purpose of the study was to promote Integrating Communication Technology, and particularly Google Docs, in remedial writing English language in order to enhance student motivation and to encourage them to attend more of this type of class.

Ghosn Chelala and Al Chibani (2013), Suwantarathip and Wichadee (2014), and Cattafi and Metzner (2007) argue that Google Docs is a tool used in the learning process to enhance applying the student centered approach in an environment full of collaboration and motivation. They add that students can work in the classroom or from home. Students feel comfortable to work anytime they feel like it as Google Docs will provide them with this opportunity. This is in line with the findings of this study in which it is shown that students were motivated using Google Docs. They considered the learning tool to be a new addition to their way of learning, and it made them eager to write more, accepting the new technology and desiring to integrate it in their classes and study routines. For example, students can work on their laptops from the library, and the teacher can be working from home with them. When it comes to learning motivation, Ghosn Chelala and Al Chibani (2013), Kowal and Swain (1994), and Swain and Lapkin (1998) write that students seem to be satisfied and show learning motivation improvement when they work collaboratively with someone else from the classroom, especially when it is the teacher.

The findings of this study on the collaborative work impact on student interest indicates that the majority of the students showed interest in working in this way using Google Docs and especially in integrating the technology within the learning process. The findings also show positive attitudes students had about collaboration on writing assignments out of class using Google Docs. This is in line with the review of this study. Ghosn Chelala and Al Chibani (2013), Suwantarathip and Wichadee (2014), and Lamb and Johnson (2010) agree that collaboration among students and the teacher is an interesting method where creativity plays a role, and the students benefit in a way that amuses them. They believe that using Google Docs in order to provide the student with feedback and work with him or her collaboratively allows the student and the teacher to think, create, and share at the same time as addressing subject areas in the classroom. When the documents are shared in classrooms and commented on collaboratively, students have the chance to work on the feedback provided by their teacher or their classmates directly. When doing so, connections between the student's prior knowledge, personal experience, and course content are reflected. Collaborative tools can serve as a knowledge platform where the members (teachers and students) can share their knowledge with each other and post information, work together, and critically discuss issue feedbacks.

Conclusion and Recommendation for Future Research

This study is the first of its kind in Lebanon. It explores a shift from a traditional way of giving feedback on the students' papers in remedial writing classes to a collaborative way of giving direct feedback on Google Docs. There are several recommendations that can be implemented in future studies.

Research should not be limited to only one classroom from one university but conducted throughout different universities and in several classes. This study can be

considered a pre-pilot study for future studies in order to see the impact on student motivation as a first step of integrating Google Docs within foreign language writing classes and then to study its impact on the students' achievement.

Also, it is worth taking into consideration that the students come from different cultures and are at different grade levels and social and economic backgrounds. Some have been previously exposed to technology in the classroom and others have not been. More orientation sessions should be held in order to prepare students for an advanced integration of technology in the course syllabus. Moreover, teachers, in turn, should be trained on such learning tools in order to integrate them in their lesson plans.

Further research studies can be conducted to compare the impact on student writing motivation in collaborative writing between face-to-face and the Google Docs methods.

Wider research should be conducted in the classroom to study student interest in technology. If students are satisfied with learning through technology, students could be assigned to work together outside class. This can help the teacher save time and facilitate the learning process.

This study suggests that Integrating Communication Technology engages students with the lessons and helps them collaborate with their peers to develop their writing skills. By allowing this to happen, teachers are preparing their students for a new 21st century learning phase.

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USING CORPUS LINGUISTICS TOOLS TO HELP TRANSLATION STUDENTS CREATE TECHNICAL GLOSSARIES

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Abstract

The creation of glossaries might become an arduous task if translation students rely simply on document analysis in order to choose the keywords to be included in their lists. This research project was carried out with the goal of developing techniques for identifying terms from a specialized field, by using both Portuguese and English comparable corpora, as well as computer tools designed for linguistic analysis. This method was based on corpus linguistics approaches, and the specific area in this study is Symbolic Freemasonry. The compiled corpora for this study were manuals and rituals used by freemasons during their meetings.

Introduction

When planning lessons for translation students, educators must include ways of improving work productivity due to the highly competitive profile of the translation market. Among the several ways available for improving productivity in translation services, we might emphasize the use of computer-assisted translation tools (CAT Tools) and the creation of integrated electronic glossaries.

CAT Tools, such as Trados or Wordfast, operate with translation memory, i.e., they make suggestions and/or substitutions based on pieces of language that have been previously translated. For instance, after successfully translating a lease agreement from English to Portuguese, a translator saves the original and the translated texts as a translation memory file. Therefore, the next time s/he needs to translate another lease agreement or similar document, the software will identify and make suggestions and/or substitutions for the extracts that are equal or similar to the ones in the translation memory file. Consequently, if a professional translator translates a great deal of lease agreements, s/he might reach a level of automated language translation that will increase considerably her/his work productivity by using CAT tools. If a professional translator wants to use CAT Tools, s/he must have in mind that "achieving full and complete memory is paramount: translation memory is at the heart of automated language translation" (Maylath, 2013, p. 42). Nevertheless, it is important to mention that if s/he translates something in an inaccurate way, unless s/he fixes the translation memory file before starting a new translation, the software will make suggestions and/or substitutions that will repeat the inaccuracies in the translation memory file.

CAT tools have been present in professional translation business for more than 30 years and they offer the feature of including personal glossaries and activating specific ones before starting working on a technical translation. Students must realize that creating and tailoring glossaries for the areas they intend to work with translations is essential for their professional development and might help them build more accurate translation memory files. A glossary is a collection of terms from a specific science or area of knowledge with their meanings and/or translations. A *term*, in comparison to a general word "is a label - usually lexical - in the special language of a specific domain, designating a particular concept in the knowledge of that domain, and arguably less context-dependent with regard to its sense than a general-language word" (Ahmad, Davies, Fulford, & Rogers, 1992, p. 269). Selecting terms for including in glossaries might be an arduous task depending on how students perform such tasks.

One of the most basic ways in which students go about collecting terms in the process of creating a particular glossary is through *document analysis*, i.e., by reading texts in the specific science or area of knowledge in order to perform such a collection. However, document analysis is time consuming and relies on the reader's skill for identification and selection of terms. Souza (2012), for example, carried out the identification and validation of special nursing language terms in physical motor rehabilitation of adult patients through the usage of the document analysis approach. The author states that 1.425 electronically saved medical records were analysed one by one in the search for terms from the target area (Souza, 2012).

In the research project conducted by Souza, she made use of Excel spreadsheets for collecting terms. In the first column she put the medical record to be analysed and in the second column she listed the words and expressions from the medical record in the first column that were candidates to be terms. It is needless to say that analysing 1.425 medical records is a Herculean task that ought to be recognized as a genuine effort to identify and validate terms from a specific area. Notwithstanding, as it was previously mentioned, document analysis relies on the reader's skills and, therefore, factors like fatigue and human error might influence the final results.

The method proposed in this paper aims at restricting human interaction to the corpus assembling and cleaning and the term validation processes, since the potential term candidates were suggested by the software used in the research through an iteration procedure.

The Theoretical Constructions

The theoretical foundations for this research were based on Corpus Linguistics approaches and terminology studies.

Corpus Linguistics

Corpus Linguistics studies the language in use, in its natural and authentic form and it is present in a *corpus*, which is a collection of texts that was electronically compiled specifically for linguistic analysis through the use of computer tools (Berber Sardinha, 2004). When analysing language in two or more corpora, we can use both parallel and comparable corpora. Parallel corpora consist of two (or more) corpora that contain the original texts and their translations in different languages whereas comparable corpora consist of two (or more) corpora that contain original texts from a similar variety in different languages (Hunston, 2002). Kenning (2010, p. 487) reinforces this idea, stating that "the prototypical parallel corpus consists of a set of texts in language A and their translations in language B" and what puts them together is meaning whereas the texts compiled in a comparable corpus were selected according to one certain criteria such as texts from a specific area of knowledge, which is the case in this study.

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The corpora used for this research were compiled from the Internet in free access, i.e., without any special access, and all the texts are available to the general public. They consist of comparable corpora, containing original texts in English and Portuguese. The chosen varieties were manuals and rituals of Symbolic Freemasonry used by Freemasons during their work. Thirteen manuals and rituals were compiled in the Portuguese corpus, and fifteen manuals and rituals were compiled in the English corpus.

Corpus linguists make use of corpora and computer tools for language analysis. The computer tools used in this research project were:

- WordSmith Tools 6.0: Collection of tools for linguistic data analysis. The tool used for this research was the Keywords Tool, which helps identifying words that stand out in a text or set of texts.
- ZExtractor: Software used for the automatic extraction of term candidates in a text or set of texts.
- SketchEngine: A linguistic data analysis system that has several features. The feature used in this research was the Keywords, which helps identifying words that stand out in a text or set of texts.
- Notepad for Windows: Text editor that allows the work with simple text files or ASCII, which is the file type accepted by the computer tools mentioned above and with which better results are obtained.
- Microsoft Excel: Software for creating spreadsheets that allows to filter, calculate, compare and analyse data.

In order to identify keywords and, consequently, potential candidates for terms in a given area of study, we compared the wordlist for the target corpora with a wordlist for the reference corpus. During this comparison, "a word will be key if its frequency is either unusually high or unusually low in comparison to a reference corpus" (Berber Sardinha, 2001, p. 89). The English reference corpora used in this study were the British National Corpus (WordSmith Tools and zExtractor), enTenTen12 (Sketch Engine), and the Portuguese reference corpus was the Corpus Brasileiro. The advantages of using corpus linguistics approaches to language analysis is that we are able to process large amounts of texts and obtain faster results than any document analysis procedure carried out exclusively by humans.

Terminology

Terminology might be defined as a methodology for collecting, describing and presenting terms (Sager, 1990). It is also seen as "a *theory*, i.e. the set of premises, arguments and conclusions required for explaining the relationships between concepts and terms" (Sager, 1990, p.3). In addition, it might also be a vocabulary from a specific area of study (Sager, 1990).

Traditional terminologists tend to work with terms in isolation mainly because they are only concerned with giving names and creating concepts and vocabulary. Modern terminologists prefer to take into consideration the language usage, and the focus is in the use of authentic texts as the main data sources (Ahmad, Davies, Fulford, & Rogers, 1992). The terminological approach in this research project is closer to modern terminologists' points of view since it makes use of authentic texts for term collection and identification. The selected area of knowledge is Symbolic Freemasonry, which is a division of Freemasonry and consists of three symbolic degrees: Entered Apprentice, Fellow craft and Master Mason. As it was previously mentioned, the texts collected for compiling the corpora were rituals and manuals used by Freemasons during their work that are freely available in the Internet.

Methods

The method to analyse the manual and rituals in the collection of terms consisted of four phases, which are:

- 1. Phase 1 -- the corpora compilation and cleaning
- 2. Phase 2 -- an iteration procedure that included the use of the WordSmith Tools 6.0, ZExtractor SketchEngine
- 3. Phase 3 -- a normalization procedure
- 4. Phase 4 -- a matching procedure

Phase 1: Corpus Compilation and Cleaning

At this phase, the corpora were compiled and prepared as described below to be analysed by the computer tools selected for this research project. This was a unique process and did not need to be repeated for each tool that was used.

Step 1 – Corpus compilation. Thirteen manuals and rituals in the Portuguese corpus and fifteen manuals and rituals in English were copied from the Internet and individually saved in ASCII format (Notepad format), which is the format accepted by all the computer tools used in this research project. In order to be representative, a corpus must be as large as possible (Berber Sardinha, 2004), and in terminological research, one of the challenges to be overcome is the lack of adequate corpora for the research (Pearson, 1998). The corpora collected for this study have around 200 thousand words each (English and Portuguese) and if we compare them to general language corpora such as the British National Corpus (100 million words), they are quite small.

Nevertheless, it is also important to consider that:

- Symbolic Freemasonry is composed of three degrees (Entered Apprentice, Fellow craft and Master Mason);
- there is one ritual for each of these degrees;
- the terms used remain almost the same in the different rites of Freemasonry (Ancient and Accepted Scottish Rite, Emulation, York and others);
- around 89% of the Lodges in Brazil work the Ancient and Accepted Scottish Rite; and
- in the United States of America and in the United Kingdom there is a balance between the Ancient and Accepted Scottish Rite, York and Emulation.

The representativeness of the corpora of this study is based on the fact that the manuals and rituals in Portuguese and English include the three degrees and the mentioned rites. Adding more similar texts to the corpora would not have a significant impact on the results since there is almost no change in the language used in them.

Step 2 – Corpus cleaning. Cleaning a corpus is the process of getting rid of all the elements that will not interfere in the language analysis. This interference, also known as *noise*, might be, for instance, page numbers, pictures, graphics and everything that is

not linguistically relevant. For this research project, as the texts were copied to the Notepad file, the linguistically irrelevant elements were eliminated.

Phase 2: Iteration Procedure to Identify Terms

At this phase, all the steps described below (Compilation/update of stop words lists or blacklists, extraction of the word list from the corpora, extraction of keywords, qualitative analysis – judgement of the term candidate status, saving the list of terms, iteration procedure with the zExtractor and Iteration procedure with the Sketch Engine) were used in the iteration procedure, which is the repetition of a sequence of steps that provides results closer to what is expected. In this case, it resulted in a list of terms of Symbolic Freemasonry. The five first steps in this phase were used for the first computer tool, WordSmith Tools 6.0 and then repeated for the zExtractor and the Sketch Engine with each corpus (English and Portuguese).

Step 1 – Compilation/update of stop words lists or blacklists. Stop words lists or blacklists are lists of words saved in ASCII format that are unlikely to be considered terms. The computer tools used in this research project have the feature of including lists of words that will not be considered for linguistic analysis. These lists include words such as articles, prepositions, auxiliary verbs and common verbs/nouns and they were loaded in the WordSmith Tools 6.0 and updated for the use with the zExtractor and the Sketch Engine.

Step 2 – Extraction of the word list from the corpora. After loading the reference corpus, the corpus of study and the stop words lists, the first computer tool (WS Tools 6.0) provided a list of words from the corpora.

Step 3 – **Extraction of keywords.** After the word list operation, the WordSmith Tools 6.0 provided a list of keywords, which are words that are candidates for being terms.

Step 4 – Qualitative analysis – judgement of the term candidate status. After acquiring the keywords list, it was saved in an Excel spreadsheet and each term candidate was judged individually if it was a term of Symbolic Freemasonry or not. The WordSmith Tools 6.0 produced a list of 517 keywords in English and 771 keywords in Portuguese. After the quantitative analysis, 393 keywords in English and 325 keywords in Portuguese were considered terms.

Step 5 – Saving the list of terms. After the judgement of the term candidate status, the keywords from the first computer tool (WS Tools 6.0) that were considered terms were saved into an Excel spreadsheet, and the keywords that were not considered terms were included in the stop words lists or blacklists to be used in the zExtractor and the Sketch Engine.

Step 6 – Iteration procedure with the zExtractor. As it was mentioned before, the five first steps in this phase were repeated for the zExtractor. Out of 428 keywords in English, 176 terms were identified and out of the 441 keywords in Portuguese, 271 terms were identified. After adding the terms to the list and excluding the repeated ones, the use of the second computer tool helped identify 41 new terms in English and 140 new terms in Portuguese. Again, the keywords that were not considered terms were included in the stop words lists or blacklists to be used in the Sketch Engine. At the end

of this stage the lists of terms in English had a total of 434 words, and the list of terms in Portuguese had a total of 465 words.

Step 7 – Iteration procedure with the Sketch Engine. Similar to step 6, the five first steps in this phase were repeated for this third computer tool. Out of 343 keywords in English, 258 terms were identified and out of the 179 keywords in Portuguese, 169 terms were identified. After adding the terms to the list and excluding the repeated ones, the use of the third computer tool helped identify 32 new terms in English and 6 new terms in Portuguese. At the end of this stage the lists of terms in English had a total of 466 words and the list of terms in Portuguese had a total of 471 words.

Phase 3: Normalization

The normalization process consisted of grouping together terms that presented variations in spelling, abbreviations, gender, number and conjugation and placing them in lines for building the glossary. Words with variations in spelling, gender, abbreviations, number or conjugation were placed together. For instance, in the English terms list, the words *bro, brother* and *brethren* were put in one line, whereas in the Portuguese terms list, the words *venerável*, *ven* and *veneráveis* were put together. After the normalization process, 466 terms in the English list were grouped in 350 lines and the 471 terms in Portuguese were grouped in 368 lines.

Phase 4 – Matching. Having the two lists in different languages, the final phase consisted of matching the terms in one language with their respective translation in an Excel spreadsheet. The terms that had no match were searched in dictionaries for possible translations. The translated words were searched in the corpus of that specific language and then included in the glossary.

Conclusions

A glossary with 392 words was achieved using the method proposed in this study without having to read all the texts in the corpora. The glossary created can be easily inserted in CAT tools that offer the feature of glossary inclusion. Even considering that around one thousand keywords had to be judged if they were terms or not, the amount is much smaller than the document analysis carried out by Souza (2012) that initially extracted 827.047 terms after reading 1.425 medical records. Therefore, in comparison to document analysis, the method in this study proved to be less time consuming. In addition to that, the iteration process contributed for identifying more terms in comparison to the use of only one computer tool, a fact that adds relevance to the proposed method. The teaching and application of this method shall facilitate the lives of translation students and professionals as it may be used for building glossaries in other areas of knowledge or interest. However, in order to obtain satisfactory results through the use of this method, translation students and professionals must be aware of the following aspects:

• **Corpus relevance:** The corpus must be relevant and not necessarily very large. When compiling the corpus, students must have in mind that sometimes bigger does not mean better, and they should focus on selecting genres that contain a high incidence of terms, such as rituals and manuals in this study or medical records in Souza's case (2012).

- **Cleaning the corpus:** This procedure excluded the possibility of contamination because non-linguistically relevant elements such as page numbers or pictures were eliminated.
- **Stop words lists or blacklists:** The update of stop words lists or blacklists helped reduce the number of the keywords lists and facilitated the qualitative analysis.
- **Reference corpus selection:** The reference corpus should be at least twice the size of the corpus of study and should be representative of the general language in use.
- Iteration procedure: The use of three computer tools in a sequential mode, updating stop words lists or blacklists, helped identify more terms in a precise manner.
- **Qualitative analysis:** The judgement of the term candidate status is something that needs to be conducted by someone who knows the terms in both languages, once computer tools make suggestions by crossing frequency and they are not able to validate terms.

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AVATARS IN LANGUAGE LEARNING

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Abstract

This paper presents the concept of the avatar and some of its uses in education, especially in the teaching of additional languages. A case study shows that a group of students using avatars to make personal presentations replicated many of their personal features and demonstrated a preference for synthesized voice. As to general personal introductions, the most recurrent features were: openings with a greeting followed by their names, course identification and semester or year. At the end of the text, I present further suggestions for the use of avatars in the teaching of additional languages.

Avatars

The word *avatar*, according to the Oxford Dictionary of English Etymology (Onions, 1966), originates from Sanskrit and means the descent of an entity and its incarnation in human form. In the virtual context, Peterson (2005) suggests the following definition: "Avatars are online manifestations of self in a virtual world (Kim, 2000) and are designed to enhance interaction in virtual space" (p. 30).

With the advent of digital technology, computer users began to become "incarnate" in virtual characters, first in games and afterward in social networks such as *Second Life* – http://secondlife.com/ –a third dimension virtual environment that simulates real life. The members of the different social networks and games environments project identities idealized in graphic representations to perform the actions expected or permitted in these virtual communities.

Similar to Gods manipulating humans, the avatar owners can execute certain actions through their graphic representations that they would probably not be able to carry out in real life. An example in the fictional world that illustrates these remote-controlled actions well is the film *Avatar* (Cameron, 2009). In the film, Jake Sully, an American ex-marine, who becomes paralyzed, controls his avatar through neural connections and acts as a mercenary fighter at the service of explorers of the planet Pandora.

In the educational area, avatars can be used as a mask to protect identities and function as an alternative to reduce stress in the performance of certain learning tasks.

Zargaryan (2012), inspired by the work of Antonacci, DiBartolo, Edwards, Fritch, McMullen, and Murch-Shafer (2008), concluded that:

Avatars allow learners to carry out tasks that would be difficult in real life contexts due to a number of environmental constraints such as location, scheduling, etc.

Avatars provide an environment of social interactions, which can serve as a basis for collaborative knowledge development. (p. 24)

It is possible to create avatars for your Facebook page, Twitter, Skype and Whatsapp accounts using the Androidify, FaceQ, Avatar Maker, Smartphone Avatar and Bitmoji applications, but they only generate images. There are other applications that allow you to insert voice, such as PeoplePutty for example, but you need to download the software to your computer or buy a CD. One application for generating avatars with image and voice that has been widely used in language teaching is Voki, described below.

Voki and Its Use in the Teaching of Languages

Voki (<u>http://voki.com/</u>) is a partially free application for creating animated avatars, with the option of using a real or synthesized voice. It is not necessary to download any program to create a Voki avatar. The user can choose the style of the character, but the choice is limited in the free version. Faces in 3D and of well-known politicians are only available in the paid version. The same limitation applies to the background and customizations, including changes of appearance, clothes and accessories. The voice is activated via telephone, microphone or text, and recording time is restricted to a maximum of one minute in the free version. If the user chooses to use text, the voice is generated by voice technology, and there is a choice of language and voice type.

Voice options include several languages. If the choice is English, users may choose an English, American, Scottish or Australian accent. For Portuguese, there is a choice between European and Brazilian variants. French has only one option while in addition to the Spanish from Spain, there are another two variants: Mexican and Latin American.

As Antunes (2012) points out, "students can hear, stop, backtrack or even self-correct their own recordings" (p.15) during voice insertion. The synthesized voice can be heard before the recording of the actual voice, as a means of helping students to learn pronunciation in the chosen selection (when this option exists). It may also be chosen by shy students who do not want to use their own voices or by those who do not have recording tools.

After the avatar is created, a link is generated and the avatar can be included in a webpage, such as Facebook, Twitter, blog or even sent by e-mail.

In the paid versions, the teacher can create a Voki Classroom and monitor students within this environment. There is also the option made for presentations – *Voki Presenter* – which creates presentations through an avatar with unlimited audio time. The recording is hosted in a cloud and can be shared with other people.

Hébert, Corcoran, Coté, Ene, Leighton, Holmes, and Padula (2014) comment :

When students create their avatar, they also give it personal features such as eye color, hair color, and facial expressions. In many instances, avatars are a direct representation of the student, but for others, the avatar represents the student's ideal self. (p. 97)

Boss (2009, para.18) believes:

Designing personalized three-dimensional avatars gives the kids a risk-free chance to explore their identity. Avatars don't look quite as real as photographs, but they aren't totally abstract, either. They're just different enough from real life to make them an ideal device for toying with appearances.

In our case, we worked with undergraduate students, but we agree that the comments of these two authors also apply to our context.

There are several uses of an avatar provided by the Voki tool. According to Cicconi (2014) it can be used in order for "that character to share thoughts and ideas through typed text, computer microphone, sound file upload, or phone" (p.62).

Bolduc-Simpson and Simpson (2014) suggest that "[T]eachers can use this free animated speaking avatar to present short one-minute concepts, make announcements, summarize homework assignments, record messages, or give instructions for doing a task" (p. 244). For students, they suggest that Voki can be used:

to create their own talking characters. Characters can be animals, historical figures, cartoon characters, VIPs, anime characters. Using Voki, students can enhance their language skills, do book reports, advertise a product, reflect on their learning, announce school events, send holiday messages home to their parents, introduce themselves, explain concepts, or give instructions. (p.244)

In her work with pre-school children, Cicconi (2014) used avatars created with the Voki tool so that students could describe scientific experiments to their parents. As the avatars are on the Web, it is possible to widen the audience for them. Besides this, as Cicconi points out (2014, p. 62), "Evaluating with Voki empowers student audiences to watch one another's Voki projects and invent a responder Voki for feedback that furthers collaboration."

