ICICTE 2015

International Conference on Information Communication Technologies in Education

Proceedings

Kos, Greece – 9-11 July, 2015

ICICTE 2015

The International Conference on Information Communication Technologies in Education 2015

Proceedings

Kos, Greece
2015

The Proceedings of the International Conference on Information Communication Technologies in Education 2015

ISBN: 978-0-9926958-9-7

Conference Organisers: Southampton Solent University, United Kingdom
Chairman of the Steering Committee: Chris Barlow
Conference Director: Nancy Pyrini
Conference: 9 to 11 July, 2015, Kos island, Greece

The International Conference on Information Communication Technologies in Education (ICICTE 2015) Proceedings

EDITORIAL BOARD

Contents

Preface to the Proceedings

Dear Friends,

It is my pleasure, on behalf of the Scientific Committee, to again welcome you to the Island of Kos for the 15th annual International Conference on Information Communication Technologies in Education (ICICTE). 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. We gather on Kos to engage in dialogue and collegial debate, renew old acquaintances, and spawn new ideas.

As scholars and educators we labour to determine the shape of meaning in our experience of the world as well as to provide the means for our students to do the same. Our active participation in ICICTE supports this endeavor as we collectively acknowledge not only the value of teaching and learning and the dynamic interface between teacher and student, but also the learning platform and outcome. ICICTE 2015 is a time to reflect on and re-imagine the role of the teacher and the methods we employ to create meaningful learning experiences in the face of rapid advances in information technology, methods of social interaction, and the political and economic climates we are presently within.

ICICTE strives to maintain a venue that fosters a community of scholarship that allows knowledge dissemination, information exchange, and lasting relationships to develop. Greece provides a perfect backdrop for this activity, owing its contribution to ancient scholastic activity.

As you journey through the *Proceedings* you will likely capture the flavor of this annual event - the little conference that could - that draws colleagues from many diverse countries and continents. You will also recognize 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 to promote the conference, produce these *Proceedings* from the first review of proposals, to the thorough reading and review of full papers by Scientific Review Committee members, to the skillful editing by Dr. Linda Morris. Program development, classification of presentations occur in the background by committee members to deliver a final draft to Dr. Ġorġ Mallia - the wizard - who, with the rare combination of artistic and technical professional talent, generates a collection of proceedings that captures the essence of each conference. Ġorġ also chairs the ICICTE Publications and Promotions Committee and co-ordinates all communications about the conference.

Again this year this conference is the result of successful collaboration between Southampton Solent University (UK), represented by Dr. Chris Barlow, who chairs the Steering Committee and the Justice Institute of British Columbia, Canada, represented by myself. I also chair the Scientific Committee. We are aided and abetted by Dr. Costas Tsolakidis of the University of the Aegean. 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.

Whether you are or have been on Kos with us, or are reading these *Proceeding*s from afar long after the conference has concluded, we urge you to reach out to the presenters with whose paper you find resonance. The legacy of the conference is captured here within these *Proceedings* and is testament of the many partnerships that have formed during our collegial meetings. We look forward to your active participation in our learning community, and hope to see you at the conference again next year.

Dr. Greg Anderson
Chair of the ICICTE 2014 Scientific Committee

Back to Contents page

LEARNING THROUGH INTERACTION AND CREATIVITY IN ONLINE LABORATORIES

Michael E. Auer
Professor of Electrical Engineering
Carinthia University of Applied Sciences
Villach, Austria

My Thoughts about the Future of Teaching and Learning

Education and pedagogy are thousands of years old. In fact, education is as old as the human race itself, as our species is characterized by its ability to learn, and learning is key in our evolutionary process. However, it is important to consider that humankind has never faced such a rapidly changing and dynamic global environment that requires so much of engineers as we are witnessing today.

And as our environment changes, it is imperative we better learn to adapt, which requires us to question and, when necessary, be open to changes in our educational systems, our pedagogies and all our methods and processes in teaching.

Never before have the challenges in education been as challenging as today. Never has so much been demanded of engineers.

Peter F. Drucker, the well-known Professor of Politics and Philosophy and author of the book *Management Challenges for the 21st Century* has identified the most important 21st century challenge:

> The most important contribution management needs to make in the 21st Century is similarly to increase the productivity of KNOWLEDGE WORK and of the KNOWLEDGE WORKER.

If we replace *knowledge work* and *knowledge worker* with *education* and *educator* (or teacher), we have a more exact dimension of the challenges we face, especially in engineering education.

Let me summarize my thoughts about the challenges in adapting the educational system to these new conditions by the following theses:

First of all. The future of learning will require the conceptualization and implementation of a new learning model. We need to be focusing more on 21st century competencies and expertise such as:

- Critical thinking
- Complex problem solving
- Reflection
- Interactive collaboration
- Multimedia communication

- Teambuilding and leadership
- And much more

Moreover, all this should be seamlessly woven into the tapestry of all content and domain areas.

However, let me also say the following:

> *Learning is primarily an individual process and therefore it needs personal efforts!*

We should not forget this. Nothing (no technology, no Web, no other tools) can replace the human teacher.

Therefore --

Second challenge. The future of learning will be a balanced approach between:

- E-Learning and face-to-face learning
- Formal and informal learning

A modern approach of teaching and learning is a blended one -- a combination of Technology Enhanced Learning (TEL) and the face-to-face contact between teacher and learner and the learners with each other. This is my deep belief.

> *We have to better exploit synergies from traditional (face-to-face) and non-traditional (online) education.*

Third challenge. The future of learning will revolve more around context than content.

Our age is the Information Age. We live in the Knowledge Society where data, information, knowledge are easy to access 24/7. We need a radical change from teaching facts and knowledge to convey skills and creativity (to find necessary data, facts, and knowledge) in a global context!!!

Education has to move from Instruction to Construction!

Nevertheless, there is also a paradigm shift from the amount of knowledge to the structure of knowledge!

For a long time the benchmark for successful learning was how much knowledge a student had acquired. Knowledge is multi-faceted and not only knowledge of facts:

- Knowledge about how to get facts
- Knowledge about abstract concepts (how efficiently to solve routine problems)
- Knowledge about how to master complex and dynamic problems
- Knowledge about learning strategies

Pure knowledge of facts occurs in the background.

Fourth challenge. The future of learning will be characterized by

- Open content
- Open knowledge
- Open technology

  For all!

The start of MIT's Open CourseWare initiative in 2002 marked a major shift in the paradigm of restricted access to academic materials.

Several other projects had adapted and further developed the Open CourseWare approach and now readily share course contents with outside users. Meanwhile we can observe also a shift to scientific Open Access Journals. There are nearly 10.000 journals already available in the Directory of Open Access Journals.

Fifth challenge. Learning today is a global project!

The Internet and other modern communication channels do not know borderlines. In education, we actually find global expertise, as we presently are witness to:

- A global market for content, skills and competences
- Expertise which can be exported anywhere whenever it is in demand
- Recruitment of experts from anywhere

Global education is the next online-learning leap.

Sixth challenge. Learning today is characterized by:

- Mobile and ubiquitous learning
- Learning on the job or workplace integrated learning
- Embedded learning

  Because we observe decreasing innovation cycles of products, technologies and many other things in society.

Therefore, people of all ages have to renew their knowledge in decreasing cycles. This is what we understand as *lifelong learning.* Or in short: *pervasive learning!*

Seventh challenge. The future of learning will be inseparably connected with ICT and especially with upcoming Web 3.0.

The transition from Web 2.0 to Web 3.0 represents a transition:

- From receiver to producer of