Antunes (2012) claims:

The production of the Vokis could enable students to not only practice speech, but would also allow them to hear and self-correct their pronunciation. We may also say that this tool could encourage and stimulate more timid students to participate, since they can talk individually to a microphone, instead of facing a whole class, where they might be subject to laughter or teasing. (p. 29)

Antunes (2012) adds:

The choice of audio format can have two purposes:

- 1. Make the student more critically aware, since on hearing his/her recording, and those of colleagues, he/she will be more error conscious.
- 2. Enable the teacher to be more precise in evaluations, in so far as it will be possible to observe the speech evolution of each student through their avatars.

In truth, avatars could represent a new form of registering and evaluating data on each student's evolution with regard to oral development. The teacher could create a "Digital Vokifolio", in which a chronological registry would be made, enabling a more in-depth and individualized reflection on the evolution of oral production and comprehension. (pp. 29-30)

One of the activities developed by Antunes (2012) with the Voki tool was a game, which she described as follows: "This game consists in the use of the avatars previously

created by students, whereby through the avatar, they need to discover both the famous character and the person who created it" (p. 52).

Zargaryan (2012) describes a quasi-experimental study carried out with communication students from the American University of Armenia. The researcher investigated the use of the Voki application in the development of oral proficiency in English as a foreign language. Survey questions were:

- 1. Does Voki have an effect on the development of EFL learners' oral proficiency?
- 2. What is the learners' attitude towards Voki?
- 3. What are the learners' learning behaviors and strategies when creating Voki? (p. 30)

Apart from the pre-test and post-test, the researcher used questionnaires and interviews. Data proved that the experimental group that used the Voki application showed superior oral performance in post-tests. With regard to the attitude to the application, participants liked working with the tool:

Voki can help them improve their English in terms of vocabulary, pronunciation, fluency and grammar. Participants stated that Voki helps them to use the target language outside class and to practice their speech in their own space and time. Results of the participants' responses show that learners think that even preparing scripts and creating their Voki by reading from those scripts helped them develop their oral proficiency and contributed to more fluent speech, free of grammar and word choice mistakes. (p.50)

As drawbacks, they pointed to the absence of interaction and the recording time limitation in Voki, which is 60 seconds, in the free version.

Regarding learning strategies and behaviors, results from the questionnaire and the interview show that the average time spent by participants in producing the Vokis was 34 minutes. Most students recorded from a script and, on average, repeated recordings four times before publishing them.

I have been using the Voki tool in classes about digital tools for a good while, both in undergraduate and graduate courses. In the following section, I describe research on the use of Voki with Brazilian students.

Research Goals and Methodology

In this research, I used a set of avatars generated by students of Portuguese and additional languages from an online course on digital tools, taught in the first semester of 2015.

The goals of the study were to:

- 1. Verify if the students reproduced their physical features when creating their avatars, as Hérbert et al. (2014) suppose or if they played with their appearance as Boss (2009) predicts.
- 2. Confirm if they chose to record their own voice or if they used a synthesized one.
- 3. Look at presentation content.

The course subject was offered to 150 students on the Moodle platform and the first task consisted in making a personal introduction through a Voki avatar. In the Moodle Platform, students found the following guideline:

This week (from March 02 to 06), we will introduce ourselves through avatars.

What is an avatar? In the virtual world, an avatar is a digital persona that you create and customize. It is you in another dimension.

This is my avatar:

http://www.voki.com/pickup.php?scid=11050927&height=267&width=200

Create your avatar and introduce yourself to our learning community. Choose a free model. The paid models have a mortarboard (the one used in graduation ceremonies)

Use <u>http://www.voki.com/</u> Read the guidelines on how to create and publish a Voki avatar:

In text: http://www.gestaoescolar.diaadia.pr.gov.br/arquivos/File/pdf/voki_tutorial.pdf http://ferramentaseducativas.com/index.php/multimedia/video/72-voki-o-avatarque-fala On video: https://youtu.be/4qNIdZ9Oza8 https://youtu.be/Z1Itetccke4

The task was completed by 120 students who posted the links to the avatars in a forum called "Avatar," where they also received feedback from the two monitors who helped me manage the course. I selected 18 avatars for analysis, using the following criterion: the same number of students with pictures on their Moodle profile. Only nine male students and 47 female students fulfilled this condition. I then chose all nine of the male avatars and, from the 47 female avatars, I picked the first ones from the first and last of the six pages in the forum until I had another nine avatars.

Data Analysis

In Figure 1, you can see the avatars of 18 students.



Figure 1. Collection of avatars produced by 18 students.

Personal Features and Features of the Avatars

With the exception of one student who chose the image of a clown, the other 17 chose avatars that reproduced features of their profile photos on Moodle, such as skin color, use of glasses, hair length and color. The wearing of glasses was greater in the avatars. All four students who wore glasses in their photos also appeared wearing glasses in the avatars, and another four avatars also had glasses. Even not knowing if they wear

glasses in real life, we know that people generally take off their glasses when they take photographs, and this reinforces the hypothesis that the avatars resemble their creators.

It is also worth noting that one of the students of French and Portuguese marked his identity as a French learner with an image of the Eiffel tower in the background. These data support the hypothesis of Hérbert et al. (2014) that students create their avatars with features that are similar to their personal ones.

Voice Recording Versus Synthesized Voice

Since the goal of the course subject was the use of tools and not the teaching of a particular language, the task was in Portuguese and students could use their voices or type in text to be read by a synthesized voice. All of the male students chose not to record their voices. One of them justified his choice of type because he did not have a microphone. One participant chose European Portuguese.

Among the female students, 4 of them recorded their own voices and 5 used a voice synthesizer. Two students chose languages they were studying: Spanish and English. This was also a form of highlighting their Spanish and English learner identities. Their introductions were very brief: one recorded herself saying "Hey, What's up?" and the other used the voice synthesizer to simply say "Hola que tal?"

The Personal Presentation Genre

Table 1 provides an overall view of the most recurrent elements of introductions made in Portuguese. Numbers 1 to 7 denote female students; 8 to 16 male students. Avatars limiting themselves to greetings in English and Spanish were not included in the table.

Table 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Greeting	х	х			Х	Х			х	х		х	Х	х	х		10
Name	х	х	Х	Х	Х	Х	Х	Х	х	х	х	х	Х	х	х	х	16
Civil status			Х														1
Age	Х			Х			Х						Х				4
Profession			х	х			Х								Х		3
Researcher								Х									1
Justification for			х														1
choosing the																	
Language and																	
Literature Arts																	
course																	
Justification for											х				х		2
choosing course																	
subjects																	
Course/ Period/year	Х	х		Х	Х	Х	Х	х		Х	Х	Х	Х	Х	Х	Х	14
Experience with							х										1
technology																	
Sentiment in relation												х					1
to the subject																	
Expectation of the				х			х	х		х			Х				5
subject																	
Likes							х										1
Wishing everyone a						х		х				Х	Х			Х	5
good semester																	

Recurrent Elements in Introductions/Presentations Through Avatars

Most greetings began with "olá" (hello), and just one student used "Oi, tudo bem? (Hi, is everything ok?). Another one used "Olá, prazer conhecê-los" (Hello, pleased to meet you) and at the end repeated that it was a pleasure to be in the group.

Another interesting activity is suggested by Zargaryan (2012): "Students can create an avatar similar to a character from a story, add a scene and give it a voice."

Conclusion

The task with avatars in the course on the use of digital tools fully achieved its goal, as students learned to use the tool. Nevertheless, for the teaching of languages, the task needs to present more instructions. I suggest the following format.

Your task is to make two personal presentations, using Voki. The first should be informal and aimed at students such as you. The second is more formal and should be addressed to the person in charge of the student exchange program in a foreign university.

Informal Presentation	Formal Presentation
Greeting:	Greeting:
Options: Hey, hi, hello	Options: Good morning, good afternoon, good
	evening
Tell us your name or nickname: I	Tell us your full name: My name is
am/ They call me (nickname)	
Tell us your age: example: I am nineteen	Tell us your age: example: I am nineteen years
	old.
Say where you come from: I am from	Say where you come from: I am from Brazil/ I
Brazil/ I live in (city) in Brazil	live in (city) in Brazil
Talk about your study or work	Talk about your study or work
I study	I study
I am a shop assistant/ I work as a waiter/ I	I am a shop assistant/ I work as a waiter/ I work in
work in a restaurant	a restaurant
Talk about your hobbies	Talk about your hobbies
I like playing basketball	I like playing basketball
I like reading books	I like reading books
I like going to the movies	I like going to the movies
Talk about your plans for this	Talk about your plans for this semester/year
semester/year	I am going to
I'm gonna	I intend to
I intend to	

Follow the steps below:

Based on Boss (2009), as an activity, I would suggest asking the students to compare their physical features with those they attributed to their avatars.

Boss (2009) noted that her students discussed the appearance of their avatars and gave the following examples:

Girl 1: I made myself taller and thinner.Girl 2: Me too.Boy 1: I made myself taller and muscular.Boy 2: I didn't keep my regular appearance because by media definition, I'm pretty gross looking.Boy 3: Me too.

To complete this task orally, students can use the Vocaroo tool (vocaroo.com), a free on-line voice recorder that enables recording in clouds, without the need to install any application. Recordings may be sent as voice messages and incorporated into blogs or wikis.

Other activities with Voki may involve the creation of characters based on literary texts and reproductions of their scripts.

In addition, the students themselves may make suggestions for new uses.

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IMPLEMENTATION OF THE NATIONAL ICT PLAN FOR THE 21ST CENTURY AMONG ARAB TEACHERS AS A RESULT OF READINESS TO CHANGE, ICT PROFICIENCY AND DEMOGRAPHICS

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Abstract

This study examines correlations between readiness to change among Arab teachers, their proficiency in ICT as well as their demographic characteristics and the extent to which the National ICT plan for the 21st Century is implemented. Findings show significant correlations between the study variables while the perception of change, efficacy to change and the value of the change to the organization are key factors that affect positively ICT proficiency and the implementation of the program. However, ICT proficiency is the main factor that predicts largely the degree of implementation among Arab teachers at elementary schools.

Introduction

The use of information communication technologies (ICT) is increasingly gaining momentum in education. In the academic year of 2011, a comprehensive program entitled Adapting the Educational System in Israel to the 21st Century was launched. The program is also known by its short name *The National ICT Plan for the 21st Century*. Schools that implemented the program activate e-learning environments in which teachers perform computerized pedagogical management and use ICT for their teaching in the classroom. Adapting the educational system to the 21st century is a multiple year program, in which schools are planned to integrate in several steps and configurations. Basic configuration consists of laptops for every teacher, blinds, speakers and high internet connection. The teaching staff is trained and escorted by education ICT guides. In the years 2011-2012, 850 schools joined the program in the North Sector, the South Sector, and in Jerusalem to reduce the digital divide in these provinces. In four years, deployment will be completed in all primary schools and will expand to secondary schools (Ministry of Education, 2012).

The goal of the plan is to implement innovative pedagogy at schools, while providing 21st century skills and assimilation of ICT at schools. The purpose is to improve five aspects of teaching: (a) teacher's skills, (b) adaptive learning and teaching, (c) real-time feedback, (d) continuum of learning in class and at home, strengthening the connection between home and school, and (e) administration using ICT. Innovative pedagogy is an approach to teaching and learning, in which the taught content and knowledge are relevant to a changing reality and for optimal functioning. Twenty-first century skills include ICT literacy, information and media literacy, thinking and problem solving, communication and collaboration, self-learning, and personal and social responsibility (Vydsilvski, Peled & Pevsner, 2011).

In comparison to previous procedures of ICT integration into the education system in Israel, the National ICT Plan of the 21st Century is broad and comprehensive in both

quantity and budget (like all schools). All 2,263 elementary schools including 516 Arab elementary schools had joined the program by 2015. This plan is directed from the point of view of its super goals, and, therefore, the process of ICT assimilation in the 21st century puts a great challenge in front of the education system. The plan requires that teachers be familiar with the possibilities of technology, creativity and investment of time, which will ultimately lead to effective application of their work in computerized tasks.

Assimilation of ICT and Readiness to Change

ICT is perceived as a catalyzer of organizational changes in content and pedagogy, and the process of its assimilation in education requires establishment of policy and making national and local changes at schools. Assimilation of ICT in the education system is deemed dramatically effective on the school organization because it creates changes that oblige the education system to react, to cope with and even to change (Solomon, 2000; Fullan, 2001). In this context, innovative and updated learning-teaching materials and methods are being developed and an innovative teaching-learning process is being applied, which is breaking through the borders of the space and time of the classroom (Ministry of Education, 2012).

Assimilation of ICT. Assimilation of the culture of ICT as a part of essential change in the school culture takes place while a considerable number of the school teachers are ready to apply this technology in their teaching (Shamir-Inbal & Kelly, 2009). Others maintain that assimilation of technological change can be done through implementation of a comprehensive systematic change that includes all the components of the school with an emphasis on the need for constant implementation of the change in order to establish and institutionalize it in the school (Cohen & Lechner, 2011). In every process of change, there are powers that are involved in supporting the change and powers that are against the change. A change succeeds when the supporting powers are stronger than the blocking and hindering ones (Fox, 2008). A survey of plans that assimilate ICT in the world show that teachers have a decisive role in assimilating successful technological change at school (Melamed & Slant, 2010; Kozma, 2008; Halverson & Smith, 2010).

The Teachers' Readiness for Organizational Change. Readiness reflects cognitions that are likely to affect people's behavior regarding change, including the degree of resistance or support to change, and the efforts to make it take place. High degree of readiness contributes to supporting change and reduces resistance to its implementation. Similarly, low readiness makes it hard to fulfil the change (Armenakis, Harris, & Mossholder, 1993). Naraian, Brown and Navarro (2011) found that schools where teachers' readiness for an educational reform was high got more advantages from the reform in comparison with schools where the teachers' readiness for an educational reform was low.

Teachers have a central role in the process of assimilating technological change and the way in which it is employed (Blau & Hameiri, 2010). Teachers have an important role in providing the skill of self-learning, organization of efficient learning and development of thinking skills and control of technological instruments. The teachers' challenge in this era lies in creating innovative educational identity that focuses on teaching where the pupils are active, interested, ask questions, discuss issues, argue and compromise.

All this takes place in a collaborative learning environment, in which ICT is an integral part of the learning environment that affects the essence of pedagogy and its results (Rotem & Avni, 2009). The findings of certain studies indicate the existence of a positive relationship between teachers' attitudes and beliefs towards change and the degree of their readiness to perform changes in their teaching process (Avidov-Unger, 2001; Avidov-Unger & Arazi-Cohen, 2014). It was found also that demographic variables such as the teacher's role and age affect the degree of actual implementation of the National ICT plan. Teachers-educators, tend to implement the plan more completely than teachers who just teach a certain subject. Other researchers pointed out a negative relationship between the teacher's age and the degree of implementing ICT in the classroom. They found that older teachers have little ICT literacy and show low self-confidence in operating ICT in comparison to younger teachers (Tondeur, van Braak, Sang, Voogt, Fisser, & Ottenbreit-Leftwich, 2012).

ICT Skills and Readiness to change

Teachers' mastery of the different ICT skills is likely to affect the degree in which they adopt technology in teaching. Therefore, development of the required skills to achieve reform goals among teachers is vital in creating sustainable change and motivation for change among teachers (Levin & Fullan, 2008). A previous experience in using ICT contributes larger confidence among teachers and is related to increased integration of technology in the teaching sessions (Wood, Mueller, Willoughby, Specht, & De Young, 2005).

Cohen and Omer (2012) found that teachers, who thought or believed they were skilled showed larger readiness for integrating ICT in teaching, expressed less worries regarding change and were available to deal with more advanced aspects of coping with the change. Success in implementing ICT programs is largely dependent on the degree in which new directions are well-planned, the availability of support in the system, and the school teachers' staff, besides the degree of the availability of resources to assimilate and maintain that technology for a long period (Mioduser, Nachmias, Forkosh & Tobin (2003).

As mentioned above, within the plan of the National ICT Plan for the 21st Century, the teachers underwent training in ICT skills and guidance regarding the implementation of the plan. However, based on experience working with teachers and school observations, reality shows that there are teachers, mainly those who have been teaching for 25 years or more, who had many difficulties in integrating this plan. Their difficulties stem from their lack of self-confidence in ICT skills, fear in coping with this feeling of insecurity, overwork as a result of the implementation of the plan, and erosion in their spare time that resulted from the necessity to prepare computerized lessons in a frequent way. Apparently, there are negative and positive factors regarding the implementation of the plan among teachers. Some factors hinder, while others promote and enhance implementation and assimilation of the National ICT Plan.

Objectives

This study examines the degree to which there are correlations between demographic characteristics of teachers, their perceptions about their ICT proficiency as well as their readiness to change and between the extent to which the national ICT program is implemented. The purpose of this research is to determine which factors promote and which ones constitute obstacles for teachers upon implementing e-learning programs in particular. The study examines the implementation of the National ICT Plan among Arab elementary school teachers who experienced the first stage of the National ICT Plan for the 21st Century in their schools at the end of the second year of its implementation. The results of the study indicate how significant each of the factors is for the implementation and assimilation of the National ICT Plan among Arab teachers.

Hypotheses

- 1. Positive correlations will be found between the components of readiness to change: change efficacy, appropriateness, management support, value to the organization; and proficiency in ICT.
- 2. Positive correlations will be found between the components of readiness to change and proficiency in ICT and between the implementation of the National ICT Plan.
- 3. Negative correlations will be found between seniority in teaching and age and between readiness to change, proficiency in ICT and implementation of the National ICT Plan.
- 4. Significant differences will be found between teachers-educators and their professional counterparts. Teachers-educators will demonstrate higher levels of readiness to change, proficiency in ICT, and implementation of the National ICT Plan compared with professional counterparts.
- 5. The teachers' readiness for change, their ICT proficiency and seniority predict the degree of the implementation of the National ICT plan among teachers.

Methodology

The present study was carried out using a quantitative research approach. The quantitative data included a survey of teachers' readiness for change, their proficiency in ICT skills and actual implementation of the National ICT Plan.

Sample. The sample included 150 teachers from three Arab elementary schools: 50 teachers from each school: 70% women and 30% men; 52% are teachers-educators and 48% teachers who teach a subject. The teachers' ages ranges between 23-58 (m=39.5; SD=7.3) and their seniority in teaching between 3-39 (m=16; SD=8.3) years.

Instrument. The instrument is a questionnaire that consisted of four parts:

- 1. Demographic data such as: age, gender, seniority in teaching, role.
- 2. Proficiency in ICT questionnaire contains eight statements about computer skills such as operation of interactive whiteboard, e-mail. Responses were measured using a five-point Likert scale (1 to 5), with 1=not at all, and 5=great (α 0.72);
- 3. Teachers' readiness for change was assessed using a questionnaire designed by Holt, Armenakis, Field and Harris (2007). The questionnaire contains 38 statements, which were translated and modified for the study population and

topic. Responses were measured using a five-point Likert scale (1 to 5), with 1=not true at all and 5=very true. Four different dimensions tested this variable: (a) change efficacy-expresses self-assessment of the ability and skill to implement the change and to perform the tasks that are required during the implementation. The questionnaire contains nine statements (e.g., *I feel like I can handle easily the plan implementation*), (α 0.87); (b) appropriateness-expresses estimation for the proposed adjustment to the organization. The questionnaire contains seven statements (e.g., *there is no doubt that the change is needed to school*), (α 0.62); (c) administration support- represents perceptions about the commitment of organizational leaders to change. The questionnaire contains 13 statements (e.g., *the school principal served as a role model for change*), (α 0.71); (d) value to the organization- represents the organization benefits from the change. The questionnaire contains eight statements (e.g., *this change will improve the effectiveness of the school in every way*), (α 0.89). Reliability of the questionnaire on all the dimensions = α 0.89.

Application questionnaire, use and integration of ICT in teaching (Peeraer & Van Petegem, 2012). It contains 15 statements (e.g., *I use power point presentations in class*). Responses were measured using four-point levels: 1= rarely, 2= sometimes, 3=often and 4=always (α 0.93).

Procedure. The research topic was selected as a result of a professional meeting with teachers who were required to implement the National ICT Plan for the 21st Century at their work and referred to the difficulties they experienced during their work as a result of the implementation of the plan. *The first stage* consists of reviewing relevant theoretical material, and after formulating the concept of the study, three schools were selected to perform the study. *The second stage* consists of selecting research tools; existing questionnaires were selected and adapted to the study population. *The third stage* constitutes the process of collecting, processing and analyzing the relevant data.

Data processing. Quantitative data were processed and analyzed by quantitative research methods using correlations, *t-tests* in two independent samples and multiple regression.

Findings and Discussion

The findings of the study are introduced with reference to the objectives and hypotheses of the study. In order to test the hypotheses 1,2,3, Pearson's correlation coefficients were used to test the relationship between the following variables: implementation of the national ICT program; components of the teachers' readiness for change (a) self-readiness, (b) appropriateness, (c) administration's support, (d)value of plan of organization, ICT proficiency, seniority, age. The results of Pearson's tests are introduced in Table 1.

	Μ	SD	1	2	3	4	5	6	7
1. Application	3.13	.912	-						
2.Change efficacy	3.20	.599	.695***						
3. Appropriateness	2.99	.475	.391***	.506***	-				
4 Support	3.22	.468	.336***	.417***	.317***				
5. Value	3.09	.688	.570***	.608***	.292***	.494***	-		
6. Proficiency	3.66	.883	.821***	.716***	.248**	.294***	.581***	-	
7. Seniority	16.10	8.34	259**	240**	490	172*	247**	- .388***	-
8. Age	39.52	7.38	272**	279***	190	182*	272**	.439***	.925***

Correlations Retween	n Denendent	Variables an	d Indenendent	and Themselves	(N=150)
Correlations Derween	Dependent	r un nuones un	a macpenaem	unu inchiscives	(11 150)

Table 1

The matrix of correlations indicates that there are clear relationships of different powers between the study variables. Regarding the first hypothesis, two clear and strong positive relationships appear between two components of readiness for change and ICT proficiency. The first is between change efficacy and between ICT proficiency (r=0.716, P < 0.001); the second is between the value of the plan to organization and between ICT proficiency (r=0.581, P < 0.001). These relationships indicate that teachers with high ICT proficiency feel more ready to implement the ICT plan in their work, and, therefore, they express high self-readiness to implement the plan. In parallel, they give value to the importance of the use of ICT and its positive contributions to the school in this information era. Clear positive relationships, though weak, were found between appropriateness of the change to the organization and between ICT proficiency (r=0.248, P < 0.001), and between the administration support and ICT proficiency (r=0.294, P < 0.001). The findings verify hypothesis (1) and show that the higher the perception of ICT proficiency is, the teachers express higher readiness for change.

The results verify hypothesis (2) and indicate existence of clear strong and medium positive relationships between the components of change and ICT proficiency and between the implementation of the National ICT Plan. Two clear positive and strong correlations were found between self-efficacy and between the degree of implementation of the ICT (r=0.695, P < 0.001) and between attitudes towards the value of change to organization and the degree of the implementation of the ICT Plan (r=0.570, P < 0.001). Another two clear and positive relationships were found in a medium power between appropriateness of the change to the organization and between the degree of the implementation of the implementation of the ICT plan (r=0.391, P < 0.001) and between attitudes towards the administration support and between the extent of the implementation of the ICT plan (r=0.336, P < 0.001). These results indicate that the more the teacher thinks that the change is worthwhile and relevant to the system, the more he/she will assimilate it in a more extensive way.

These results are compatible with the results of previous studies that showed that the teacher's pedagogical technological knowledge and his positive attitudes regarding change and assimilation of ICT plans are relevant to a realistic higher implementation of the plan (Avidov-Unger & Arazi-Cohen, 2014; Palak & Walls, 2009). The strong positive relationship that exists between ICT proficiency and the degree of the implementation of the ICT plan (r=0.821, P < 0.001) indicate that teachers who have well-control ICT skills feel high personal capability regarding the implementation of the ICT plan (Xalemoglu Varol, 2014).

Regarding hypothesis (3), significant negative relationships were found between seniority and age and between the other study variables, but most of the relationships are at low power. Only two significant relationships were found in medium power between seniority and age and between the degree of mastery of ICT skills (r=-0.388, P < 0.001); (r=-0.439, P < 0.001) respectively. The older teachers are and their seniority is longer, the lower is the level of their ICT proficiency. No significant relationship was found between age and between attitudes regarding appropriateness of the change to the organization.

It is possible to assume that older teachers find difficulty in changing educational paradigms to which they have got accustomed until now. This difficulty together with low skills of ICT causes a feeling of low self-readiness, and consequently to less implementation of the ICT plan. These findings are compatible with the findings of a previous study that found that older teachers have less technological knowledge and low self-confidence regarding the operation of technology in comparison with younger teachers (Tondeur et. al., 2012).

To test hypothesis (4) a *t-test* was conducted in two independent samples in order to test differences between subject teachers and teachers-educators regarding their readiness for change (self-efficacy, appropriateness, support and value), their perceptions about their ICT proficiency and their implementation of the ICT plan. The results of the *t-test* show that there is difference between teachers-educators, and subject teachers, in the degree of the implementation of the ICT plan. The degree of implementation of the ICT plan among teachers-educators (m=3.241, SD=0.867) is clearly higher (t=2.286, p< 0.05) than the degree of implementation of the ICT plan among subject teachers: (m= 2.871, SD=0.972). This finding is compatible with the findings of the study conducted by Avidav-Unger and Arazi-Cohen (2014), which showed that teachers-educators implement the ICT plan more completely than subject teachers do. This can be attributed to the possibility that the ICT plan focuses mainly on teachers-educators and less on subject teachers. There were no significant differences between teachers-educators and subject teachers.

In order to examine hypothesis (5) a stepwise linear regression was conducted. Table 2, depicts the criterion to enter the regression model of every variable and its significance of p<0.05.

	Model	β	R	R Square	R Square change	F
1	ICT proficiency	0.821***	0.821	0.674	0.674	0.821***
2	ICT proficiency	0.772***	0.844	0.712	0.037	177.870***
	Appropriateness	0.200***				

Stepwise	Linear	Regression

Table 2

Note: The independent variables are attitudes regarding readiness to change, ICT proficiency, seniority and age; the dependent variable is the extent of the implementation of the ICT Plan

* P<0.05 ** P<0.01 *** P<0.001

As we see in Table 2, after two steps we received a significant regression model (F=177.870, P<0.001). Only two variables, ICT proficiency and attitudes regarding appropriateness of the ICT Plan to the organization were found to be predicting the degree of implementation of the plan. The regression model explains 71% of the variance in the variable implementation of the ICT Plan whereas ICT proficiency constitutes the largest contribution to the explained variance of the implementation (β = 0.772, p< 0.001). Regarding the attitudes towards the appropriateness of the ICT Plan to the organization, a lower degree of contribution was found regarding the explained variance of the implementation of the ICT Plan (β = 0.200, p< 0.001). It seems that teachers who believe that the ICT Plan is appropriate to school implement it in a larger way. The other components of readiness for change (self-efficacy, support and value), and the variables of age and seniority did not contribute to the prediction of the degree of implementation of ICT plan among teachers. The added value that is received from the regression-model points out that ICT proficiency is the most important variable and it explains best way the degree of the implementation of the plan in a practical way.

Summary

The purpose of this study was to find out if and to what degree there are relationships between teachers' readiness for a change that requires implementation of the National ICT Plan for the 21st Century, ICT proficiency, and demographic variables and the implementation of the plan among Arab teachers at elementary schools.

The study adopted the quantitative approach in order to test the research hypotheses. The sample included 150 Arab teachers from three Arab elementary schools. In the beginning, the relationships between the study variables were examined. After that, the differences between teachers-educators and subject teachers were tested with reference to the study variables. Conclusion, the model of stepwise linear regression model was conducted.

The findings show that there are positive relationships between all the components of readiness for change (self-efficacy, appropriateness to the organization, administration

support and value of the change to the organization) among themselves, and between them and ICT proficiency, and between all these variables and the implementation of ICT plan.

Self-efficacy for change and the value of change for the organization are the central components of readiness that are connected in a positive and strong way with both ICT proficiency and the implementation of the National ICT Plan. Teachers with high perceptions of self-efficacy have high assessment to the contributions of the change that is bound with the implementation of the National ICT Plan were found to have high ICT proficiency and implemented the plan to a high degree. At the same time, older teachers with low mastery in ICT skills in comparison with younger teachers, and teachers-educators were found to implement the ICT plan in a more complete way in comparison with subject teachers.

The findings of the study point out ICT proficiency as a central variable that largely predicts the degree of the implementation of the ICT Plan among Arab teachers at elementary schools. There is no doubt that successful assimilation of the National ICT Plan for the 21st Century at educational institutes is dependent on many pedagogical, administrative, and bureaucratic factors. Still, the findings indicate that teachers' readiness for change, their ICT proficiency and their perceptions regarding the ICT National Plan constitute a significant and decisive cause in the process of assimilating the plan in teaching and learning. Therefore, establishing readiness for change among teachers and increasing their understanding of the factors that affect it, along with guidance and support for the acquisition of ICT skills, will enable initiators of reforms and educational leaders to develop professional instruments and processes that are required for successful implementation and assimilation of educational and technological reforms.

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ICT USE BY SCHOOLS IN KOTA SALATIGA, CENTRAL JAVA

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Abstract

This research sought to identify the range of information communication technologies (ICT) accessed and used by students in Kota Salatiga (Central Java). The study endeavoured to fill a research gap about how ICT is used in Indonesian schools. The instruments developed are seen as tools for use in developing countries. The survey collected data that was quantitative and qualitative. The research questions investigated were:

- 1. What is the range of ICT presently used in schools?
- 2. How are ICT used? What is the frequency of their use?
- 3. What ICT would students like to use in classes?

Introduction

The views of students about the use of information communication technologies (ICT) in schools provide for pedagogical action to meet the needs of contemporary learners in a global economy. This project sought to identify the type of ICT accessed and used by students in Kota Salatiga (Central Java). The study attends to a research gap in understanding the use of ICT in Indonesian schools by collecting data from students in primary, lower secondary, senior secondary and vocational schools who participated voluntarily in the data collection activity: a paper based survey. This study considered the frequency of use of ICT and school and home contexts. The research used a mixed methodology, where the survey collected data that was both closed (quantitative) and open response (qualitative). The sample size was 1738 students. Survey data were analysed using a data collation tool designed by Universitas Kristen Satya Wacana (UKSW) while text analysis was completed using a range of additional open source and commercial tools. This was a collaborative study by researchers from UKSW and University of the Sunshine Coast (USC), establishing baseline data to inform future policies for using ICT in education to improve the quality of teaching and learning in the schools of Kota Salatiga, and by broader inference, Indonesia.

Literature about ICT in Learning

The benefits of incorporating technologies into teaching and learning in Indonesian schools have been recognised for a considerable time. Yuhetty (2002) argued for the integration of technologies into school education in order to build the international competitiveness of Indonesia, noting that the success of utilization of ICT depends on

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the infrastructure, which includes the telecommunication network, the availability of Internet facilities and the use of Internet and the power grid. This notion of how access to ICT can increase competitiveness within and beyond Indonesia is a recurring theme in schools in substantial dialogue held with Indonesian teachers (Analytical Capacity Development Partnership, 2015). The literature about ICT in learning generally supports the notion that ICT allow teachers to develop different teaching approaches, which in turn are reflected in pedagogical changes. Hunt (2007) noted that certain pedagogical advantage exists for students when they use ICT. Hunt suggested that when learners use ICT, they can be exposed to a number of advantages, including:

- Access to information, people, places and events
- Opportunity to make thinking visible to oneself and others
- Collaboration opportunities that can enhance understanding
- A desire to continue learning: lifelong learning

Indonesian teachers (Silviyanti & Yusuf, 2014) also recognized these advantages for students in achieving constructive outcomes, couching much of their commentary in terms of the need to prepare teachers to be better users of ICT, ensuring students can gain these advantages. However, many teachers prefer the traditional ways of teaching: "This is how I was taught, so I will teach the same way." Another aspect of research toward the contribution of ICT to learning relates to home-school ICT access and use. Emerging evidence in the Programme for International Student Assessment (PISA) (Organisation of Economic and Cultural Development, 2014) suggests that students who use computers at school, as well as at home, are more successful on international testing of reading. Key ideas evident in the literature point to the advantages accrued through the use of a range of technologies (and disadvantages when use of ICT is prohibited or discouraged), including mobile devices. Many studies choose to collect data from teachers and parents. In considering the use of ICT, this study seeks to investigate and understand the ways in which students access and use ICT through the eyes of students.

The Literature about Student Voice

While there is a need to understand teacher perceptions of ICT use, a balanced view is constructed by identifying student perceptions of ICT use and access. This study was about students and their learning with ICT and thereby acknowledged the worth of student voice as equally relevant to data collected from teachers and parents. Historically, findings about children and their access to and use of ICT, and specifically ICT for learning, have been based on data collected from parents, teachers (Primrose, 2003) and commentators in the field (Prensky, 2007). Limited research has produced findings from data provided by children. Thrupp (2008) describes this approach to data collection as giving voice to students, student voice. Children are able to contribute valid data. Fromme (2003) argued for the need to see childhood as based in a social and cultural milieu. Consequently, to understand ICT as an element of this social and cultural milieu, it must be acknowledged that the children are the experts (Fromme, 2003). Data collected from children using techniques that acknowledge that children provide relevant and valid information (Downes, 1999; Fromme, 2003; Somekh et al., 2002; Thrupp, 2008) are important to the dialogue of ICT in learning. Jervis (2003) and Somekh et al. (2002) used drawings and concept mapping. Moreland and Cowie (2004) used cameras for data collection with children about technology. This technique was supported by interviews in studies by Thrupp (2008) and Mojica-Casey (2014) who

used student voice to collect data about access to and use of ICT. These techniques acknowledge the distinctiveness of gathering consistent and clear data from children and the need to capture the "social, cultural, situational and contextual" reality of children (Stake, 2005, p. 452)

The following research questions, focused particularly on student voice, are considered relevant to this study.

- 1. What is the range of ICT presently used in primary, lower secondary, senior secondary and vocational schools in Kota Salatiga?
- 2. How are these ICT used in classes? What is the frequency of their use?
- 3. What ICT would students like to use in classes?

Methodology

The research used a mixed methodology, where the survey collected data that was both closed response (using Likert scales) and open response (qualitative). Trained enumerators were sent to schools to administer the surveys. The fifty-two schools provided 1738 participants located in Kota Salatiga, Central Java, Indonesia. The schools represented primary/elementary, lower secondary, senior secondary and vocational phases of schooling. Further sampling represented schools in urban and periurban areas; a further consideration was that the schools represented approximately 60:40, in favour of government schools. The remaining schools were either private schools or those operated by charitable foundations (yayasans). Data analysis was a collaborative effort of researchers from UKSW and USC. It was completed using SPSS and an online data collation tool developed by staff at the Faculty of Information Technology, UKSW. All surveys were conducted in Bahasa Indonesia with translations of open response data provided for English-speaking researchers. Permission was granted by the Kepala Dinas Pendidikan: Kota Salatiga. Ethics approval was granted by the University of the Sunshine Coast Human Research Ethics Committee.

Data Analysis

In this section, data from Questions 1, 2, 3, 4, 5, 6 and 9 are analysed. Questions 7 and 8 of the survey probed the use of smart phones and social media and are the subject of a future paper.

Demographic Data

The data demonstrates a balance between the primary (33) and secondary (19) sectors and between gender. It represents Years 5 to 12 of formal education in Indonesia.

Table 1

Number of School Type in Sample N=1738 Number of Number of male Number of type female students students 1. Primarv/Elementarv 33 481 456 2. Junior Secondary 10 218 201 3. Senior Secondary 6 151 105 4. Vocational High School 3 68 58

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Access to and Use of ICT

The data probing student use and access to ICT at school was collected from nine questions. The following is a broad summary, including instances where data have been considered at the school type level.

Table 2

Access to and Use of Computers at School	N=1738			
35.5% of students never use a computer in class				
53% of students use a computer either one or more times a day or two to three times a wee	ek.			
84.2% of students do not use digital cameras in classes				
5.2% of students do not use television for learning in classes				
16.7% of students use email at school				
16.5% of students use text messaging at school either one or more times a day or two to th week	ree times a			
50.9% of students use the internet at school either one or more times a day or two to three week	times a			

For the complete cohort, the trend is for use to increase with years of schooling. Of participants, 53% used ICT at school one or more times a day or two to three times a week. This is supported by 51% reporting use of the Internet at school and 25% reporting use of email at school. However, other uses such as laptops, tablets, digital cameras, television and messaging are not strongly evident. An analysis of the data above, by school type, shows that 50.1% of primary/elementary students use computers either one or more times a day or two to three times a week. For students in lower secondary, the frequency of use decreases to 37.7%. However, for students in senior secondary and vocational schools, there is an increase to 77.9% and 78.2% respectively. One question sought responses about using the Internet for learning. 50.9% students use it either one or more times a day or two to three times a week. When these data are examined by school type, it shows that 37.3% (349) students in primary school use the Internet either one or more times a day or two to three times a week; 53.5% of students in lower secondary use the Internet either one or more times a day or two to three times a week; 91.7% of students in senior secondary use the Internet either one or more times a day or two to three times a week; and 59.5% of students in vocational schools use the Internet either one or more times a day or two to three times a week.

Attitude to School and ICT Use

A series of questions in the next part of the survey considered the issues of attitude to using ICT, attitude to school and how ICT was used at school. It was considered unnecessary to analyse by school type with participants from all categories of schooling highly represented in the positive.

Table 3

Use of ICT at School and Attitude to School and ICT Use	N=1738
90.3% of students reported that their teacher uses a wide range of ICT	
91.1% of students believe that ICT helps them to learn more	
89.6% of students enjoy using ICT for learning	
87.3% of students expressed the view that they like being at school	

97.3% of students expressed the view that they learn a lot of new things at school

Participants expressed a strong and positive attitude to school and learning. Furthermore, they strongly believe that ICT would contribute to increased learning. Within this data, it is difficult to ascertain if this belief is due to the use of ICT by teachers in the classroom (90.3%) or students having experiences beyond the school that help them know how ICT can support learning. Participants report limited use as is evident in the nature of and number of responses in Table 4.

Table 4

In What Ways Do You Use ICT at School? Not all students responded Common themes here related to: Completing lessons (92 references)

Finding information and knowledge (422 references) Finding materials for presentations and completing tasks (479 references) Typing notes (74 references)

Out of School Use of ICT

Participants accessed and used ICT outside of school, both at home or elsewhere. In previous research in Australia, it had been found that home ICT environments were richer than that at school (Appleton, Hunt, Heldsinger & Thrupp, 2006; Thrupp, 2008). These data (Table 5) support this notion.

Table 5

Other ICT You May Use	N=1738
88.5% of students own or use a mobile phone	
58.1% of students have Internet access at home	
98.5% of students have television at home	
34.8% of students have a gaming machine at home	

The high level access to phones (88.5%) in association with Internet access provides access to a wide range of ICT processes unavailable at school. Further analysis by school type found Internet access in the home increasing with age from 53.8% of primary students to 94% junior secondary whilst for senior secondary and vocational schools the figures respectively are 97.2% and 96.8%.

Table 6

Examples of Othe	Not all students responded		
	No. of references		No. of references
Computers	332	Handphone (HP)	471
Laptops	732	Television	142
Notebooks	37	Calculator	36
Tablets	320	WiFi Modem	52
Radio	361	Printer	22

Examples of Other ICT Used at Home

These open responses (Table 6) provided insight into home ICT environments. The limited range could be due to lack of identification by some participants as to examples of ICT in the home. This was found to be problematic in a study by Appleton, Heldsinger, Hunt, & Thrupp (2006). Home environments are tending to be richer than
school, a not uncommon situation. This disparity has so far not encouraged students away from an interest in schooling generally but they are clear that school could offer more ICT opportunity, whether it be through a supported Bring Your Own Device (BYOD) program or greater access to ICT at school.

Where Computers Are Used and Frequency of Use

While the previous sections have enabled a comparison of the school and home ICT environments, data analysis here delves more deeply into the nature of the use of computers at school. Knowing where computers are used in schools can provide an insight to the pedagogies employed by schools and teachers, e.g., are laboratories of computers the most effective way to deploy them? It can also provide an insight about time available to use computers and potential indicators about the professional development needs of teachers. Table 7 shows broad information about student use of computers at home and school, providing for ready comparison.

Table 7

Where Computers Are Used and Frequency of Use

N=1738

31.2% of students use a computer in their *classroom* either one or more times a day or two to three times a week

64.1% of students use a computer in a school laboratory either one or more times a day or two to three times a week

71.5% of students use a computer *at home* either one or more times a day or two to three times a week

26.3% of students use a computer in an *Internet shop or public space* either one or more times a day or two to three times a week

Use of computers away from the school environment outweighs use in the school environment. Further examination of data shows 12.7% of primary students use computers in a laboratory one or more times a day or two to three times a week as compared with 17.2% of junior secondary students. Increased use was evident for senior secondary students with 35.9% and 63.5% of vocational students. There appeared to be limited availability of ICT in school libraries.

Software Used in Schools

The survey suggests that the software available for student use is limited. Microsoft Office Suite was noted in many instances. With the exception of MS Office and Corel Draw, all other noted packages comprised freeware. An analysis of student responses is shown in Table 8 and Table 9. This data is indicative of use and does not allude to quantity of use or competency with the software.

Table 8

Software Used with ICT at School

N=1738

94.1% of students have used Microsoft Word at school 77.6% of students have used Microsoft Excel at school 71.1% of students have used Microsoft PowerPoint at school 23.1% of students have used Photoshop at school 20.7% of students have used blogs at school

14.0% of students have used wikis at school

Other Software Us	Not all students responded No. of references		
No. of references			
Paint	711	MS Word	57
Google	286	Notepad	53
Corel Draw	210	YouTube	50
Google Chrome	177	Adobe Flash	34
Mozilla Firefox	122	Email	10

Table 9

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The use of online tools like blogs and wiki is infrequent -- possibly suggesting that they are not valued for learning at any level of schooling, or that teachers are not comfortable in their use. The use of blogs was analysed at school type level, increasing from 9.5% for primary students to 32.4% for junior secondary to 37% for both senior secondary and vocational students. Limited use of some software could be indicative of the need to further investigate how these tools can be used to support learning.

Student Capability: Self-Ranked

Students were asked to self-rank themselves in terms of how capable or proficient they were at using ICT: 77.5% of students rated themselves as Capable or Very Capable. Evidence suggests that capability is constructed at home and not through school access or use. Further investigation of criteria used by participants to self-rank would clarify this data, especially exploring the criteria across the years of schooling.

Wish List for the Future of ICT at My School

Students were asked to make open-ended suggestions at to how their ICT experience at school might be enhanced. While most responses focused on ICT devices, a number also spoke of the need to have better qualified ICT teachers. Commentary suggests pedagogical changes that enrich the engagement of students in different approaches to learning enabled by ICT. Participants portrayed knowledge of the extended types of learning (e.g., finding information) available to the contemporary student where ICTenabled learning is an element of curriculum design. (ACDP, 2015; Thrupp, 2008). Typical responses are listed below and should be considered in the context of words they are associated with.

Table 10

What Do You Wish for in New ICT?

- Practical work using computers and not text books
- Finding information more easily
- Having better WiFi access
- Using smartphones in class
- ICT makes better learning
- Google helps to find information and improve knowledge
- Skilled teachers for advanced ICT

The phrases above are a compilation of the broad themes identified in the data. Leximancer (University of Queensland) was the text analysis tool used. The responses here suggest a need for a pedagogical shift in teaching, a shift away from a didactic, aural and book oriented pedagogy towards a pedagogy that supports creativity, independent and collaborative learning, and is visually and spatially oriented.

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Answering the Research Questions

Following is an analysis of how the data previously discussed and analysed contributes to answering the research questions.

RQ 1: What is the range of ICT presently used in primary/elementary, junior secondary, senior secondary and vocational schools in Kota Salatiga?

Access to ICT appears an issue for students in some schools, particularly the primary years. Generally, access and use increases at the upper end of schooling. The range of ICT is limited, both in hardware and software. This finding is in contrast to ICT access and use at home. Use and access in the home increases further towards the upper years of schooling. Use and access at school is also much higher in the upper years of schooling. This is consistent with findings in Western countries like Australia. Despite this, students remain positive about using ICT for learning and enjoy attending school. It appears that their view that ICT supports learning has been developed more from their access and use at home.

RQ 2: How are these ICT used in classes? What is the frequency of their use?

Frequency of use of ICT in schools in Kota Salatiga ranges from Never to One or more times a day. Some of this relates to the use of ICT by teachers. The use by students is less frequent. This suggests one of two issues. Firstly, it could suggest that teachers view ICT as of use to learning only if use is within a teacher-directed context, this being the teacher using the ICT. Secondly, it could suggest a lack of ICT resources in sufficient quantity to enable access by students. The lack of ICT such as digital photography, wikis and blogs suggests the need for exploration by teachers of their use in creative ways to extend learning, that is, using new tools for new ways of learning. The software listed by students suggests a more traditional view of curriculum and pedagogy.

RQ 3: What ICT would students like to use in classes?

Participants were clear and comprehensive on the view of ICT needed to meet their needs as contemporary learners. It is noteworthy that students understand that access is not the answer but that ICT use in the classroom needs to be matched by pedagogical change through different approaches to and different ways of learning. For example, note was made of the need for students to locate information through hands-on access. In planning for the use of ICT, teachers need to design alternate classroom management and evaluate the use of collaboration and communication between students, now easily enabled by ICT. Students were also insightful of the needs of their teachers, identifying that they need teachers with a greater knowledge of ICT and readiness to adapt pedagogy, sometimes moving away of traditional approaches.

Where to from Here?

It can be concluded that participants enjoy their current schooling though data at the higher end of schooling is less conclusive than for primary and junior secondary schooling, due to sampling size. Currently though, learning with and about ICT appears to be largely a function of the home. Students are suggesting that the responsibility for learning with and about ICT could rest more fully with the school. They also suggest that for this to occur a wider range of ICT-enabled learning contexts need to be implemented, and, for this to occur, support for teachers in strengthening both their knowledge of ICT and alternative pedagogical approaches is required. Consequently,

there is evidence in this study for schools, teachers and education systems to reflect upon the identity of contemporary learners and work with this identity to improve the ability of Indonesia to compete.

This study has provided validity for the instruments developed: survey forms and collation tools. Negotiations are progressing with a view to developing a fully online version of the instrument that can be accessed by other schools seeking to determine their student ICT profiles and views of ICT access and use at school: a sort of student ICT Opinion Survey. Data of this nature can inform school planning for ICT acquisition and maintenance, as well as drive pedagogical change through targeted Teacher Professional Development.

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OPEN WINGS II: TOWARDS THE DEVELOPMENT OF THE GREATER SENSE OF SELF

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Abstract

This paper presents the "Open Wings II" project, which is the continuation of an effort started in 2012 to create a community of self-directed learners in elementary education and to enhance their homonomy, the meaning they derive in life by being and feeling part of a greater whole. Technology-enhanced international videoconference presentations resulted in both knowledge gains and attitude changes. These in turn inspired collaborative, creative interdisciplinary projects through which students demonstrated that they could embed themselves in contexts that contribute to homonomous identification and development.

Introduction

As in previous school-based projects since the year 2012, the main aim of the "Open Wings" project is to create a community of self-directed learners and to enhance their homonomy, the meaning derived in life by being and feeling part of a greater whole (Angyal, 1941, as credited by Boucouvalas). The idea lies in the introduction of the homonomous (connected) Self. As constructed by Boucouvalas, self with a lower case "s" refers to one's separate individual self, characterized by autonomy, while Self with a capital "S" refers to the expanded connected sense of Self, characterized by homonomy. Together, they constitute the complementary dimensions of selfhood, suggesting a conceptualization of s/Self that includes both autonomous and homonomous dimensions (Boucouvalas, 1988, 1999, 2009). Figure 1 by Boucouvalas depicts an open system of worlds within worlds, contextualizing an individual as part of greater wholes, each of which addresses part of one's homonomous identity. Figure 2 by Pyrini adapts the visualization to the needs of elementary school students (Pyrini, 2013).



Figure 1. By Boucouvalas (2009).



Figure 2. By Pyrini (2013).

The student is embedded in contexts that contribute to homonomous identification and development with an interdisciplinary approach. As individuals, students are first connected with the small working group of the class, then connected with students and teachers from other classes in the school, subsequently connected with the local community, and finally with the country and the European Union. The spiral may of course extend to other contexts and disciplines.

Project Description

Aims and Objectives

In the "Open Wings" project the students of Nancy Pyrini and several other elementary school teachers "open their wings" to connect with Deacon Orestes J. Varonis, Ph.D. and Ms. Evangeline (Litsa) Marlos Varonis in the state of Ohio of the United States of America via WebEx, a Cisco web-conferencing tool. Orestes narrated how he left Greece after high school in order to study in the United States and ended up making his life there. The narration offers opportunities for direct links with different subjects of the school curriculum such as: language, history, geography, physics and religion. Our hypothesis is that the story telling increases the students' engagement and attention and learning comes naturally. We also anticipate that Orestes will serve as a role model and will manage to influence students' beliefs, misconceptions and negative attitudes towards economic migrants and refugees. This specific aim proves especially timely now that a new wave of anti-refugee xenophobia has stricken the European Union member states and the globe. In such a fragile context, the need to support children to empower not only their personal homonomy but also the homonomy of the groups they participate in is imperative.

The students may very well engage their homonomous dimension by strong identification within their ethnic group and in turn manifest as an autonomous identity. Then, if the ethnic group fails to connect with even greater wholes, or feels threatened by other groups, centrisms may arise (Boucouvalas, 1999, 2009), and the refugees and asylum seekers as well as the economic migrants can easily become scapegoats.

The objectives of the project are consistent with the five fundamental types of learning to provide quality education and foster sustainable human development (Delors et al., 1996; UNESCO, 2011), specifically:

- To closely examine the narration of the story of Orestes' life, to address the content, the context as well as global issues and local priorities, to recognize that the society, now as then, is in the midst of a pervasive transformation and to reflect on the ever-growing needs of the local society (*Learning to know pillar*).
- To solidly balance the homonomous and the autonomous developmental trajectories, individually as well as collectively, and to deal with the well-being and the complete development (mind, intelligence, sensitivity, aesthetic appreciation and spirituality) of all members of the project (*Learning to be pillar*).
- To build capacity for group-based decision making, crisis management, tolerance, flexibility and understanding of change as well as to raise awareness of diversity, equality and inclusion in the learning processes (*Learning to live together pillar*).

- To develop an action plan to bring change in the school environment and the local community (*Learning to do pillar*).
- To integrate the values inherent in homonomy into all aspects of learning and to empower students to assume responsibility for creating and enjoying their own learning environment. To empower students' active citizenship (*Learning to change pillar*).

Participants

Two schools participate in the project: the 1st Primary School of Rafina and the Primary School of Agia Marina, Neas Makris, both located in East Attica, Greece. Four classrooms are involved at the 1st Primary School of Rafina: two first grade classes of 49 students and two sixth grade classes of 37 students with five teachers involved. One classroom is involved at the Primary School of Agia Marina, a sixth grade class of 16 students with one teacher involved. All five classes include some children with special educational needs.

Since our research interest includes the use of technology in this case study, we narrowed our focus here to the sixth grade, focusing on the 53 sixth graders: the 37 from Rafina and the 16 from Agia Marina. The schools do not have considerable technological infrastructures to support the project. For example, our colleague from Agia Marina may access the Internet only if she leaves her classroom, and another classroom is not always available. Our colleagues teaching the first graders do not have computers or video projectors or any other electronic device in their classrooms. Therefore, for most learning activities we need to rely on the technology the children have available at home and can bring to school when necessary.

Methodology

Spanning one school year (September 2015 – June 2016), the project embraced the e-Reflect methodological approach, developed within the framework of the "e-Regenerated Freirean Literacy through Empowering Community Techniques" project (e-Reflect, 2016). This project falls under the Erasmus+ programme in the field of cooperation and innovation for good practices, which is consistent with our theoretical framework as it supports self-directed learning and the balanced development of both trajectories, the autonomous (separate, individual) and the homonomous (connected, collective). The "Reflect" acronym stands for "Regenerated Freirean Literacy through Empowering Community Techniques". It was initiated in 1992 by Action Aid (2009), as an innovative approach to adult learning and social change that fuses the theories of Paulo Freire with participatory methodologies developed for Participatory Rural Appraisal (PRA). The method allows adjustments to meet the needs of specific groups of learners taking into account the conditions of their environment and, given its roots in adult learning, is designed to help them mature as learners.

The method includes six stations:

Station I: "We listen to the world around us." The objective of this station is to share and discuss a personal change experience.

Station II: "We spot an issue." The objective of this station is to brainstorm on local, community and global issues and decide upon a focus issue.

Station III: "We analyze an issue." The objective of this station is to analyze in depth the causes of an issue.

Station IV: "We plan for action." The objective of this station is to identify factors that encourage or inhibit change and to design action plans to tackle the issue.

Station V: "We act." The objective of this station is to implement the action plan developed in the previous station.

Station VI: "We reflect." The objective of this station is to reflect upon the whole learning experience and especially the learning process.

From a variety of tactics suggested during the professional development of teachers involved in the e-Reflect project, we selected those better serving the philosophy of our project:

Friendliness. We, teachers and students, are trying to become parts of meaningful groups to discuss our ideas.

Bargaining. We use integrative bargaining, an approach which concentrates on finding a win-win situation for all parties involved in case of a conflict. The basic rules we follow for a successful bargaining session are: (a) Have a common goal, (b) Respect each other's positions, (c) Ensure that all sides are motivated to make the situation work, (d) Safeguard that trust and good mutual communication form the basis of talks.

Reason & Education. We try to persuade each other using reasonable and logical arguments.

Forming Coalitions. We are building knowledge coalitions seeking for external support. Such is the basis of our cooperation with Orestes and Litsa as well as with the Vocational and Training Schools of Markopoulos-Oropos and Rafina when we needed expert support in engineering.

Empowering. We establish connections in order to develop our greater sense of Self while developing Core Values and a Sense of Mission. The core values that emerged during our work can be summarized as follows:

Develop positive attitudes towards: (a) immigration and the state of a refugee, (b) major changes that people need to make in their lives due to the rapid developments in their countries and the world, (c) mobility of individuals and groups in the European Union, (d) the safe use of ICT to seek for information and develop knowledge, (e) the respect of intellectual property and the protection of intellectual rights.

Our sense of mission is to "Open our Wings towards the development of the greater sense of Self," the title of this paper, in order to "become the change we wish to see in the world," quoting Mahatma Gandhi.

Project Activities

The project activities included student participation in specific stations, each of which was intended to take place or at least begin in a pre-determined order. However, based upon learning outcomes, that order changed during actual implementation.

Station I: We Listen to the World around Us

During our work at the first station, the students discussed in focus groups what "change" means and which are the driving and restraining forces towards this process. What we perceived as amazing is how fast the students realized that change is a process which may sometimes be laborious. They also very quickly realized that change affords opportunities for growth. But at this point they were quite puzzled about how our country, which has experienced a major transformation process during the last six years, not only is not growing but on the contrary is starting to lose basic social infrastructures and services. The session ended with a "contractual agreement" including our mission statement and our mutual goals. The contract has been signed by all members of the group and hangs on the wall. Quotes from the contract follow (the original text is in Greek and translated here by the primary author).

Open our Wings towards the development of the greater sense of Self and become the change we wish to see in the world.

Empower our active citizenship by first taking a small step forward and act within our school communities and then by leaping forward to act in the society so as to inspire others to follow our example.

Express our ideas and emotions through art.

The eight videoconferences with Orestes and Litsa are included under the activities of Station I, as the objective of this station is to share and discuss a personal change experience.

In the course of six 45-minute videoconferences, Orestes narrated the story of his life by talking through PowerPoint presentations that included many photographs and maps, from his humble beginning as a child in a Greek island, to the many obstacles he had to overcome as a foreign student in USA, and to his successful career and family life in USA. Also during an additional two 45-minute videoconferences, Litsa spoke first of her personal journey to health as she identified herself as a DES Daughter, as her mother was prescribed the synthetic estrogen DES during pregnancy, followed by a discussion of new internet-based academic challenges and the design and development of instructional materials on citation and plagiarism.

In the first videoconference, Orestes discussed his early childhood years on the Greek island of Chios, the challenges and the difficulties growing up without electricity or plumbing, and his disappointment and frustration at not having financial means to continue his education beyond high school. He also shared with the students how the hope for a better future changed unexpectedly during his last year in high school, after one of his teachers gave him the name and address of a small college in the USA and encouraged him to write to that college about admission and financial aid. He spoke of his decision to pursue this possibility for academic studies abroad and of his detailed planning and negotiating efforts in order to obtain from this American college foreign-student admission and a small amount of financial aid.

In the second videoconference, Orestes continued his narration by discussing the legal and financial obstacles he had to overcome, such as, permission from the Greek Government to study abroad, acquisition of a Greek passport, passing the required English language competency examinations, acquisition of a Visa to enter the USA as a foreign student, and the coverage of academic and travel expenses to USA. He also discussed the means by which every single obstacle was overcome due primarily to his renewed hope for a better future, diligent actions, a miraculous sequence of certain events, and assistance received from several kind individuals. At the end of each of the first two videoconferences, the students watched educational videos and became engaged in interactive on-line activities and games to better understand the refugee crisis Greece is suffering; these activities are freely available at the website of Amnesty International (Roch, 2016).

The third videoconference with Orestes was mainly focused on Geography as he presented the path he traveled by land, sea, and air from Chios to Olivet in Michigan. Included were the specifics of travel by air from Athens to Cairo in Egypt, by taxi from Cairo to Suez in Egypt, by freight-boat from Suez to Erie in Pennsylvania via the Canada/USA Great Lakes Seaway, by bus from Erie to Lansing in Michigan, and by taxi from Lansing to Olivet in Michigan. This difficult and ultimately successful geographic journey became a metaphor for his intellectual and personal journey as he attended college in a foreign country, studied in a foreign language, earned money to support his education, and eventually settled into a new existence in the United States.

The fourth videoconference was in Orestes' area of professional and academic specialization, focusing on his earned degrees in Physics, Mathematics and Electrical Engineering, and on his technical specialization in the research, development, and implementation of advanced electromagnetic sensors and systems for the inspection of industrial products and processes. This session was directed to only the older students, and they found it difficult to follow. The main aim was to demonstrate an example of a successful career in the field as motivation for their own future plans.

The fifth videoconference was on the Greek-Orthodox Church and Community in Ohio, the state in which Orestes and Litsa now live. A major focus was how members of the Greek immigrant community, now in the 4th and 5th generation, still maintain and promote to American society their Greek culture and religion through their identity with the Greek Orthodox church.

The sixth videoconference featured Litsa discussing a different kind of journey, a journey to health. She identified herself as a DES Daughter, as her mother was prescribed the synthetic estrogen DES during pregnancy. This drug was prescribed for over thirty years to pregnant women in an attempt to prevent miscarriage, despite the fact that it was never proven effective and in fact was known to cause cancer in laboratory animals. Although it was taken off the market for that purpose when it was linked to cancer in the children of the women who had taken it, it continued to be used in animal feed as it allowed farmers to bring animals to market faster and also increased milk production. Litsa integrated her discussion of DES with a discussion of endocrine disruptors that are still found in the food supply and in food packaging, as well as a more general discussion of how substances that women are exposed to during pregnancy can affect their own health, the health of their children, and even the health of their grandchildren. She also discussed the importance of avoiding toxins in order to remain healthy, including the toxins in cigarettes and narcotics. She finished by making an economic argument, showing a graph of the salaries of two young men drafted into the American National Basketball Association (NBA): one started with a high salary that fell year after year because he was abusing drugs and lost the trust of team owners and coaches; the other started with a much lower salary that rose year after year because he worked hard, behaved with integrity, and respected the rules of the team. At the end, the player experiencing success was identified as Kosta Koufos, a young man of Greek

descent whose mother had immigrated to the United States and who has played during the summer for the Greek National Team.

In the seventh videoconference, Litsa discussed her multiple-authored paper "Beyond Cut-And-Paste: Creating Interactive Online Resources to Introduce First Year Students to Academic Citation," presented at ICICTE 2015. She discussed how higher education students need to master the skills that will allow them to identify as members of an academic community, including the ability to cite the work of others and avoid the mistake of plagiarism. In order to address the high incidence of plagiarism among first year students, a team composed of staff and graduate students at The University of Akron collaborated to create interactive online training in citation and plagiarism, including multimedia, text presentations, and automatically-scored quizzes. She summarized the design, development, implementation, and evaluation of the Spring 2015 pilot project, stressing the high degree of collaboration involved.

In the final videoconference, Orestes talked to the children about his family and social life in the U.S., and shared with them the experience gained during his 50-year high school reunion in Chios, his travel with Litsa to Ellis Island and the Statue of Liberty in New York, and their visit to "The Greeks" exhibit in Chicago's Field Museum of Natural History. Of particular interest was the comparison he made between: 1) his journey to the U.S. seeking educational opportunity, which eventually provided him the means to a better life; 2) the journey made by millions of European immigrants crossing the Atlantic Ocean on boats, passing through the non-dignified examination halls at the Ellis Island, seeking a better life in the U.S.; and 3) the current refugee crisis in Europe, with over a million individuals from the Middle East, Asia, and Africa migrating into Europe in 2015 alone. In closing, he shared a few pictures from Rafina taken in September 2015, when he met with some of the students of the prior year's "Open Wings I" project. It was serendipitous that during this last session some of those students visited the class, attended the session, and had the opportunity to once again thank Orestes and Litsa for their efforts and contributions.

Station II: We Spot an Issue

Students brainstormed on local, community and global issues inspired by the videoconferences and decided upon their focus issues: (a) Distinguished Living Personalities of the Greek Diaspora, (b) Intellectual Rights and Plagiarism, (c) Genetically Modified Food, and (d) Key Competencies for Academia and the Labour Market as Cultivated through Sports Education and Participation.

During our work in Station II, there was a great deal of brainstorming about possible actions to tackle the problems that the children had identified, and therefore Station III was postponed in order to come up with an Action Plan.

Station IV: We Plan for Action

The students decided: (a) to organize a "Students Symposium" simulating all the procedures followed in an academic conference in order to produce "scientific papers" on the themes that they chose in the previous Station, present their work to their parents and members of the local community, and publish their proceedings aiming at raising awareness on those issues; (b) to launch a website to announce all the news and steps taken to implement their action plan; (c) to organize a basketball game and (d) to give a

rock concert at the end of the school year including songs that convey a message about social and political themes covered during the Open Wings project.

Station III: We Analyze an Issue

Students studied in groups, investigated in depth their themes of interest by utilizing the Internet. They were especially cautious as regards to the evaluation of the resources they found concerning criteria such as credibility of the source, differences between resources and the possible reasons why this is the case, evidence of bias, references, quality badges, and other markers of trustworthy sites.

Station V: We Act

The students collaborated on implementing their action plan. A website was created and updated as the work progressed. The invitation and the programme of the Symposium were published on the website and circulated via social media by the teachers and parents. The teachers' guidance and support in this process was intense for the protection of the children's anonymity and privacy. The completed manuscripts of the students' papers were submitted and the teachers undertook the role of the reviewers and editors of the proceedings. The Symposium was held on June the 10th 2016 on the premises of the School of Agia Marina. Students carefully selected the repertoire of the concert so as to convey political messages relevant to the aims of the project and rehearsed diligently for their performance. They also prepared a video to display during the performance.

Station VI: We Reflect

The students reflected on their learning experience and represented their course and progress, drawing their personal spirals. The picture of each student was placed in the center of the spiral and then the students continued either with the connections they built, or with learning subjects they researched deeply. Then, students were divided into groups and each group created "The Knowledge Tree" of the group. See Figure 3.



Figure 3. "The Knowledge Tree," artwork created by the students of Group 2 (ST'2) of the 1st Primary School of Rafina.

Learning Outcomes and Intellectual Outputs

Pre-test and Post-test Results

Two sessions of testing, identified as Session #1 and Session #2, were conducted by administering pre-test and post-test questions to three groups of sixth graders from two elementary schools. The tests evaluated changes in knowledge and attitudes towards immigration and refugees that resulted from the topics covered during the Open Wings II videoconferences, and data was collected through the use of handheld audience response system devices (clickers) utilizing Turning Point 5 software.

- In Session #1, focusing on the first two videoconferences delivered by Orestes, 20 questions were given to students, 17 multiple choice questions and three true/false questions. Eleven of the given questions had a single correct answer, and nine questions were designed to allow the students to express their opinion on a given topic.
- In Session #2, focusing on the geography included in the third videoconference delivered by Orestes, 15 questions were given to students, nine multiple choice questions and six true/false questions. All 15 questions had a single correct answer.

Data analysis summarizes (a) changes in *student knowledge* following participation in the videoconferences, as indicated by percent correctly responding and (b) changes in attitude, in particular *student views of the refugee crisis* in Europe, as indicated by percent agreeing or disagreeing with certain statements.

One key finding was the change in students' attitudes towards refugees. At a time when Greece is experiencing an economic crisis, it has also become a bridge between other countries and western Europe, and the millions of immigrants and refugees entering Greece have required significant resources and incited distrust in a population already responding to economic austerity measures. A question designed to address student concerns was phrased "The immigrants' wave to Europe frightens me" and gave students seven response options on a Likert scale: strongly agree; agree; somewhat agree; neutral; somewhat disagree; disagree; and strongly disagree. For the purpose of analysis, all the "agree" responses were summed and contrasted with the "disagree" responses. Before the sessions, over 68% of the students agreed that they feared the immigrants and just over 19% did not; the others were neutral. The students were significantly less fearful of the immigrants following the sessions ($X^2 = 5.44$; p < 0.05): a majority, albeit a slight majority, of 51.71%, were not afraid. However, despite their increased insight into the state of the refugees and economic migrants, xenophobic feelings remained, with 48.29% agreeing that they were frightened (see Figure 4). The students' cognitive conflict was quite clear, but we hypothesize as a result of hearing Orestes' story they realized that people leaving their countries to seek a better future elsewhere are people like their dear Orestes.

There was a similar but less pronounced change in attitude towards the statement "Refugees financially burden the countries where they go," with the majority agreeing at the time of the pre-test (50.66%, vs. 41.54% disagreeing) but more disagreeing at the time of the post-test (44.45%, vs. 38.18% agreeing), with the others being neutral; however, this difference was not significant (($X^2 = 1.17$; p = 0.28). See Figure 5.



A table representing additional results from the Session #1 pre- and post-tests is available on the <u>website of Open Wings</u>.

A second key finding is the students' gains in factual knowledge following the videoconferences. For Session #1, across all groups, the average correct on the pre-test was 35.37% while the average correct on the post-test was 60.64%. The class taught by Nancy Pyrini averaged 35.46% correct on the pre-test and 81.82% correct on the post-test. For Session #2, which focused on geography, across all groups, the average score on the pre-test was 47.55% while the average score on the post-test was 73.10%. The class taught by Nancy Pyrini averaged 42.10% correct on the pre-test and 89.89% correct on the post-test. While all three groups evidenced gains in knowledge between pre- and post-tests for both sessions, the largest gain was that of the 6th graders taught by co-author Nancy Pyrini. We hypothesize that this is due to the additional collaborative enrichment activities she embedded into her curriculum related to topic; this interpretation is supported by Pascarella and Terenzini (2005) who note that "collaborative learning approaches can significantly enhance learning" (p. 103).

Due to the nature of the content of the fourth through the eighth videoconferences, testing was not administered. However, the sixth and seventh videoconferences became part of the students' research on "Intellectual Rights and Plagiarism" and "Genetically Modified Food" themes.

Students successfully identified their focus issues and came up with their action plans. What we found interesting is that aside from actions of an academic nature, the students embedded both sports and art into their action plans.

The students developed their research methods to include primary research that went beyond an internet search. They decided that their papers should include interviews of distinguished living personalities of the Greek diaspora as well as key competencies for academia and the labour market and how the development of these competencies can be enhanced by sports education. They set certain criteria for their search and came up with Dr. Leo Irakliotis, a researcher and administrator in higher education, and NBA player Kostas Koufos. They extended invitations to both of them and received positive responses, arranged for interviews via Skype and WebEx respectively, and developed questions relevant to their research on the papers, taking into account time constraints. They successfully participated in the first interview, which was recorded so it could be accessed again. Due to unforeseen circumstances at the 1st Primary School of Rafina, the second videoconference could not take place at that site, although Kostas and the students at Agia Marina connected. It was not possible to reschedule that interview session.

As a result of this authentic research experience, the students learned how to seek information from experts in various fields. For example, in one instance help in engineering was needed, and the students reached out to vocational schools in the Athens area and asked the students there to help them. The vocational schools responded immediately and positively and even prepared experiments and a simulation to demonstrate. All these actions took place within the school-day and were another example of the collaborative problem-solving that this project had hoped to inspire.

As mentioned above, the website went live and was regularly updated, including the addition of student-created invitations to and the programme of the Symposium, which were also circulated via social media by the teachers and parents. The students' completed manuscripts were accepted by the teachers/reviewers with minor edits. The students also handled organizational issues such as transportation from Rafina to Agia Marina, catering for the breaks during the Symposium, which they prepared themselves, and washing and making available jumpers at the Schools in preparation for the basketball game.

In collaboration with music teacher Mr. George Ververidis, the students selected the following songs for their rock concert (additional information is available on the <u>Open</u> <u>Wings website</u>): "It's My Life" by Bon Jovi; "Eye of the Tiger" by Survivor; "Beat It" by Michael Jackson; "Another Brick in the Wall, Part 2 Education" by Pink Floyd; and "We Are the World" by USA for Africa. The sociopolitical messages of the songs reflected the students' engagement with and reflection upon the project. The students also created a video to display during their performance, including both political messages and moments from their school life. Along with "The Tree of Knowledge," these opportunities to select messages and creatively represent them contributed to achievement of the Station VI reflection process. In addition, there were opportunities for discussion and reflection during the Symposium itself. The relevant outcomes were scheduled to be made available on the website of the project, in Greek, after the event took place.

Conclusion

Technology-enhanced international videoconference presentations resulted in both knowledge gains and attitude changes in elementary school children. These in turn inspired collaborative, creative interdisciplinary projects through which students demonstrated that they could embed themselves in contexts that contribute to homonomous identification and development, creating a stronger sense of both self and Self. Emerging from the 2008 economic crisis, Greece is going through a major transformative process which affords opportunities for growth of humanitarian principles towards sustainable development, as well as of inhuman behaviors, such as lack of mercy and compassion, which are destructive for the social tissue. Educators can help prepare the youth for the crises ahead, which will demand collective action and unity by informed active citizens, and the pedagogical framework behind this case study serves this goal.

On a more personal note, the emotional experience of this project was profound and difficult to convey in words. In an e-mail (personal communication, June 16, 2016) following the student presentations, Nancy Pyrini commented "All I could think of was how magnificent it is to keep the students happy and motivated and how my kids did not want to leave school, during the day and at the end of the school year, how emotional we got the last few days and how they burst into tears before, during and after the graduation ceremony because they just could not let go of what we built, and then how they regained their strengths, stating "it's time to open our wings and fly...".

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THE DEVELOPMENT OF A SOCIAL NETWORK TO SUIT USC STUDENTS' PROFILE

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Abstract

With the advent of information and communication technologies (ICT), the education panorama has been changing every day. It is observed that, due to the increasing need of the use of technological tools, teaching and learning change. This research resulted in the development of a social network prototype -- a mobile application for the Android platform -- aiming to help the integration of students, giving them the opportunity to meet according to the degree of relevance. The application enables the interaction with professors by sharing information, projects, courses and other services offered by the university.

Introduction

Moran (2012) affirms "The school is attractive" (p. 7). According to this author, the school does not offer attractions, and it is demotivating and for this reason, many students, especially those in higher education, are giving up studying because of lack of interest and stimuli. They do not like to research, and believe that school is too far away from their realities.

Also, according to Moran (2012), "It is not enough to put students in school. We must offer them an instigating, challenging, provocative and dynamic education, active from the start and in all educational levels" (p. 8). Many schools and universities are still attached to traditional teaching models, in which students are submitted to traditional, inflexible, repetitive and monotonous methods. It is true that many of these students are fully connected and immersed in a virtual world that is already part of their daily lives; their relations and interactions with the world are no longer the same as they communicate and update themselves constantly through information and communication technologies (ICT) that are available and growing all the time.

Schools that are not connected are incomplete. Students without a continuous access to digital networks are excluded from an important part of current learning: the access to varied and available online information, the quick search in databases, digital libraries, educational portals; the participation in communities of interest, in discussions and online publications, in short, the varied range of digital services (Moran, 2012).

For this reason, universities must be connected and ready for a new student profile, so that they can keep up with the advance of technologies and become more complete. It is necessary to offer students an innovative learning that motivates them, which is not necessarily conditioned to a classroom, as for Moran (2012) "[...] we can learn by being physically together and also connected, we can learn at the same time and rhythm or at different times, rhythms and forms" (p. 10).

With the advancement of ICT, social networks emerged and quickly became part of the teenagers' daily routine. Social networking is one of the representation forms of affective or professional relations from one human being to another, in the form of network or community. It can be responsible for sharing ideas, information and interests (Lorenzo, 2013).

According to Rosa and Kamimura (2012), social networks allow their users a diversified exchange of information and subjects of common interest, such as photos, videos and ideas. Thus, social networks are groups on the Internet that allow the sharing of data and information of various characters and shapes. For example, through them, you can post different files, texts, images and others.

The spread of social networks among the new generations, who are familiarized with the use of computers and mobile phones since childhood, has established a radically different scenario for social interaction. Even from a distance, you can stay connected to someone, and, in different circumstances, the distance tends to increase the level of connection.

At first, the use of social networks was mainly focused on the relation between friends or people with common interests; however, with their remarkable expansion, these networks now have a different role in society, in politics, in the media and in education. Academically, we can say that social networks symbolically toppled walls. We no longer need to be together in the classroom or occupying the same space for interaction. According to Lorenzo (2013), some institutions have found useful applications of social networking in education, and, currently, these applications have become important tools in the teaching and learning process in higher education.

According to Lorenzo (2013), networks allow us to share information about topics studied or proposed in the classroom as well as to strengthen the involvement of students and teachers through a new communication channel, making it an effective option for the construction of the relationship between students and teachers.

Social networks should be seen as virtual environments that offer various forms of interaction, which stimulate the contact with socio-cultural diversity, create conditions to create a network of friends and, at the same time, stay informed about the user's interest issues.

According to Monteiro (2011), Facebook, Twitter, WhatsApp, which are often cited as study dispersers, are increasingly inserted in the student's life. It shows that the problem and also the solution are not the social networks, but how these tools are used. With the use of a collaborative space, such as social networks, the teacher has the opportunity to verify aspects often difficult to identify in the classroom, such as the ability to write texts, the writing improvement, the research about a subject, the presentation of an opinion and the debate among students (Lorenzo, 2013).

The teacher is a professional who needs to recognize the possibilities and the added value to the teaching and learning process that social networks, virtual communities, blogs and micro blogs provide. It is not enough to be "new"; the teacher has to understand what this "new" brings for their pedagogical practice.

It is possible to share with students many materials involving subjects to be worked on in the classroom, such as multimedia, news, videos, music, film clips, etc. However, besides using the networks for the provision of content, teachers can use them in different ways in the teaching and learning process.

According to Pechi (2013), "To use the time students spend on the Internet to promote interesting discussions about everyday topics helps students to develop critical thinking and encourages the most timid ones to express their opinions" (p. 1). It is possible to take advantage of such proposals for individual and collective evaluation.

There are other applications provided by network communication that contribute in the educational process, such as notes and work results consultation, answering questions, calendar, instructions on activities, etc. According to Lorenzo (2013), "The challenge for educators is the incorporation of internet resources in social networking with the purpose of benefiting the teaching and learning process" (p. 35).

Pechi (2013) presents some social networks resources that allow this merging, such as: Virtual Groups, Discussion Forums, Blogs, Chat, Instant Messaging, Meetings and Video Conferences, E-mail Bases, Video Bases, etc. These resources leverage the educational processes and open up new possibilities for class complement in higher education; they do not limit the student to the physical space of the classroom because, according to Moran (2012), "[...] the physical and the virtual world are not opposite, they complement and integrate each other in an increasing, continuous, inseparable interaction" (p. 9).

It is believed that the use of ICT and social networks have become indispensable to an innovative class proposal. However, the traditional educational process must be respected. Therefore, the use of technological proposals through information and virtual communication tools are complementary to the classroom.

Considering that the Universidade do Sagrado Coração (USC) provides students from different courses the opportunity to meet each other in common subjects, the development of the social network proposed here -- exclusively created to suit USC students' profile -- aims to help integrating students by a Similarity Algorithm between profiles, giving users the opportunity to meet according to the level of relevance. For example, those who attend the same disciplines, providing a greater connectivity and even a first contact with a classmate.

The social network proposed in this study also aims to facilitate the interaction between teachers and employees sharing information, extra-curricular activities, projects, courses, events, publications, discussion forums, and many other services offered by the university, giving visibility to the whole community involved and allowing its effective evaluation.

Methodology

An exploratory research helps the researcher to know which of the many options apply to the research problem, and it might help to establish the priorities for the research. Priorities may be established because a particular explanatory hypothesis raised during an exploratory research will seem to be more promising than others are. Furthermore, the exploratory research will be able to generate information about the practical possibilities of conducting specific research (Mattar, 2012).

Therefore, this project was initially an exploratory research that studied the key terms that guide the purpose of this research.

Subsequently, theoretical materials of different subjects were studied. They are all associated with the purpose of this paper and include these fields of study: Software Engineering, Data modeling, Human-Computer Interaction, JavaScript, among others.

Data Collection Instrument and Target Public

We elaborated a questionnaire that served as a data collection instrument to verify which mobile operating systems the students use the most and their degree of satisfaction. Before the questionnaire was released for application, its questions were analyzed to check the actual need of verifying which mobile operating system students use the most. The focus of this proposal is the development of a prototype for the Android platform, which was confirmed to be the favorite among the subjects interviewed.

The target public of this research consisted of all USC students, regardless of the field or course. According to the survey, the most used operating system is the Android platform, as observed in Figure 1.



Figure 1. Survey of the operating systems used by students.

The Seek mobile application was designed to work on smartphones that use an Android platform superior than the 4.0 version. We used as external database – the MySQL and a web service developed in Java using the Axis2 library. Figure 2 illustrates this context.



Figure 2. Seek architecture.

The main objective of this social network is to search and list the relevant students for each user. The social network also searches all registered users, and it has a virtual bulletin board in which any Seek user can publish.

Results

Seek Development

To develop the Android application it was necessary to configure an environment containing the latest versions of the Java Development Kit (JDK) and Android SDK. The IDE used was the Eclipse Development Toolkit, version 22, and the library used to communicate with the Web service was the Ksoap.

Operation

Opening the Seek application, the user finds a login screen, as observed in Figure 3.

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🔍 Seek		
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	Login	
	Sign Up	
\bigtriangledown	0	

Figure 3. Seek login screen.

If the user is opening Seek for the first time, there is the option of registering, in which a login and a password are necessary, along with name, course, five attended disciplines and their respective weekdays. It is also necessary to send a photo, which will be used in the profile account. Figure 4 shows the registration screen.

			₫ ▼∠	22:42
🔍 Seek				
Name				
Igor Fastro	ni Cor	rêa		
User				
igorfastro	nicorre	a		
Password				
	••••	•••••		
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Computer S	cience			
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Figure 4. Seek register screen.

As soon as the user connects into the Seek system, an interaction screen (Figure 5) is presented with three options:

- Search All searches all registered Seek users.
- Relevant Search searches only users who attend one or more subjects in common.
- **Bulletin Board** a virtual bulletin board where any user can publish information such as jobs vacancies, among others. The purpose of this last option (virtual bulletin board) is to provide greater interaction between Seek users.

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Figure 5. Search users and access to the virtual bulletin board screen.

Figure 6, is an example of a result that is displayed when the option "Search All" is chosen. The application connects to the Web service that makes a search in the database to bring all registered users, which returns the information to the application, displaying all registered users in alphabetical order.



Figure 6. Search for all registered users screen.

The application allows the user to click on any name in the list and automatically visualize on the screen the selected user profile containing all the information, such as: name, course, photo and all the attended disciplines. Figure 7 illustrates this context.

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Figure 7. User profile registered on Seek screen.

Figure 8 illustrates the virtual bulletin board screen, in which any user can view what is published. On the bulletin board, the user can register relevant information requiring disclosure in the academic world, such as lectures, workshops, book sales, blood donation campaign, private lessons, etc.



Figure 8. Bulletin board screen.

Final Considerations

Although increasingly present in the everyday life of students and professors, social networks are still part of a world that can be much more exploited by education. There are still professors and students who do not use this resource to strengthen the teaching-learning process. This may be explained by the fact that the use of social networks demands from the professor and the student a new attitude towards the educational process. This becomes a major challenge. Therefore, we must seek an understanding between students, professors and educational institutions on how the social networks can work as assistant teaching methods. It is important to highlight that, the same way this type of media can be used for leisure, entertainment and for facilitating social relations, it can and should potentiate the teaching-learning process by collective creation and communication. Professors should mentor and facilitate learning through these new media.

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DEVELOPMENT OF A MULTIPLATFORM COMPUTER ALGEBRA SYSTEM TO SUPPORT THE TEACHING OF MATHEMATICS

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Abstract

Nowadays, it is common for teachers to hear from students complaints about math. They also show a great lack of interest in this subject, which is the basis of the scientific growth of a country and enhances the individual's logical reasoning, critical thinking and investigative habits. There is a variety of software focused on the field of mathematics; however, many people use the computer only as a teaching machine, arranging the content to be taught to the student in a convenient way. This paper aimed at the development of a computer algebra system to support the teaching of mathematics, using the computer as an incentive for learning.

Introduction

Education is the basis of a country, being responsible for its support and development. Thus, to promote the growth of a nation requires a quality education fostered by financial and scientific investments, new techniques and teaching methods. Much of the educational basis of an individual is formed in childhood and adolescence through subjects studied during elementary and high school, among which mathematics is the most difficult to learn. However, it is of great importance as it contributes to the development of the capacities of problem solving, researching, facing new situations, and being creative; at the same time, it provides the creation of a broad and scientific vision (Lintz, 1999).

However, it is common for teachers to hear complaints from students who do not like math and have difficulties to resolve simple operations (Paz Junior, 2008). The report "*De Olhos nas Metas*" shows the vast majority of students do not learn mathematics as expected, which might be a big problem, since mathematics is a cumulative area and a lag in certain content impairs further learning (Gonzatto, 2012).

One of the possible reasons for this lack of interest is that the classical model of math teaching aims at learning by repetition, which has been heavily criticized by advocates of modern mathematics education who seek to teach it by the understanding of its rationale (Paz Junior, 2008).

One way to promote interest in mathematics teaching is the use of technological resources as support material for classes, in which we can highlight the computer algebra systems. According to Alves, Amaral, and Mendeiros Neto (2002), these systems handle mathematical symbols according to the abstract rules of symbolic mathematics.

A particular programming language that, when not ambiguous, allows the computing representation of mathematical functions determines this symbolic manipulation. One of the advantages of these tools is the understanding that students have of the codes they have created in addition to the rapid response of the computer, which allow students to test different aspects of the same theme. Another aspect that should not be forgotten is the fun they provide to students, since they increase the students' interest in a given subject and promote interaction between them.

There are complex tools that allow the implementation of methodologies like these in university settings, but they are far from the reality of the elementary and high schools because of the prior knowledge they require and the difficulty of teaching students how to use them.

In this regard, this paper proposed the development of a computer algebra system that can be used to enhance the teaching of mathematics in elementary school, counting on a proper syntax that was developed aiming at clarity, easiness to learn and, at the same time, to demonstrate mathematical expressions and code reading. The proposed software has versions for Windows and Linux operating systems. Due to the low computational requirements necessary, its implementation is viable even on older computers, while the teacher can set the number of students per computer.

Methods

First, a bibliographic search was carried out to define the computer algebra system features, aiming to check its comprehensive range in the math teaching process, the language features used to represent the mathematical expressions, and, subsequently, to choose functions that must integrate the language library.

This survey occurred through researches carried out in the national curriculum guidelines relating to math teaching, which describe the mandatory contents taught in elementary and high school grades. The Brazilian Ministry of Education and Culture provides these guidelines. Such researches defined the period covered by the software – from 5th to 8th grade of elementary school.

These grades were chosen because the previous ones would hardly use the software as, at this stage, students only become familiar with numerical and math concepts. On the other hand, the subsequent series would hinder its implementation, expanding the project scope too much.

In the next stage, the national curriculum guidelines were analyzed again, as well as textbooks about teaching math in the selected grades in order to obtain information for guiding the language development.

During this study, we found the main contents taught in this period are: numbers and operations (arithmetic and algebra), space and shape (geometry), quantities and measures, statistics, problem solving, learning new meanings for the numbers, selecting and using calculations, learning arithmetic, factorization and simplification, surface and volume calculation, relation between measures and magnitude between two measures.

Thus, it was possible to outline the features the system should have. However, in view of the potential of the language for high school and for the computational logic teaching, the language was designed to meet the requirements mentioned above and expand for these other purposes, mainly by increasing its library, eliminating or reducing the need of changing the syntax.

During the syntax definition, knowing the extreme necessity of the computational representation of mathematical operations, the first measure taken was the selection of operators and their computational representations.

Besides the four classic operators, we also chose the rest of the division, exponentiation and square root in order to allow their quick and simple expression. Their equivalent symbols are:

sum: +
subtraction: division: /
multiplication: *
rest of the division: %
exponentiation: ^
square root: \$

The order of execution is exponentiation and square root, followed by multiplication, division, and rest of the division, and, finally, sum and subtraction. For operators with the same precedence, the execution occurs from left to right

Then, we chose the relational operators and their equivalent computational symbols, which seek to be similar to their equivalent symbols in math:

equal: == different: <> greater: > greater equal: > = lower: < lower equal: <=

The equal symbol was chosen to be == to allow the interpreter developed to differentiate the equal of the attribution symbol, besides being used in various programming languages.

The next step consisted of the selection of the types of data that can be stored as variables. Considering the issues addressed in this stage consisted primarily of natural and rational numbers, we chose computational forms to store them through the types of variables "integer" and "real"; the integer variable allows storing integer numbers, which encompass both natural and integer numbers.

The real variable allows expressing both rational and real values, increasing the range of issues that can be addressed. It is noteworthy that according to the theory of numerical sets, the real variable model can store natural, integer and rational numbers, besides the real numbers.

To facilitate the representation of textual values by students, we created variable models, such as "letter," which is nothing more than a representation of a character for a given numerical value stored in the variable. The type of empty data, present in certain languages, was avoided to keep the consistency of language and, at the same time, try not to confuse the student.

The next step was the creation of the variable declaration model. The method chosen was the statistic as it facilitates the implementation of the interpreter and provides students with an understanding of the type of variable and its representation for language and equation. This, consequently, forces them to think about the best model to solve a given problem and makes it easier for students to understand how the programming occurs. The variable declaration model created was: type name.

It is also possible to declare several variables of the same type at the same time, just by placing a comma between a variable name and the other: name type, name, name Declared variables have 0 (zero) as a value and can be modified through assignments that occur in the form of: variable = expression

Expressions can consist of numbers and / or mathematical and / or logical operators, other variables and parentheses. The parentheses make the expression inside them to be processed before any other operator. When the expression within the parentheses contains more than one operator, or other parentheses, they are processed as new expressions. These always return a true value that when attributed to integer or letter variables are converted. In the existence of more than one parentheses, they are executed from left to right.

The next step was the creation of the block model, which are ways of defining areas containing instructions and can be used in conditional tests, repeat loops, or in the declaration of functions. In this language, a block is created using the word "beginning" to delimit its beginning and "end" to delimit its end.

A function is declared by its type of return value, name, the parameters given in parentheses and separated by a comma; left blank if there are no parameters and, in the end, the block containing instructions, as shown in the example below:

```
integer fibbonachi (integer position)
beginning
...
end
```

The conditional test consists of the word "if" followed by a logical test and a block with instructions that will be executed if the expression in parentheses is true; it can be followed or not by the word "else" with a conditional block that will be executed if the expression is false, as shown in the example below:

if i < 12 beginning end else beginning ... end

Finally, repeat loops were created, "while," "make" and "for." The first is composed by the word "while," followed by a condition and a block executed while the condition is true. The example below illustrates this context:

```
while i < 12
beginning
...
end
```

The next loop to be presented consists of the word "make," a block, the word "while" and the conditional test. Its difference compared to the previous loop is that even if the condition is false, the block will be executed once the conditional test is performed only at the end of the block, as shown in the following example:

```
make
beginning
...
end
while (i > 12)
```

The last repetition loop consists of the word "for" followed by parentheses containing a variable used in the test, semicolon, the test performed, semicolon, an operation of the variable performed at the end of the block, and block with instructions, as can be seen in the following example.

for(i; i < 12; i+1) beginning ... end

The next step was the development of the BNF (Backus-Naur Form) to assist in the development, providing a concise notation of the language structure. Right after, we chose the technique used for the development of the compiler, in this case, the downward recursive, due to being easy to implement and satisfying the performance requirement needed, which interprets the code deriving more general expressions for specific sub expressions, recursively, and then interpret them.

In the sequence, we modeled the system based on the BNF notation in order to enhance the software quality and facilitate its development. To do this, UML diagrams were used (Unified Modeling Language). Since the system consists of two modules, the interpreter and the editor, we used different diagrams for each module.

For the interpreter, we used the Diagram of Activities in order to demonstrate its behavior, elucidating in a simple way the activities performed to interpret the user input, thereby facilitating the encoding.

For the editor, we developed the Use Case and the Activities Diagrams. The first served to demonstrate graphically the possible interactions of the user with the system while the second served to demonstrate the user's actions more specifically.

For the interpreter development, we chose the C programming language due to several aspects that make it ideal for the development of this program, including the facts that the language presents few restrictions, it is friendly and structured and it offers portability, executable compact and fast code generation, interaction with the operating system, reliability and simplicity.

During the implementation, libraries were divided into two types: the internal, containing input and output data operations, implemented within the compiler code and the external, responsible for mathematical functions, implemented in separate modules in the Libraries folder inside the interpreter binary directory.

The interpreter reads the contents of the Libraries folder and lists its programs at runtime; to expand the interpreter library, it is necessary only to simply create new programs that follow the logic used and add them to the library folder.

Finally, a graphical interface using Java 8 and JavaFX was implemented due to its simplicity as it has native dynamic structures and a simple implementation of regular languages. JavaFX in turn provides a powerful and easy way to develop nice visual applications. As it does not have a native support for rich text, we used the RichTextFx external library for this purpose. However, as this implementation is relatively heavy, it limits its use on computers with low computational resources. Therefore, we developed another interface, faster but with smaller visual resources.

This was developed using the C ++ language along with the QT framework, due to the easiness of the object orientation, along with the easiness of the QT and its speed. However, it does not have an interface as elaborate as the JavaFX.

Results

The computer algebra system was developed to be used in a multiplatform context to have some code snippets created for this purpose. It was compiled and successfully tested for Windows and Linux operating systems, without code changes from one version to other nor conditional macros.

The libraries created for the language were area_cylinder, area_circle, area_cube, area_sphere, area_parallelepiped, area_pyramid_3, area_pyramid_4, area_triangle, average, median, mode, pi, volume_parallelepiped, volume_cylinder, volume_pyramid_4, volume_pyramid_3, volume_cube and volume_sphere.

The interface created in JavaFx aiming the usability can be seen in Figure 1. Besides using a heavier technology, it also uses programming techniques that facilitate the development and increase of its quality, as it is the case of regular expressions.

🙁 🗇 💿 IBus	
📄 🗢 💼	
▼ Variáveis	1 inteiro total
total	2 inteiro numero
numero	3
Funções	4 numero = 4
	5
	6 para(numero; numero > 0; numero -1)
	7 inicio
	8 total = total + numero
	9 fim
	10
	11 mostra(total)
	12
10	

Figure 1. Main interface running a factorial algorithm.

The other interface was developed using the programming language C++ with the graphic framework QT aiming more performance than usability as it can be seen in Figure 2.

🧧 🗇 Lube ex Chaos		
: 🎳 🛥 📥 📙 🕨		
Funções ► Variáveis Funções	1 inteiro i 2 i = 2 3 se (i == 2) 4 inicio 5 mostra(i) 6 fim	
2		

Figure 2. Secondary interface running a conditional test.

On the screens created, one toolbar displays the possible actions in the program, a tree view for the display of variables and functions created by the student, a text area for editing the source code and another for the display of the code result.

Actions the program allows on the source code written by the student:

- New file: Action that deletes the displayed code, but does not affect previously saved files.
- Save: Save the file currently displayed; the first screen asks the name and where to save; in the next uses, the changes are already saved in the same file.
- Save As: Every time used it shows a screen asking the name and where to save the files.
- Open: Opens a previously saved file, displaying a screen asking the name and the file location.
- Run: Runs the program source code, displaying the result or, when there is an error, the reason and the place where it was found.

As it can be seen in the displayed images, the interfaces created try to use techniques that besides being pleasant, also call attention, making the experience more enjoyable, facilitating the use and generating interest by the program.

These techniques include the use of icons addressed to the target public, the cohesion between them and the use of sources that are pleasant and mostly a technique called syntax highlighting, widely used in source code editors, which aims to color the typed text to emphasize important points and differentiate the key words, making its writing simpler and pleasant. Once two graphic interfaces were created, the icons, font, size and color syntax highlighting were modified between the two. As there are element differences in the graphs of the two technologies, to maintain the same elements would create a dissonance on the screen, making the experience unpleasant, a reason for the modification of the components.

Final Considerations

Many students currently see mathematics as a villain. Part of this lack of interest is due to the current model of education, which has changed little over the years. Currently, some teachers still use the model of teaching of successive repetition of certain content, a pedagogical model very criticized by advocates of the modern mathematics that seek to teach the logical processes involved in solving certain problems. However, considering it has a broader scope than the teaching of science itself, helping the individual to develop a logic and a questioning spirit, leading them to find ways to learn from the error itself and still learn to develop their own logic in solving life issues, this lack of interest can be a big problem.

There is a clear need for a modernization of the existing teaching models, as well as getting closer to the reality of the student. One way to achieve this it is to use computers as a tool to help teaching. The developed software aims to accomplish this approximation and allow it to focus on the logical mathematical process, shortly leaving the minutiae aside, like the manual execution of elementary mathematical operations, for example, addition and multiplication.

The software contains a programming language, so it helps learning mathematics and teaches concepts of programming logic that can be used to aid the development of these aspects, leading individuals to develop logic concepts, create theories to solve problems and test them in order to learn from mistakes, developing a functional theory and, when possible, using it outside the classroom to solve issues of their daily lives. However, the teacher and the school need to be prepared for the use of these tools; otherwise, they may be more harmful than beneficial. It is also necessary to know how to choose the type of software appropriate to a specific age and subject, as there are different types of educational software, which can be set differently in different objectives and become more advantageous for certain ages and content. The software developed fits in the third and fourth cycles of elementary school, being too complex for previous series, in which, simpler and more interactive software, such as games, can be more effective.

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THE DEVELOPMENT OF A CHATTERBOT FOR ENVIRONMENTAL EDUCATION

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Abstract

With the accelerated growth of cities around the world, the need of learning about our environment becomes inevitable. In the face of such a situation, it would be of great importance to implement an educational software, easy to use and understand, so that children and adolescents could acquire an awareness in a practical and objective way. On this basis, the present research is aimed the development of a computational tool – a Chatterbot, with an educative and informative potential that has information related to Environmental Education as knowledge base.

Introduction

The relation between humanity and nature is understood through mankind exploring natural wealth and resources to satisfy its will. Since the time when records were carved in cavern walls, man's exploration of the environment has intensified, and the need of consumption has noticeably increased. However, the search for these resources interferes directly and indirectly on how we live now: soil degradation, pollution (rural and urban), waste creation, toxic and nuclear waste and global warming are examples of man's interference with nature. In the past decades, we have witnessed the emergence of numerous movements in favor of the environment. In several countries, programs and strategies have been undertaken in order to curb environmental degradation and / or to find new alternatives for production processes and less impacting consumption (Rodrigues & Colesanti, 2008).

Technology, seen as responsible for the environment degradation, can be one of the alternatives to minimize the environmental problem. By using new mechanisms of communication between man and machine, we can introduce basic concepts of nature preservation, in which the learning is of utmost importance to inform and clarify the current situation of the environment. However, the use of new technology must be thought **of in** a practical way for learning. It has to be at the same time didactic and with low complexity, which is hampered by the instability of the language.

Through an application with a concept of *artificial intelligence* (AI), in which the program thinks and interacts as a human being, a quick and didactic learning about the environmental issue becomes possible.

According to Fernandes (2005), *artificial intelligence* is the modeling of intelligence treated as a phenomenon. Understanding intelligence is not an easy paradigm to unravel, since there is no complete theory about the human mind and the reasoning processes.

A Chatterbot would be a way to promote awareness, because mechanisms of human language formation (semantic, syntactic, pragmatic and morphologic analysis) are used

simulating a normal conversation, in an almost human way, which could replace a human being. Unlike a human being, the Chatterbot has the power to save all the information that is imposed to it.

Russel and Norvig (2004) affirm, "If we are going to say that a given program thinks like a human, we must have some way of determining how humans think" (p.5).

Environmental Education

By definition, *environmental education* can be understood as "[...] the processes by which the individual and the collectivity build social values, knowledge, abilities, attitudes and capabilities geared to the conservation of the environment, population's asset of common use, essential to a healthy quality of life and sustainability" (Política Nacional de Educação Ambiental - Lei nº 9795/1999, Art 1º [free translation]).

According to the Environmental Education Program (2005), environmental education requires a perspective of complexity to the social level in which its implication must interact in different layers of reality: objective, physical, abstract, cultural and affective. In addition, it becomes the fundamental instrument of environmental management along with social interaction of its rights and social inclusion.

Informatics Applied to Environmental Education

There are many ways to understand technology. For some people, it is composed of scientific knowledge applied to humans' benefit. It should be understood widely, like any other artifact, method or technique created by humans to make their work lighter, their locomotion and communication easier, or simply to make their lives more satisfactory, pleasant and fun. In this sense of amplitude, technology is not something new; it is as old as humankind (Chaves, 2007). Technological advances have been created in order to have more knowledge and seek better life conditions (Damasio, 2007).

Currently, environmental education is necessary to change the increasing state of socialenvironmental degradation, in which the educator has a mediator function in the construction of environmental references and should know how to use them as techniques for the development of a social practice focused on the concept **of nature**. The information is not how it used to be. The large expansion of the Internet, media outlets, cyberspace, **and** education for citizenship represents the possibility to motivate and sensitize people to transform the many forms of participation in the defense of quality of life. Therefore, environmental education increasingly takes on a transforming function, becoming an essential objective to promote sustainable development (Silva, 2007).

Artificial Intelligence

In the last decades, with the increasing complexity of the problems to be treated computationally and the amount of data generated by different sections, the need of more sophisticated computational tools, became clear, reducing the need of human intervention and dependence on specialists. Thus, these techniques would have to be able to create themselves from experiences, a hypothesis, or function, able to solve a determined problem.

The word *intelligence* comes from the Latin inter (between) and legere (choose). Intelligence means what allows the human being to choose between two things. Intelligence is the ability to accomplish on an efficient form a determined task. On the other hand, the word *artificial* comes from the Latin artificiale, which means something not natural, in other words, which was produced by the human being. Therefore, artificial intelligence is a kind of intelligence produced by the human being to endow machines of any kind of ability simulating the human intelligence (Fernandes, **200**5).

Artificial intelligence developed many ways of simulating human conversation, bringing about, among other technologies, the appearance of the chatterbots, which are simulator programs of a conversation with another person.

They are scheduled to talk about the most various subjects (...) they are also computer sophisticated programs which can understand and answer correctly sentences and questions done by users as **if** they were people in a chat room (Siqueira, 2005).

Chatterbot

There are many kinds of intelligent agents, a chatterbot can be classified as a reactive agent because it executes an operation according to the perception of **its** sensors. This kind of agent can contain learning systems, with the use of the tag "learn" on AIML (Silva, 2012).

The term *bot* is an abbreviation of the word *robot*, an agent that works for a system or user, simulating human activity. Chetterbot or chatbot is one of the categories of bot that has as function to simulate conversations with users from its environment (Tarouco et al., 2003).

According to Othero and Menuzzi (2005), in 1966 Joseph Weinzenhaum developed Eliza, the first chatterbot able to simulate dialogues. It was a simple program **that** stimulated patients to deepen more details of their problems during the simulation, thus creating, a kind of psychologist, or sentimental counselor. Initially, Weinzenhaum's aim was to create only a conversation program using a system based on types to construct sentences through the patient's answer.

Methodology

Exploratory research helps the researcher to know which of the various options are applied to the research problem. Besides that, it may also help to establish the priorities for researching. These priorities may be established because a particular explanatory hypothesis that emerged during the exploratory research may seem more promising than others. Furthermore, exploratory research can generate information about the conduction practice possibilities of specific researches (Mattar, 2012).

Initially, this project was characterized as exploratory research, which attempted to study the system's integration using three languages (AIML, MySQL and PHP), for the construction of a specific prototype, more specifically, a chatterbot specialized to help in environmental education. The research proposal was developed in two distinct stages: a stage to analyze the theoretical aspects and a practice stage in which there was the system implementation.

In the first stage, theoretical materials from various subjects were studied, which are related to the work scope, involving areas such as artificial intelligence, natural language processing, AIML, chatterbots and. As a product of this stage, the developing of a type was proposed, for the development of the conservational agent.

In the second stage, there was the proposed chatterbot implementation. In other words, the conservational agent's installation and customization, its knowledge base manipulation, and then, the necessary tests.

The tags AIML used for the chatterbot implementation were created starting from the type in order to maintain the consistency of the knowledge base, as well the coherence of answers provided by the agent. The tags used are the same described in the paper regarding to the language AIML.

Study Place and System Structure

The AIML knowledge base is indispensable for the chatterbot Ema execution because all the bot knowledge is present in it. As mentioned before, it was divided in two parts: one with a standard knowledge base, generated to attend ordinary context entries with more frequency of use, and the other with specific knowledge in which the conversational agent will act. Access to the conversational agent occurs according to Figure 1.



Figure 1. Simplified system architecture.

As it can be observed in Figure 1, the user, by means of a computer with internet access, can have a conversation with the bot using the HTTP protocol. Its communication is possible through requisitions and answers. The web server is composed of database servers MySQL and PHP. The PHP server is responsible for the parser AIML execution. The working of the two knowledge bases is done through MySQL server.

The Use Case Diagram presented in Figure 2 describes the scenario and, at the same time, shows the system functionalities.

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Figure 2. Use Case Diagram chatterbot.

As Figure 2 illustrates, the system is composed of two actors – the user, who has as objective to find a clarification for his/her doubts, and the chatterbot, which interacts with the user. There are also two use cases, one that illustrates a dialogue between the two actors and another that represents the information search on the knowledge base.

To separate the standard knowledge from the specific in conversational agents, two files were created in the "aiml" format. In the first, only the content regarding to common character questions was inserted, whereas the second contemplates sentences regarding the approached theme.

After the creation and edition of these files, their upload was carried out through the option Upload AIML, which is presented in the Program-O Administrative Area. Loading the file ". aiml," a knowledge base is immediately created, so it is automatically erased and recreated. This way, the bot's knowledge could be worked using both files. It is worth highlighting that modifying the information existing in the files makes it necessary to upload the updated files again.

Updated Software

The *chatterbot* was developed using the platform Program-O. Both knowledge bases were written in AIML language, which is based on XML language, and developed with the purpose to create conversations in a natural language. The updated software used to create *chatterbot*, to manipulate its *AIML* knowledge base and to edit the configuration files was the Notepad++6.8.1, which is a free text editor, versatile and in Portuguese, designated to editing written files in many languages.

We also used the XAMPP v3.2.1, which is a software that installs and automatically configures many servers, such as, APACHE (HTTP web server), MySQL (database server) and FTP (files server). Another tool available by XAMPP is the PHPMyAdmin, which is a database manager that facilitates the administration of databases on MySQL.

Developing the database knowledge. Portuguese was found to be a problem for a search mechanism simply because it has accentuation. Through a study of a *PLN* mechanism, it was planned that each pattern that had accentuation must be created in different ways, for example, the pattern "*VOCÊ ESTÁ ÓTIMO*" (YOU ARE GREAT) must have its variances with/without its respective accentuation, such as "*VOCE ESTA OTIMO*" (YOU ARE GREAT) or "*VOCÊ ESTA OTIMO*" (YOU ARE GREAT).

The disadvantages in developing a knowledge base with these variations is that the information would be redundant. To solve this problem, patterns were created following this model *"VOCE ESTA OTIMO"* (YOU ARE GREAT) - with no punctuation. Thus, before searching for the information on the database, the sentences written by the users will go through a pre-processing in which the punctuation will be removed. The pattern found on the platform makes a treatment on the sentences typed by the users, removing symbols, retaining only the letters. The punctuation removal was added to this treatment.

The Standard Knowledge Base

The standard knowledge base was created from the examples of other categories found on the Internet; however, they were all written in English. After a study and analyses of these examples, it was possible to create similar patterns to the ones found on the Internet. They could be found in salutes, greetings, storage of name or specific knowledge base and treatment of unknown sentences.

The Specific Knowledge Base

The specific knowledge base was developed through base questions and answers on several themes about the environment. A key term was taken from each question; those were used to create categories and subsequent themes to facilitate the search, such as, in the question "O que é meio ambiente?" ("What is the environment?"), the words used to create a new category "que" (What) inside the theme "meio ambiente" (environment).

Tests

With the knowledge base inserted, little content related to the theme was attributed, due to the variety of subjects and contents diffusion found during the gathering of requirements. As the knowledge base was filled, the developer performed the functional test, that is, the system was being verified without having access to the source code, knowing only how it should behave through the access modes with the right questions.

Through the creation of themes referring to the covered topics, it was possible to provide the users with an easy access to the main questions treated by the theme, that is, even if the user does not know the right question to be asked. If a theme the conversational agent recognizes is mentioned, the user will be taken to the section of such theme. To avoid problems with the communication, a selection list was created, which can help the user decide what to ask to the bot, as illustrated in Figure 3.



Figure 3. Selection question list.

To allow the use of the illustrated list in Image 3, a table was created in the chatterbot's database containing questions pre-set by the developer. At every reload on the page, eight randomized questions are brought to the selection list.

Test Run of a Conversation

Some test runs were made with different contexts to present the bot's behavior before some questions. By default, in the beginning of every conversation, Ema – the *chatterbot* introduces itself in a friendly way and encourages the user to ask a question. Figure 4 illustrates the introduction screen.



Figure 4. Conversation opening screen.

Through the database pattern it is possible to greet and ask personal questions to the conversational agent, as observed in Figure 5.



Figure 5. Greeting the conversational agent.

The topics of the covered themes about environmental education can be accessed in two ways: just saying the theme or writing you wish to talk about such \mathbf{a} theme. Figure 6 demonstrates this situation.

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Figure 6. Defining the theme that will be covered.

It is also possible to ask a question by using the selection list that can be found right beside the button "*Dizer*" ("Say"). When a help option is selected, the area in which the user would supposedly speak will automatically be completed, that is, taking the role to help the user to create the desired question. Figure 7 demonstrates this situation.



Figure 7. Using the help option to form a question.

Final Considerations

This study presented the stages of the development of a chatterbot to assist in environmental education, highlighting the interaction between the virtual agent and the student, providing a higher interactivity between educators and professionals of the area, stimulating the learning in a didactic level.

With the development of a chatterbot it was possible to conclude that the field of **artificial intelligence** study is an area that can be more explored to assist other areas and, where it is possible to create a source of artificial knowledge, which can be applied to other activities.

In addition, some adaptations are necessary to develop an intelligent agent that works with the Portuguese language, as it is recommended that the agent can be capable of performing a complete recognition of the spelling.

Another factor to be noted is that the process of developing a knowledge base requires more creativity than knowledge, because it is fundamental to imagine what can be asked to the agent, stimulating the creativity. Another relevant issue is that, in order for the agent to be more precise in the answers, the database must be subjected to a continuous process of improvement and refinement, which requires considerable time and study.

For this refinement, it is possible to use a logging mechanism that contains all the conversations already made by the agent and the user, which assists in clarifying the doubts about the improvement.

This project contributed as a multidisciplinary proposal, which included computer science as a support tool in the environmental education, thus, promoting greater interaction between educators in this area and consequently improving the results in the treatments. Computer science does not replace real human interaction yet, but it offers benefits helping students learn better.

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ICICTE Graduate Student Paper Award entries

EVALUATING ICT INITIATIVE IN SCHOOLS IN NORTHERN KENYA: EXPECTED FAILURES, UNINTENDED CONSEQUENCES

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Abstract

This study investigates changes that teachers and schools in the village of Korr, Kenya have experienced as a result of the introduction of the information and communication technology (ICT). Based on data from surveys and interviews, it identifies the meaning of technology integration in education on the ground, by analyzing teachers' technological use and their perceptions of using technology for education. Revealing a considerable gap between what is locally applied and what is globally perceived in terms of ICT integration in education, this research contributes to the dialogue that emphasizes local meaning of global agendas and advocates for local voices.

Introduction

Given the belief that technology can improve teaching and learning in unprecedented ways, interest in integrating ICT into education has increased dramatically since the beginning of the 21st century (Gutterman, Rahman, Supelano, Thies, & Yang, 2009; Tinio, 2003). Despite the debate over its effects in education, the growing interest in ICT has resulted in a number of educational initiatives that introduced technology in developing countries (Hawkins, 2002). There is, however, a paucity of studies exploring the other side of success or failure and the complicated circumstances underlying such initiatives. Considering the gap between rhetoric and reality, this research contributes to the field of international development by investigating the ICT initiative in schools in Korr, Kenya, focusing especially on its expected failures and unintended consequences.

Introducing ICT, in fact, seemed nearly impossible in Korr because it is one of the underprivileged regions in Kenya without any basic social infrastructure. However, changes began when a non-profit organization that had worked in partnership with the Tirrim Group of Schools in Korr, Hope is Education (HoE), aimed to provide local teachers with basic access to ICT. A task force team named Hope is ICT and Educational Development (HIED) was formed in South Korea to introduce ICT to schools in Korr, which covered teachers' capacity building as well as the infrastructure development (Hope is Education, 2012). In addition, HIED conducted research on perceptions and uses of technology among teachers in August 2012, as baseline data for needs assessments.

For the four years after the project, ICT has indeed brought about a few changes in Korr most manifestly in teachers' technological use. Yet, if the immediate implementation of technology-based learning is the standard by which we measure the success of ICT initiatives, this one seems to fail, which is neither surprising nor unexpected considering the deficiency of adequate infrastructures and lack of experience. On the other hand, interestingly enough, some unintended consequences were gradually revealed. Although

technology has not changed the teaching and learning practice dramatically, it has become the catalyst for changes in school culture.

In this context, this research evaluates HIED's ICT initiative in Korr, analyzing changes that teachers and schools in Korr have experienced as a result of the introduction of ICT. Specifically, it explores how teachers have been using computers and the Internet and what changes such technological use have brought in schools. By situating the study in the larger context of introducing ICT in education in developing countries, it also investigates what lessons can be learned from the case of Korr.

Literature Review

In recent years, a number of developing countries have experienced the introduction of technology in education. Consequently, numerous studies have attempted to draw lessons from such ICT initiatives (e.g., Gutterman et al., 2009; Hawkins, 2002; Stanton & Gerrard, 2007). Especially interesting from my point of view is that, at a fundamental level, there seems to be a similar consensus on various lessons learned from different countries.

Hawkins (2002) addresses important lessons learned from experiences from 21 countries where the World Bank has launched substantial numbers of ICT projects. The author calls attention to the issue of sustainability, in particular, and claims that "keeping them [computers] working is a greater challenge" (Hawkins, 2002, p. 39). Based on 32 ICT projects in a number of countries, Stanton and Gerrard (2007) also emphasize the significance of securing technical and financial capacities for sustainability. In addition, in Gutterman et al.'s (2009) synthesis of 25 countries, monitoring and evaluation surfaced as serious issue to ensure sustainability of ICT projects, which Stanton and Gerrard (2007) establish as well.

Furthermore, much scholarly work has been done on the topics of teachers and technology integration, and greater attention has been shown to the question of how individual teachers integrate technology in education (e.g., Hennessy, Harrison, & Wamakote, 2010; Albirini, 2006). Hennessy et al. (2010) investigate teachers' motivations for using ICT, existing barriers to their use of ICT, and effects of the use of ICT on teachers in sub-Saharan Africa. They then point out that most teachers are not competent to use ICT and do not have enough knowledge of how to incorporate technology into learning and teaching. Albirini (2006) also analyzes teachers' attitudes toward ICT in schools in Syria, and reports the lack of computer resources and teachers' low proficiency in using computers. Indeed, some common challenges seem to exist, which teachers in Korr might also have faced.

On the other hand, it is imperative to review the context of the country where Korr, the research site, belongs. Kenya has a relatively well-established education system, and it is evident that the country has a need and aspiration for ICT (Ministry of Education, 2006). However, considerable doubt has been cast over how those needs have been met to date (Farrell, 2007; Kinuthia, 2009). In fact, and regrettably, the ICT strategies outlined in the Ministry of Education (2006) appear to have lost track of its mission and are skewed from reality. Although the government of Kenya explicitly states its mission as "to integrate ICT in education and training for improved access, learning, and administration" (Ministry of Education, 2006, p. 3), throughout the document, it does not provide any specifics on how to utilize ICT to improve administration at the school

level. It neglects the importance of utilization of ICT in administration, or it identifies strategies for administration with strategies for access or learning, which leads to a misunderstanding about the role of ICT in education at country level.

Leaving aside the focus on its integration into education, ICT certainly seems to influence people's value and cultural perception, even if it was not intended. Sida (2009) states that the essence of ICT is closely related to empowerment. Indeed, empirical data support that the free flow of information provides people with the right to know and freedom of expression, which leads to the promotion of democracy in the Global South including Middle Eastern and African countries (Shirazi, 2008; Sida, 2009). These analyses shed light on the unintended consequences that the ICT has brought in Korr in the context of empowering teachers and changing the school culture.

Theoretical Framework

One of the most fundamental changes that has dominated the educational sector in the 21st century is the introduction of e-learning, a result of a transition to the current information society. Although the effectiveness of using ICT in education still remains controversial, it is difficult to deny that we have already entered an era in which technology has transformed the way we learn and teach (Garrison & Anderson, 2003).

Several developing countries are also experiencing the introduction of ICT and its integration into education in an unprecedented way (Hawkins, 2002; Stanton & Gerrard, 2007). Interestingly, unlike in more developed countries, such changes do not seem to trigger a high level of controversy about integration of technology in education in the developing context. There seems to be a nearly universal consensus or at least a tacit agreement that integrating technology will improve education in developing countries.

With these in mind, I approach the present research from a world culture theory perspective. Whether or not the existence of a worldwide trend in education is a myth, certain cultural convergence seems to exist in terms of technology integration in education, which many countries now prioritize. However, I believe that now we should go beyond the concept of worldwide phenomena that has preoccupied the world culture scholarship to get the big picture right. According to Silova and Brehm (2015), some researchers have also questioned the existence of world culture by pointing out the considerable divergence between universally propagated notion and locally perceived meaning (e.g., Anderson-Levitt, 2003; Schriewer, 2012; Steiner-Khamsi, 2004). Local distinctiveness, which most world culture research has neglected, could be what actually matters in the world culture debates.

By adopting a world culture lens, I will identify and critically analyze the local meaning of technology integration in education in Korr. Despite the global phenomenon, there has been a significant gap between what is globally perceived and what is locally applied in terms of technological use in education in Korr. The geographical remoteness and lack of infrastructure have constrained technology development in Korr, which in turn hindered the discussion of technology integration into education. Although the pace of change has dramatically accelerated since Internet access became available in 2014, local discourses on how to integrate ICT into education may still be far from what is globally discussed. Thus, analyzing teachers' perceptions, attitudes, and uses of ICT at the moment and investigating changes that have occurred as a result of the introduction of technology would reveal the local implications of technology integration into

education—that is, what is available and what is practicable at the local level.

As Hope is Education (2012) advocates, I believe that the local people should be the primary agents who make decisions regarding what technology is appropriate to a specific context and how it can be integrated into education. In line with the critics of world culture scholarship, this study contributes to the dialogue that emphasizes the local meaning of global agendas and controversy over global consensus.

Methodology

I was involved in HIED's ICT initiative in 2012, and thus was able to design this research with longitudinal data. In 2012, HIED conducted interviews with people in Korr including teachers, school administrators, and community leaders, and surveyed 31 teachers—total population at that time—in Tirrim schools. Both data captured people's perceptions, attitudes, and uses of technology before the ICT initiative. Data for this study were collected remotely online by means of closed questionnaires and semi-structured interviews between late 2015 and early 2016.

To capture changes in teachers' technological use, I developed a questionnaire that asked about the frequency and pattern of using ICT, including computers and the Internet. I collected responses from 26 teachers out of the total population of 29 in Tirrim schools at that time. While analyzing the data from surveys, I made sense of the data as quantifying the frequency and tendency of teachers' technological use. Although I did not draw concrete comparisons while discussing the changes between 2012 and 2015, comparing the general trends helped me identify some major changes.

Further interviews with three teachers after the survey in 2015 and 2016 followed, which provided me with a vivid picture of changes. The interviews were semistructured to capture the kind of data I needed and to incorporate teachers' views of which I was not aware. With the data from interviews, I went through a series of coding process, and I re-analyzed them using NVivo, software that facilitates qualitative data analysis process. Themes that had emerged in the process of analysis were comprehended and consolidated in light of the preliminary literature review.

While the data have resulted in provocative findings, the present study has inevitable limitations due to the nature of remote data collection, which lacks the field investigation and observations. To overcome these limitations, I tried to obtain as much information as possible from the survey, which provided accurate data regarding teachers' use and perception of ICT. I also designed the interviews to incorporate various views by asking about specific events or incidents they had experienced and diverse opinions they had faced. Furthermore, the rigorous process of data analysis including a series of coding procedures consolidated the data without missing the details.

Findings

A comparative analysis between 2012 and 2015 data presents a snapshot of major changes in teachers' technological use in education and their perceptions of ICT. Also, exploring some unintended consequences is especially worthwhile in this study, since it was local teachers at Tirrim schools who have been agents of changes, which underlines the importance of local meaning as well as local voices.

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How Teachers Use ICT in Education

Data from two surveys showed a stark change on teachers' technological use over the years. In 2012, as seen in Figure 1, teachers used only three kinds of digital devices; and more than half of Tirrim teachers used the radio most frequently. Interestingly, although network service was not available in Korr at that time, a number of teachers had cell phones that they used outside the village for communications, which may well indicate a high demand for ICT among local teachers. Yet, the use of computers was greatly limited due to the lack of infrastructure and resources.

Figure 1. Distributions of digital device used by teachers in 2012.



Note. Recreated from "Finding hope on the other side of the world: ICT project report" by Hope is Education, 2012, p. 18. Copyright 2012 by Hope is Education. Recreated (or reprinted) with permission.

In four years, teachers' technology use has changed greatly. The laptop rental program launched after the ICT initiative and the access to the Internet have put an entirely different complexion on teachers' ICT use in Korr. Indeed, the survey results in 2015, as illustrated in Figure 2, revealed that 70% of teachers use computers and 74% use the Internet at least once a week.





More than once a day Two to four times a day Once a week Less than once a week

Furthermore, the primary purpose of teachers' technological use has also changed. As illustrated in Figure 3, more than half used ICT for communication in 2012, including cell phones and the Internet, which they often used outside the village at that time. Only 12% responded that they use ICT primarily for education in 2012.

Figure 3. Primary purpose of teachers' ICT use in 2012.



Note. Adapted from "Finding hope on the other side of the world: ICT project report" by Hope is Education, 2012, p. 17. Copyright 2012 by Hope is Education. Adapted (or reprinted) with permission.

On the other hand, Figure 4 shows teachers' primary purpose of ICT use in 2015. Overall, the number of teachers using ICT for education has increased. Yet, the key takeaway is the differences between usage patterns in computers and the Internet. While 63% of teachers using computers utilize them for education, only 38% accessing to the Internet use it for education.

Not only is it due to the different nature of computer and the Internet, but it may be attributed to the local context of Tirrim schools. To best suit their needs, Tirrim schools distributed laptops to four schools (lower primary, upper primary, secondary, and nomadic) for school administration. However, the Internet system has not yet started to migrate in Tirrim schools, which well explains the relatively lower use of the Internet for education among teachers. Given that most teachers use the Internet via their personal cell phones, it is not surprising that until now, utilization of Internet has mainly influenced teachers' personal lives.



Figure 4. Primary purpose of teachers' ICT use in 2015.

Furthermore, by breaking down the educational purposes, Figure 5 shows that school administration comprises a majority of teachers' ICT use in education. In other words, the number of teachers using computers of education has increased mainly because more teachers use computers for school administration, not for teaching and learning.



Figure 5. Educational use of computers and the Internet in 2015.



Due to the geographical remoteness of the village, there has been a great need for technology development in Korr to provide a link with the outside world. Furthermore, according to Hope is Education (2012), Tirrim teachers expressed a higher level of need for technological use in education than was anticipated. This may be attributed to the rapid pace of change in neighboring towns or big cities in Kenya like Nairobi, where more people in Korr have exposure through both direct and indirect experience.

Little has changed in four years in teachers' perceptions of ICT and their attitudes toward technological use in education. As most teachers responded that they believe ICT is beneficial to education in 2012, many teachers agreed that ICT would have a good effect on teachers and students in Korr in 2015. They also emphasized the importance of ICT in education by mentioning that they may be able to encourage more children in the village to attend to the school with the help of ICT.

Nevertheless, teachers' perceptions of reality reveal the actual meaning of using ICT in such an underserved village as Korr. Despite their strong desire to utilize technology in education, teachers expressed concerns that they are not ready to use it to improve their teaching and learning practices. Also, in line with their usage patterns of ICT in education, both 2012 and 2015 data reveal that more than half of teachers prioritized improving efficiency of school administration using ICT. Teaching ICT skills to students and developing curriculum using ICT are the second priority in Korr, for which most teachers feel they are not ready. This indicates a serious gap between teachers' perceptions and national strategies as well as global priorities that aim to integrate ICT into teaching and learning. The needs and priorities teachers identified unpack their perceptions of ICT and attitudes toward its integration in education, which reveals the local meaning on the ground.

Unintended Consequences: The Foundation of Teachers' Association

After the ICT initiative, local people and groups in the community started to show an interest in the newly built development center with the solar power panel and the laptop rental system. The introduction of ICT reached far beyond the boundary of schools, sparking interest and generating attention throughout the village. Although community engagement and collaborations are usually helpful, it became hectic after too much attention led to various opinions and disagreements about the best way to utilize ICT in Korr.

Interestingly, this tension featured the initial step of regular teachers as local power in this traditional village where decision-making power has been a privilege of a few people holding certain positions. Individual teachers began to speak with one voice, and they actually suggested and implemented the plan to distribute computers to each Tirrim school for efficient school administration. Because they had realized such change was necessary, they started to follow up with action.

Furthermore, in September 2014, 24 Tirrim teachers founded an autonomous group called Tirrim Teachers Association (TITA). It seems that certain influence ICT had brought had become the catalyst for such movement. Teachers who led this movement also witnessed how ICT influenced teachers' thoughts and movements. ICT had provided each teacher with a direct connection with the outside world, whereby they could get a massive amount of information and an opportunity to take the lead. Indeed, a number of teachers voluntarily contributed money and time to establish TITA, which is a learning community and decision-making group for teachers.

The founding of TITA shows that ICT has empowered local teachers with the freedom of information. It can be considered a form of democracy, since TITA members are willing to challenge the traditional structure and culture in their schools. Albeit in the early stages, Tirrim teachers have begun to make themselves heard on various issues surrounding the school.

Furthermore, since TITA plans to organize workshops for teachers on using ICT, it is expected to play a pivotal role in expanding technological use in education. Indeed, although most teachers have mainly used ICT for administration up until now, such networks will reach fruition when they have the capacity to actually integrate ICT into teaching and learning.

Discussion

Coupled with the theoretical framework of this study, the findings support the view that there may be a large discrepancy in the understandings of technology integration into education in the developing context between expectation and reality. They reveal that introducing ICT by no means guarantees the successful integration of technology in the curriculum or the development of e-learning in schools where teachers and students do not already have a culture of using ICT. This is why I argue that the ICT initiative in Korr resulted in predictable failures: it was impractical in the first place to expect Tirrim teachers to integrate ICT into their teaching practices as a result of the 2012 initiative, which HIED itself had acknowledged (Hope is Education, 2012). Incorporating the implications from Korr, it appears that an alternative approach to introducing ICT for educational development is needed, especially when schools first encounter ICT and thus start from scratch when integrating it into their educational approaches and practices.

The concept of cultural capacity, which is based on the accumulation of ICT experiences within schools, is key here. The change that schools in developing countries would undergo in integrating ICT into education reaches beyond the merely personal level; it signals the transition to an information society. Indeed, what matters in the developing world context, in which most countries are latecomers to ICT, is helping schools bridge the cultural gap through strategic approaches and intensive support. Improving individual teachers and students' ICT skills and knowledge for integrating technology into actual teaching and learning is the second priority, which is, and indeed must be, based on a broader culture of using ICT in schools.

In this context aries the importance of infrastructure development that many researchers argued (e.g., Gutterman et al., 2009; Hawkins, 2002; Stanton & Gerrard, 2007). To create environments within schools where the culture of using ICT can flourish, developing ICT infrastructure is essential. Since providing basic access to ICT could increase teachers' overall technological usage and influence their cultural capacity in Korr, sufficient infrastructure development will allow schools to accumulate experiences and exposures, which would serve as a foundation for integrating technology into education.

Moreover, the case of Korr sheds valuable light on the importance of the local meaning. Specifically, what local teachers think of technological use in education was different from what is commonly pursued at a policy level in Kenya and around the world. Most teachers prioritize using ICT for school administration and do not feel ready to integrate it into their curriculum or teach it to their students. Based on the case of Korr, this study has revealed that the local meaning of using ICT in education may differ dramatically from the way that ICT is being introduced in many other developing countries.

This gap between local meaning and global perception may be attributed to the different local contexts, of which people from outside an area might not be sufficiently aware.

Thus, there is no universal rule that applies to different educational settings around the world for ICT integration in education. Disseminating best practices or transferring policy and strategy may not be an effective way of introducing ICT in developing countries. Even if some practices or policies work well in one setting, that does not necessarily mean that they will in other settings. Not all schools have to utilize ICT for school management, nor do all students have to change the way they learn by adopting e-learning. Figuratively but technically, if the world were only 100 schools, we might find 100 different kinds of local meaning of ICT integration in education.

It is worth reiterating that at the heart of local meaning is the cultural capacity. The more capacity and experience in ICT schools gain, the more obvious their definitions of ICT integration in education will become. The founding of TITA has great implications in this context; it was not until then that teachers clearly envisioned ways of utilizing ICT to improve education in Korr. Indeed, it is empowered and experienced individuals who will take the initiative and ultimately make changes. Such local voices will illuminate local meaning, thus paving the way for improving education on the ground.

Conclusion

This study has investigated changes that the introduction of ICT has brought to teachers and schools in the village of Korr, Kenya. What emerges from the analysis is that the meaning of ICT integration in education on the ground may be different from what is nationally or globally perceived at a policy level. Notwithstanding that it is a case study focusing on a small group of teachers and schools, it has thought-provoking implications in a larger context, which provides a stepping-stone for future research.

It is obvious that ICT in educational development is growing in importance, as has also been confirmed many times by the international community (e.g., Incheon Declaration, 2015, Qingdao Declaration, 2015). It is my hope, then, that this study will contribute to broadening and deepening our understanding of ICT and education in the developing context.

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TEACHING IN IMMERSIVE VIRTUAL WORLDS: CONCEPTUAL CHALLENGES AND OPPORTUNITIES

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Abstract

The immersive and social affordances of virtual worlds offer many new opportunities for educators but also challenge established teaching practices in higher education. This study describes the experiences of eight teachers from the fields of Pharmacy and Nursing who have chosen to implement immersive virtual worlds in their courses. Results indicate that the immersive, social nature of the environment challenges teachers' conceptions of teaching and learning, requiring a student-centred approach to design and implementation of activities.

Introduction

Immersive virtual worlds (IVWs) have been utilised in Higher Education (HE) for more than a decade and their use has steadily increased, particularly in disciplines such as medicine (Boulos, Hetherington, & Wheeler, 2007; Gamberini, Barresi, Maier, & Scarpetta, 2008), education (Nussli & Oh, 2014; Storey & Wolf, 2010) and language development (Knutzen & Kennedy, 2012; Wehner, Gump, & Downey, 2011). There is considerable research on the affordances offered by the unique three-dimensional features of IVWs which provide online learning opportunities that are both immersive and collaborative at a time and place convenient to the learner (Inman, Wright, & Hartman, 2010; Wang & Burton, 2013). The existence of technological barriers both for teachers and students is also well documented (Oh & Nussli, 2014; Warburton, 2009) as is the student perspective (Gamberini et al., 2008; Hew & Cheung, 2010). However, there is little published research carried out from the teachers' perspective and in particular teachers' conceptions of teaching and learning in IVWs are rarely considered. This type of research is necessary to facilitate the induction of teachers into teaching and learning with IVWs and has implications for the sustainability of IVWs.

This study aims to fill the gap by exploring teachers' conceptions of teaching and learning in an IVW and the relationship between these and the design of student learning activities. By investigating teacher conceptions of teaching and learning in IVWs, implications for support and training can be considered that have the potential to increase the quality of student learning and teacher experiences in IVWs.

The experiences of eight teachers from the fields of Pharmacy and Nursing who designed and implemented learning activities in an open source IVW, OpenSimulator (http://opensimulator.org/wiki/) are described. The study reports on the teachers' conceptions of teaching and learning, their experiences of designing and teaching in an IVW and discusses the pedagogical implications of the potential paradigm shift involved in teaching and learning using educational technology such as an IVW.

Background

It is widely acknowledged that IVWs hold great educational potential in terms of role playing and fostering experiential learning and social interaction (Jarmon, Traphagan, Mayrath, & Trivedi, 2009; Savin-Baden, 2008). They can facilitate learning in a realistic context with authentic tasks (Dickey, 2005; Lombardi, 2007), enable rich communication and social interaction and allow consideration of phenomena from different perspectives through role playing and simulations (Childress & Braswell, 2006; S. H. Kim, Lee, & Thomas, 2012; Warburton, 2009).

With regard to vocational education, such as Nursing and Pharmacy, IVWs are being increasingly used to support the achievement of both generic and discipline-specific skills, particularly where students are geographically dispersed. Englund and Wester (2015) have previously described the use of an IVW to offer opportunities for experiential learning in an authentic environments (Wenger & Lave, 1991) and Conradi et al. (2009) have examined the use of an IVW to create a safe and immersive environment for paramedic students to rehearse competency and decision making skills without fear of real-world repercussions. Considerable research has been carried out concerning the use and application of IVWs in HE, although much is of a descriptive nature mainly considering the opportunities offered, providing guidelines for implementation, possible technology barriers and student attitudes and perceptions of the environment.

Educational technology (Edtech) such as virtual worlds can offer a wide variety of opportunities for learning, but there is also increasing evidence that the use of IVWs places new demands on teachers in the design of appropriate activities (De Freitas & Veletsianos, 2010; Savin-Baden, 2010) and involves the adoption of new roles grounded in a student-centred approach to teaching and learning (Ketelhut, Nelson, Clarke, & Dede, 2010; Savin-Baden et al., 2010; Wang & Burton, 2013). De Freitas and Veletsianos (2010, p. 5) propose that the social capabilities of virtual worlds can be challenging for teachers when designing and using IVWs and that one of the reasons for this is their conceptualisation of teaching and learning:

In effect, the definition of learning as information regurgitation is giving way to a notion of learning as centring upon 'immersive learning experiences' that are inherently social and collaborative. The key challenge for educationalists here is to respond to a significantly more dynamic and complex learning environment and its associated sets of teaching tools.

Conceptions of Teaching and Learning

Extensive research has been carried out in the area of conceptions and approaches to teaching (Lam & Kember, 2006; Prosser & Trigwell, 2014; Samuelowicz & Bain, 2001). In the present study, conceptions of teaching and learning are defined as e.g. the teacher's beliefs about teaching and learning, whereas approaches to teaching and learning are defined as the strategies teachers adopt for their teaching practice (Kember, 1997). Some teachers demonstrate teacher-focused conceptions, viewing teaching as the transmission of information, while others have a more student-focused conception emphasising the promotion of the students' own learning process. Trigwell and Prosser (1996) identified five qualitatively different conceptions of teaching (A to E) that are structurally related in a hierarchy of inclusiveness, ranging from information transmission to facilitating learning through conceptual change (see Table 1 for a more detailed description of the categories).

Teachers' conceptions of teaching and learning have significant consequences for how Edtech is used to facilitate learning (Englund, Olofsson, & Price, 2016; C. Kim, Kim, Lee, Spector, & DeMeester, 2013; Song & Looi, 2012). Edtech can be used in a variety

of ways, however teachers most frequently use it to support their particular conception of teaching and learning (Kirkwood & Price, 2012). For example, content-focused teaching is likely to manifest itself in technology use for the presentation of information. Comparatively, a learning-focused use of technology allows students to demonstrate their understanding and encourages communication and collaboration (De Freitas & Veletsianos, 2010; Kirkwood & Price, 2013; Savin-Baden, 2008).

Correspondingly, differing conceptions of teaching and learning will result in differing designs for learning activities when using IVWs. Minocha and Reeves (2010) found that conceptions of teaching and learning and design mutually influence each other in that teachers' conceptions guide the design of learning spaces in IVWs and consequently the type of student learning opportunities.

Building on Trigwell and Prosser's research into conceptions and approaches to teaching (1999; 1996), the five categories developed, A to E, have been used in this study as a theoretical framework for a) the identification of the respondents' conceptions of teaching and b) to examine the relationship between conceptions and design of IVW learning opportunities. Following on from Savin-Baden (2008), these categories are described in Table 1 together with the corresponding categories for the dominant Edtech used and the main focus on learning. Table 1 thus builds on Trigwell and Prosser and Savin-Baden's work to illustrate the relationship between conceptions of teaching with technology and the challenges that may be encountered in designing and implementing learner activities in IVWs.

Table 1 (next page) would seem to indicate that a more student-centred approach is required if IVWs are to be successfully implemented. It is probable that a change in the nature of the teaching environment, from teaching in a closed Virtual Learning Environment (VLE) to teaching in an IVW necessitates a corresponding change in conceptions of teaching and learning towards a more student-centred, communicative approach and corresponding strategies for the design of learning activities.

Method

In order to gain insight into the teachers' conceptions of teaching with technology and their experiences of teaching and learning in IVWs, a qualitative approach to data collection was adopted (Kvale & Brinkmann, 2009).

Context

Umeå University, Sweden, has long experience of distance and online programmes and an open source IVW, OpenSim, is hosted by the Centre for Educational Development (UPL). In collaboration with technicians and educational developers from UPL, teachers from the online Pharmacy programme developed a virtual pharmacy and hospital. The IVW is used in the 7.5 ECTS courses *Pharmacotherapy in the Elderly* and *Clinical Pharmacy*. In the courses, the students are provided with opportunities to practice communication with customers, patients and colleagues and are also assessed on achievement of course learning objectives. These courses have now run for five years.

In 2012 the online District Nursing programme also developed a virtual emergency room in collaborations with UPL for clinical assessment and emergency care as part of the course *Care in rural areas*, 7.5 ECTS. The purpose of the activity was to train and examine nursing students in the clinical evaluation and treatment of an acutely ill patient. Team communication and the students' abilities to evaluate the patient's condition and communicate effectively with colleagues are assessed in the IVW. This

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Conception of teaching	Conception of teaching with technology	Dominant Edtech	Learning tocus
A: Teacher-focused activity with the intention of transferring information to the students. The focus is on transmitting discipline-based facts and skills. No prior knowledge by students is assumed or that students need to be active in the learning process.	Activity is teacher-focused where technology is used to transmit information about the discipline. No interaction with students is anticipated. Demonstration and delivery of discipline-based facts and skills using technology as a supplementary tool.	Closed and contained VLEs	Achievement of task
B: Teacher-focused activities with the intention of helping students acquire the main concepts. Students don't need to be active in the learning process and their understanding of the subject matter is built through working within the predetermined teacher and/or content framework structures.	The teacher uses technology to help students acquire the concepts of the syllabus. Students' understanding of the subject matter is facilitated through working with predetermined content materials delivered via institutional technology channels and VLEs.	Closed and contained VLEs	Development of capabilities
C: Interaction between the teacher and students aimed at helping students acquire concepts and understand their relationships. Students' knowledge is gained through active engagement in the teaching- learning process and interaction between teacher and student.	The teacher engages in dialog with students in the learning process using communication technologies. Students are introduced to activities such as digital simulations and animations.	VLE with use of communicative technologies e.g. discussions boards and some social software.	Developing understanding of the content
D: A conceptual approach that focuses on students developing their own conceptions of the subject matter. Here the teacher adopts a student-focused strategy. The focus of activity is on elaborating and extending students' understanding.	The teacher uses technology for collaboration and communication with students and between students. Technologies enabling online project work and group discussions used. Problem-based approaches may be implemented where students can create their own digital resources.	Open source VLE, communicative technologies. Tools for online group work eg, Google docs. Some use of IVWs	Synthesis across boundaries
E: The teacher adopts a student-focused strategy with the intention of helping students to both develop and change their conceptions of phenomena. The focus of student activity is on students' restructuring and changing their current world view by interacting with subject material in a way that challenges their currently held concentions	Curriculum and learning resources are created jointly by teacher and students. Open educational resources and social media are used in the learning process. Communication, creation and delivery of digital resources is collaborative. The use of technology is aimed at helping students prepare themselves for their future roles and mofessions	Open source VLE, social software and immersive virtual worlds	Critical thought and analysis

course has now been offered for three years and the virtual emergency room will be expanded 2017 to include undergraduate students.

Table 1 Conceptions of teaching with educational technology

Respondents

Data was collected through semi-structured interviews with four teachers from the Pharmacy programme, spring 2015, and four teachers from the Nursing programme spring 2016, to elicit their conceptions of teaching and learning in an IVW and their strategies for the design of activities. Convenience sampling was used to identify respondents actively involved in using IVWs in their teaching. The respondents received a participant information sheet concerning the purpose of the study prior to participation and gave their written consent for the data gathered to be used in this study. Table 2 illustrates the data set used: subject discipline, teaching experience of respondents and IVW learning activities designed by the respondents.

Table 2Data set used in study

Subject discipline (level, mode)	IVW learning activity	Teaching staff
Pharmacy (postgraduate and undergraduate, online)	Communication skills, assessment of course learning objectives	4 teachers, all female, experienced in online teaching with technology, little experience of face-to-face teaching, no previous experience of IVWs
District Nursing (postgraduate, online)	Teamwork, communication skills, assessment of course learning objectives	4 teachers, 1 male, 3 female, all experienced in online teaching with technology and face-to-face teaching, no previous experience of IVWs.

Interviews were approximately one hour in length and were conducted at a time and place convenient to the respondent. The respondents' contributions were anonymised and stored according to research ethics regulations (Swedish Ethical Review Board, 2004). Qualitative software (NVIVO® ver.10) was used to record, store and organise the data.

Analysis

Thematic analysis was used to analyse interview data (Braun & Clarke, 2006). The interview transcripts were read iteratively by the researcher to gain an overall sense of the data. The interview data was then read again and coded in terms of emergent themes. In addition, the five categories of conceptions of teaching (Trigwell, et al., 1994) were used as a framework for the identification of the respondents' conceptions of teaching with technology and in IVWs. These categories are described in Table 1.

Findings

The findings illustrate a number of themes contributing to the respondents' conceptions of IVWs as an environment for teaching and their design of learning activities. These themes include:

- Conceptions of teaching and learning in IVWs
- Rational for using an IVW
- Attitudes to Edtech
- Design of activities
- Disciplinary fit

Conceptions of teaching and learning in IVWs. With reference to Trigwell and Prosser's (1996) categories of teaching conceptions, Table 1, the majority of respondents (6 teachers) in this study were placed in category D, using technology for collaboration and communication with students and encouraging problem-solving among students. One teacher, who had taken begun teaching in the IVW as a substitute teacher, was categorised as C with a more teacher-focused approach and one as E, employing collaborative production of resources and helping students prepare themselves for their future roles and professions.

I think it's important for students to collaborate, to discuss and create knowledge for themselves. I get the students to work together. I prioritize group work in my courses. I rarely give lectures, more seminars. I most often use a kind of problem based learning but I give them tools, so I think for me it was no problem to work the same way but in an IVW. (Teacher A, Pharmacy)

Especially where activities in OpenSim are concerned, my role is very different. It's more a partnership between the students and myself to create knowledge and understanding to strengthen them in their future role as pharmacists. (Teacher B, Pharmacy)

So I see it as my task as a teacher is to try to find educational solutions so that they get support and a framework for their learning. I do not see my role as a teacher that I should deliver knowledge to them, but I show them where the knowledge is and they have the opportunity learn. I give them the tools to assimilate the knowledge. So I feel I have more of a supervisory, consultative role perhaps. Teacher D, Nursing)

Rational for using IVW. Not surprisingly, since both the Nursing and the Pharmacy programmes are delivered online, the main reason stated for teaching using an IVW was to facilitate interaction and communication for geographically dispersed students.

Mainly to practice communication, but in a realistic situation like the emergency room in OpenSim. When the students enter the room, they become the district nurses and trainee nurses, they really take on their roles. Then there's the fact that the students can't come to campus. The course is online since it's intended for nurses who live and work in sparsely populated areas. The students needed to train teamwork in an environment that would seem like a rural health centre. We also needed to assess them online, so that was why we chose it. (Teacher A, Nursing)

Many of the respondents also discussed facilitation of inter-professional communication, teamwork and opportunities for authentic, experiential learning as being important in the choice of learning environment.

I think communication is a very important part of becoming pharmacists; therefore our students need to practice oral communication with customers and colleagues. I also feel that they become more professional. They don't just act like a pharmacist; they become the pharmacist in the virtual world. So I think that's good both for the students and for the teaching goals. (Teacher C, Pharmacy)

Attitudes to Edtech and IVWs. The teachers engaged in the design and implementation of the virtual activities were positive to the experience and commented that it had

inspired them to develop their ideas and explore the possibilities offered by IVWs further.

I probably had pretty high expectations that using an IVW would be good, I had seen H's course, so I thought it would probably be pretty good to use it in mine too. It seemed like a good way to hold patient rounds and discussions with doctors without the students having to come to campus. I saw that it had potential. (Teacher B, Pharmacy)

Although it was considered time-consuming initially to gain the skill and expertise necessary to navigate and teach in OpenSim, the affordances offered by the IVW, especially for distance students, were seen as outweighing the obstacles.

On the negative side, I felt that there was very much technology involved. [...] So it was very stressful because there were so many things that could go wrong technically and it took time to learn the system. But purely educationally I thought it felt really fun and challenging. (Teacher D, Pharmacy)

Design of activities. The design of activities in the IVW is in congruence with the respondents' conceptions of teaching and learning, focusing on communication and interactivity and they are well-integrated with the course as a whole:

I actually feel that the IVW is an integral part of the course, especially since one of the expected outcomes of the course is to be able to communicate their knowledge to laymen and professionals. I think [the IVW activity] is completely in line with that, it enhances the course more than anything. Teacher B Pharmacy)

The respondents were also well aware of the affordances of the environment:

The virtual room is suited to an exercise we have where the students have to take care of a patient who comes to the emergency health centre and has a problem. The students need to practice systematic thinking, teamwork and even giving an oral structured report and it works well in the IVW. Exercises such as these are successful, but it shouldn't be something that you could just as easily do in a net-meeting. You have to think what function this virtual health centre can fill to help the students learn. (Teacher C, Nursing)

Disciplinary fit. The respondents' use of IVWs for educational purposes is very much in line with the disciplinary conceptions of teaching and learning of the institutions (Wimpenny, Savin-Baden, Mawer, Steils, & Tombs, 2012). This was true particularly where the Nursing programme is concerned.

But in nursing, we're so used to thinking in terms of problem solving, experiential learning, communication and teamwork, so I think it's something that fits great. (Teacher B, Nursing)

Findings also suggest that teacher confidence and competence in using IVWs within the disciplines were central to practical application and understanding. It appears to be of prime importance when designing IVW learning to not only know 'how to do it' technically, but under which circumstances and with whom, and how these can affect the way that particular subject matter is learnt.

So for me, the activities I teach in OpenSim match very well with how we teach within the nursing program because we focus on being systematic, communication

and teamwork and such. It's the same way of thinking about teaching, the same mindset. (Teacher D, Nursing)

Discussion

The majority of teachers involved in the study were experienced online educators, with student-focused conceptions of teaching and learning, well-prepared to adopt the role of facilitator and mediator. For these teachers, the pedagogical impetus to create communicative virtual learning experiences for their students was greater than the technological barriers encountered. Other teachers however, may need support to explore their conceptions of teaching and learning and the affordances of immersive virtual worlds to be able to move away from traditional classroom learning and design activities not with an emphasis on 'learning about' but which focus on 'learning by being'(De Freitas & Veletsianos, 2010).

This has clear implications for the sustainability of IVWs embedded in educational activities such as the Pharmacy and District Nursing programmes. As the initial innovators move on to other assignments new teachers will need to be initiated into not only the technical aspects of teaching and learning in IVWs but also the pedagogical requirements of teaching in an immersive virtual environment. Long-term teacher professional development may be needed to support conceptual change and facilitate a shift to more student-focused teaching and learning where necessary (Ketelhut et al., 2010; Kirkwood & Price, 2012).

In terms of design, teachers need to understand the opportunities for new teaching practices offered by IVWs and a teaching environment that permits and encourages creativity and experimentation is essential. There is a need to identify and capitalise on what IVWs are most suited for, activities that can only be effectively carried out in IVWs, and to develop more student-centred ways of teaching rather than replicating traditional classroom teaching (Savin-Baden et al., 2010).

Teachers' conceptions of teaching are also shaped by their disciplines, and teaching practices reflect the conceptions and culture of the discipline (Shulman, 2005). Further, design decisions are influenced by these underpinning disciplinary conceptions and the activities created frequently echo disciplinary values. Translating the disciplinary traditions and conceptions individuals bring into IVWs can be complex. However for teachers working on the District Nursing and Pharmacy programmes the use of IVWs for interactive, communicative and collaborative work was completely in line with the disciplinary culture and practices of their professions.

Conclusion

The objective of this study was to explore teachers' conceptions of teaching and learning in an IVW world and the relationship between these, the design of learning activities in IVWs and their conceptions of teaching and learning with technology.

Findings indicate that in IVWs the teachers' position is that of a facilitator which necessitates a shift away from the traditional role of teacher as lecturer and purveyor of knowledge to a more student-centred, facilitative role. The main challenges faced by teachers are closely linked to the particularities of the immersive virtual environment, which is social, communicative, interactive, and can require a change in teachers' conceptions of teaching and learning. If the affordances offered by IVWs are to be realised when implementing IVWs, there is a need to be aware of the conceptions of teaching and learning and designers when planning student activities.

Limitations. The sample size of the study is relatively small, consisting of eight respondents from two medical disciplines, limiting the degree of external validity and reliability of the results. This study could be elaborated in the future to include a greater number of participants from several disciplines to increase generalizability.

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ICICTE 2016 Proceedings

GeNIE: A PORTAL FOR GAMIFICATION OF HIGHER EDUCATION

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Abstract

Gamification is the usage of game elements in non-game environments like education, business, sales and marketing. In the last decade, educators began to investigate the effects of different gamification elements within the context of education. Existing research revealed the errors in the methods of majority of studies in the area of gamification of education. The actual reason behind the issues in the existing literature is quite simple; the shortage of computerized support. This project aims to provide a solution to this shortage by creating a modular and platform-independent system for gamifying university-level education through Java-related technologies.

Introduction

Salen and Zimmerman describe a game as a "system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (2003, p. 11). There are two mechanics in every game: rules and elements (Ibanez, Di-Serio, & Delgado-Kloos, 2014). In digital games; these elements can be identified as points, badges, achievements, quests, and all the other components that make a game. Rules on the other hand define the means of acquiring or achieving these elements. Rules are basic how-to's of the game that define ways of unlocking badges, completing achievements, earning titles, or even progression in the game. In every game, there is a task that the player needs to complete in order to achieve some form of recognition through a feedback mechanism while also motivating players towards completing even more tasks, guaranteeing a loop that will drive them even further. Video games have been taking advantage of these loops to motivate players to spend more time in the game; therefore, it comes as no surprise when game elements started to be used in businesses for commercial purposes.

There are many applications and businesses that gamification is applied to from healthy living ("Fitocracy", n.d.) to promoting literacy ("Mindbloom", n.d.). Even brand loyalty programs can be considered gamified systems as they take advantage of points and reward mechanisms. In an educational application, instructors try and use these elements to improve a student's intrinsic motivation towards learning. Current literature on applying game elements to education contains a great deal of opposing studies and there seems to be no convergence of an opinion on any of the elements or the way they are applied to a course. The aim of this project is to address the shortage of a computer-assisted software for conducting research on gamification in education. This project employs multiple technologies and frameworks to create software that can run on many different environments with little to no modification. Another aspect of the project is providing a modular solution which can be modified according to the specific needs of the instructor; even though, adding or removing certain features would require an intervention from a software developer experienced with this kind of software, it will still be much easier than creating a software from scratch.

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Background

Gamification aspect of the portal targets a subset of game elements, which is the most widely implemented set of elements by researchers so far; Points, Leaderboards, Badges, and Achievements (Hamari & Koivisto, 2013; Ibanez *et al.*, 2014; Iosup & Epema, 2014). These elements were chosen so that future improvements and research could focus on other elements of gamification that might prove to be more advantageous on education. Another key approach taken with this project is improving the modularity of the gamification elements. This modularity is achieved by providing an option to researchers to toggle each individual element, as well as the master switch that toggles gamification on a course basis. This switch is also given to the students to improve their autonomy by enabling them to opt-out of elements they don't wish to participate.

Iosup and Epema (2014) presented one of the longest running studies on gamification. They taught two courses, an undergraduate course that was taught for 3 consecutive years, and a graduate course that was taught for 1 year during the writing of their paper. Their main challenge was to make technically and conceptually challenging courses interesting. Authors have identified 3 core mechanics and 4 core dynamics for gamification. The 3 core mechanics were points, leaderboards, and levels. Levels consisted of user levels and access levels while access levels controlled what a student can see which only consisted of additional material and nothing mandatory for the course. The 4 core dynamics authors identified were badges as a way to show off achievements, tutorials, social engagement loops, and unlockable content. After the gamification of these courses, they have observed an increase in attendance and in completion rates that was accounted to gamification elements by the students' responses. The bonus grades collected have increased over the years but it especially saw a rise after the social interactions were introduced. Lastly, Iosup and Epema express the need for a computer-assisted software for managing gamification and they explain that approval and support limitations were faced in order to get the approval for their software project.

A review study that was published on 2014 by Hamari, Koivisto, and Sarsa (2014) found that majority of the literature was subpar. Authors scanned through 8 different databases and found 8050 papers about gamification in total. The amount of peer-reviewed papers, however, was only 809. Then the peer-reviewed papers were divided into following four categories: Conceptual papers, engineering papers that are describing a system without evaluation, the term was mentioned in the text but the paper was irrelevant, short paper/extended abstract/in-progress. The papers that fit into these categories were deemed subpar while the remaining papers were considered tangible studies. The result was a mere number of 24 tangible studies, out of which education was the most studied context with 9 papers. Authors point out multiple issues that are inherent in many studies which are; small sample sizes, improper psychometric measurements, absence of control groups, durations, lack of clarity, and lack of multilevel measurement models.

Analysis & Design

The motivation and the aim of this project, as well as the gamification elements and technical specifications that are used will be explained in this section. For this project, after careful consideration it was decided to develop a basic Learning Management System (LMS) and implement a subset of gamification elements using this newly

developed LMS. Even though using an already existent open source LMS could be modified to provide the gamification functionalities, effort required for understanding the infrastructure of an already mature LMS would be a vigorous task that would hinder the ultimate goal of this project, which is to provide an easily expandable and modular system.

Goals

GeNIE essentially has one main purpose, which is to provide an easily expandable and modular gamified system for further use by researchers. Achieving modularity within the software itself is a matter of designing the system accordingly; however, this system is also designed to be able to run on different kinds of servers, which is a matter of choosing the right tools for the development. By providing researchers a base system in which the most studied gamification elements are already functional, we hope that future studies can focus on implementing other elements and the resource expenditure on similar specifications can be avoided in the research area of gamification of education.

Another aspect of this project was the target audience, which we decided as the university students. University students are currently the main target audience of the gamification studies and since GeNIE is aimed at overcoming some burdens of future researchers, it was the suitable choice. It doesn't mean that it cannot be used for other student demographics either; as mentioned earlier, the system is built with modularity in mind but it would require more customization work.

Analysis

Majority of the researchers tested a subset of elements of gamification called pointsification (Seaborn & Fels, 2015; Hamari *et al.*, 2014) and it is likely that more researchers will come up with software solutions for these elements. So, the subset of elements to be implemented was chosen as the subset of elements also known as pointsification that mainly consists of Points, Leaderboards, Badges, and Achievements. This can potentially allow future researchers to focus on other elements and direct their resources accordingly.

Points are used for two main purposes in games, indicating progression and performance. Points that indicate progression are generally named experience points. In games, experience points are often linked to a level system, which isn't implemented in GeNIE. However, the system uses points as an indicator of a student's performance. GeNIE would allow instructors to give custom names to their point system so that it can be tailored for the specific theme that will be applied to the course. The other feature is the point-to-grade conversion that is handled by the system according to the weight given to the point system. It is important to provide a conversion scheme from points to actual grades as it can act as a motivator in that case. Points are also be used as the ranking criterion within the Leaderboards. Currently, the point system cannot be turned off like the other elements as it is directly linked with the point-to-grade conversion scheme, but it can be neglected. However, with further work, it can be modified to be as independent as other elements.

After examining the current literature, certain issues regarding the modularity of many of the developed systems were discovered. Understandably, researchers got a system designed and developed according to their needs at that time (Iosup & Epema, 2014;

Sheth, Bell, & Kaiser, 2012) but issues would arise if they needed modifications for these systems as it would require further resources to do so. On the other hand, putting a switch for each of the elements, and for the general gamification could provide great flexibility to researchers by moving this aspect from a static implementation to a dynamic one. This switch however, works on a course basis and not on a system-level so researchers can experiment with different settings of gamification using the same system, as well as having control groups within the same system. With such options and this software, only introducing new features would need resources without having any effect on the already developed elements or on the system in its totality. Also, this switch for toggling each element is given to students as well; so, they can individually opt-out of any element they don't wish to participate, which could increase a student's feeling of autonomy.

Leaderboards have the option to toggle anonymity of student names, which when toggled, hides the names of other students from the leaderboard. This can help reduce social pressure that is caused by this element. Also, instructors have the option to hide or show certain parts of the leaderboard if they wished to do so. For example, they can show the top five students in the Leaderboard or both the top five and bottom five students. This is also left to the instructor's choice. Currently only viable criterion for Leaderboards within this system is points but it can be extended to account for other criteria as well.

Badges provide another means for rewarding students through different tasks, using Achievements in this project; that will be showcased on a student's profile once they unlock that badge. Badges should have a unique and appealing visual aspect to them, as they are the main social recognition objects that are not based on a competitive element, like Leaderboards. Hamari and Eranti (2011) defined three components of an achievement as follows: Signifier, Description, and Completion Criteria. Signifier is the part of an achievement that is presented to the students. It can consist of a visual element and a textual element. Description lists the details of the achievement and explains it while completion criteria are the set of rules for unlocking that achievement. Ideally, an achievement would have a fourth component, a reward. There are multiple tracking criteria already defined within the system including attendances and assignment submission dates. The flexibility of achievements allows creation of achievements, not only with positive criteria but also with negative criteria if it's required. For example, there can be an achievement for submitting an assignment after the deadline has passed or getting below a certain grade.

Design and Software

As previously mentioned, one of the main objectives of this project is modularity and platform independence. For achieving such a platform, an architectural pattern called *Model-View-Controller* (MVC) is used. This pattern splits a platform into three components; *Model*, representing the data; *View*, representing the user interface; and *Controller*, which contains all the logic of the platform. Using this structure allows future developers to freely change a component without having any effect on the rest of them. Multiple frameworks and small components are used to achieve this structure and a better platform independence.

This project uses the programming-language called Java; which is an object-oriented platform-independent and class-based programming language ("Java SE — Oracle

Technology Network — Oracle", n.d.). GeNIE is designed as more of an enterpriselevel software solution rather than a simple web page and there are many underlying software frameworks being used to enrich the functionality of the system.

The main framework that is being used is called The Spring Framework ("Spring Framework", n.d.). Spring, provides multitudes of different modules to help build a system and enhance every aspect of it. Multiple components of the Spring Framework are being used in this project including Spring Web Flow ("Spring Web Flow", n.d.) and Spring Security ("Spring Security", n.d.), which respectively provide functionality for creating a flow within the pages, and the authorization and security aspects. Along with Spring Framework, multiple small components that are overseen by the Apache Software Foundation (ASF) are used ("Welcome to The Apache Software Foundation!", n.d.), including Maven ("Maven - Welcome to Apache Maven", n.d.). These are used for achieving a better platform independence and are included with further enhancements in mind. All these components can be considered the Controller part of the MVC structure, along with all the custom functionality of GeNIE.

View of the MVC is developed using PrimeFaces ("PrimeFaces", n.d.), which provides many rich components that could be used when creating a user interface for a web page. This can be easily changed with another technology or another design as other components of the whole system are designed with such a change in mind. Model, the last component of the MVC, represents the data of a system. An Open Source database system called MySQL ("MySQL :: The world's most popular open source database", n.d.) is used for providing database functionality. However, another framework called Hibernate ("Hibernate. Everything data", n.d.) is used to facilitate a connection between the database and the rest of the system. Main reason for using such a component for this communication is providing an easily changeable database. It is only a matter of changing a couple lines of properties to completely change the underlying database system of GeNIE, and it would work seamlessly. It is a really powerful tool that greatly improves the functionality of the system, as well as easing future improvements to it.

There are multiple servers that can run a Java-based application but for this project a server called VMware vFabric tc Server ("Pivotal tc Server Overview", n.d.) was used for hosting the application, which is actually an enterprise version of the ASF's Apache Tomcat ("Apache Tomcat - Welcome!", n.d.) server.

Implementation of a Course

As the development details of GeNIE would be overly technical for the purposes of this paper, the implementation of a sample course into the system will be explained in this section instead. Dr. Yavuz Samur provided a sample course and related content to be implemented with GeNIE, which he also presented in a paper (Samur, 2015). This course uses a point-to-grade conversion schema to calculate the final grades of students. The maximum amount of points a student needs to get an A is 1000 while the maximum attainable amount of points is higher than that amount.
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✓ New Course		New Semester Course		
Course Name Course Code	Educational Technology, Field, Theory, and Profession (EDT5001	Academic Year Academic Year Dates	Year of 2015/2016 20/09/2015 - 04/06/2016	
Short Description A short description of the course with maximum 500 characters. This will be displayed on the course selection page.		Semester Semester Dates	Fall Term Image: Comparison of the second seco	
This course introduces students of Educational Technology to the field. It is the fundamental course in instructional technology. The course tries to cover most of the topics in the field. It tries to introduce the field with the history and the course will also cover the current trends and what future will bring to the field of educational technology.		Course Name Enrollment Key	Educational Technology, Field, Theory, and Profess	
A detailed description of the course with maximum 5000 characters. This will be displayed on the course details page.			Add	
itslearning website. It should be noted that it is the responsibility of the student to download, read, and reflect upon the appropriate readings for each class, when appropriate. These resources are provided in order that class time may be better utilized for the construction of meaning and the integration of ideas and concepts. Required readings will also be available via learning management system, itslearning – should you not be able to locate a reading, please notify the instructor immediately.				
	Add			

Figure 1. Windows for creating a course (Left) and assigning that course to a semester (Right).

Initially an Administrator needs to create relevant academic year and semester information within the system before an instructor can create courses and assign those courses to a semester. Course creation happens in multiple steps, which is done by an instructor, first a course has to be created and then it has to be assigned to a relevant semester. After a course is created, the grading criteria should be set, which is done on a semester-based manner rather than course-based to provide a possibility for accurate retrospective data. The next step then is creating the *Course Plans* from the relevant page within GeNIE. Once all *Course Plans* are created, instructors can add materials and assignments to that specific plan.

After the course is properly created and everything is set, students can enroll in the course through the enroll button in the *Course List* page. There is a page called *Grading & Attendance* for entering data for students' assignment, exam, or project grades as well as their attendances. This page will also list the final grades calculated accordingly from the grading criteria that was set during course creation.

Gamification page, as the name suggests, is where all the settings related to gamification, Leaderboards, Badges, Points, and Achievements, lie. This is where an instructor can toggle a certain element, set the maximum points required to earn the assignment grade point and an alias for points to be used throughout the system. All related options could be found in their related tabs within the *Gamification* page, it is all designed to be self-explanatory. Achievement and Badge creation, and settings related to Points and Leaderboards are all found on a single page called *Gamification*. Figure 2 shows this page for the sample course created.

EDT5001 - Fall Term							
General Settings	Leaderboards	Badges Achievements					
Update General Settings							
Gamification	Enabled	Disabled					
Leaderboards	Enabled	Disabled					
Badges	Enabled	Disabled					
Achievements	Enabled	Disabled					
Point Name	Points						
Maximum Points 🚯	1000						

Figure 2. Gamification settings page for the sample course.

Evaluation

In order to evaluate and collect user experience reports after the creation of the sample course, users were asked to fill out a survey. In total, 37 responses were collected through this survey, which focused on the respondents' first expressions on GeNIE and asked them for reviews. As it can be seen from Table 1, the system was rated as being technically reliable and fast as no one encountered any issues during their usage. The user interface of GeNIE was rated consistent, which means the wording, colors, dialogs, and functionality felt consistent across the whole system. The respondents rated the interface of GeNIE as being simple and easy to use but they noted that the system didn't favor discoverability and they felt lost at times, especially at the very beginning of their usage. Further developments on this system should work on improving the interface as well as introducing a simple tutorial for getting users started with the system.

Some users commented that they would be highly motivated by badges while others said they would be motivated most by achievements but they wouldn't bother trying to unlock every single achievement. Even though respondents rated Leaderboards as the second biggest source of motivation, this controverts the current research that suggests otherwise. A comment is right on track with the literature which states that they would be hesitant about the leaderboard and they would be terrified to be at the bottom; they also stated that they would actually feel bad for whoever was at the bottom and worry about their standing there.

Table 1

Survey Results for GeNIE

Question	Mean	Std. Dev.	Std. Err.
Simplicity of the user interface	7.92	1.52	0.25
Ease of use	7.65	1.46	0.24
Organization of information on the screen	7.51	1.69	0.28
System speed	8.08	1.80	0.30
System reliability	8.43	1.46	0.24
System consistency	8.08	1.53	0.25
Do you think if everything can be done by trial and error? (Discoverability)	6.84	2.05	0.34
Did the system provide enough information and feedback?	7.03	2.15	0.35
Do you think GeNIE would've helped during your education?	7.76	1.77	0.29
Do you think if leaderboards would motivate you towards studying more?	7.38	2.25	0.37
Would you compete for the top places in the leaderboards?	6.84	2.19	0.36
Do you think if badges would motivate you towards studying more?	7.16	2.36	0.39
Would you spend time to collect all badges?	6.76	2.34	0.38
Do you think if achievement would motivate you towards studying more?	7.65	2.10	0.34
Would you invest effort to unlock all achievements?	6.92	2.15	0.35
Would you try to collect more points even after you reach the maximum required points?	6.81	2.16	0.35
How much time did you spend on GeNIE? (Minutes)	22.11	27.53	4.53
Your Overall Score of GeNIE	6.92	1.80	0.30

Conclusions and Future Work

Gamification is a relatively new area when compared with many other research areas and there are not many efficacious studies in this field/area. There are no standards or guidelines that would help researchers or instructors on gamifying their courses but this is not a surprise as the term Gamification itself doesn't have a standardized definition. During the lifetime of this project, it became clear that this research area suffered from the shortage of software support that it needs to be properly applied. GeNIE targeted this void and hopefully addressed it up to some extent. However, it needs improvements in multiple areas, which will be discussed below.

Future Research

Gamification elements haven't been examined in full detail yet, and it is still unclear if certain elements would do more harm than good, even for the Leaderboards. All

gamification elements, including the ones that aren't mentioned in this paper should be implemented and examined in order to find a definitive answer regarding their effects on students. Furthermore, these elements should be examined in their simplest form as well as a combination of elements, or even an ecosystem of elements. The scarcity of single element studies is appalling which is also mentioned in a single element study focusing on Badges conducted on a non-educative context (Hamari, 2015-in press). Another neglected approach is the perspective of a student's peers on their accomplishments. Studies that are focusing on a single element should take advantage of that opportunity and ask students about their perspective and feelings on their classmates' accomplishments; e.g. a question regarding feelings if one of their friends completed an extremely hard achievement before them. However, all future research should exercise great caution to avoid the pitfalls that affected past studies as shown and detailed by Hamari *et al.* (2014).

Future Developments

Main points that were criticized by the respondents were the lack of tutorials for getting a new user informed and ready to use the system and the shortcomings of the user interface. More gamification elements should be added to the GeNIE; however, they should be in compliance with the rest of the system on toggle-able elements. There can be future improvements made to the current elements as well; such as, opening up new paths for gaining points apart from achievements. There are many possibilities and paths that can be taken for improving GeNIE as it is an open source project and can be found online (ccubukcu/GeNIE, 2015).

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International Conference on Information Communication Technologies in Education

Proceedings

ICICTE 2016 seeks to address the many challenges and new directions presented by technological innovations in educational settings. With the keynote speaker, plenary sessions, workshops, and forums examining the integration of technology into all facets of education, the conference provides participants with a forum for intensive interdisciplinary interaction and collegial debate. Those attending ICICTE 2016 leave with an excellent overview of current thinking and practices in applications of technology to education. Thematic streams include alternative processes, procedures, techniques and tools for creating learning environments appropriate for the twenty-first century.

Conference themes include: Pedagogy in the evolving tech environment, the architecture of learning; accessibility, the evolution of the classroom; instructional design and delivery, evaluation and assessment; strategies and tools for teaching and learning; simulations and gaming; informal, non formal and formal adult education; multi-grade education; open/Distance learning; impacts on educational institutions: effects on faculty, staff, administration, and students; curriculum and program development; teacher training; building communities of teachers/educators; cooperative learning; the internationalization of institutions and of education, political economy and educational technology: Intersections, effects on training institutions and industry; ethical considerations in the use of information technology in teaching and learning; the use of technology in education to promote democratic ideals, freedom, equality; the applied psychology of ICT-mediated learning; arts education; intellectual property and online education; ethics, human right and access to open education resources; and, ICT, elite performance and professional training.



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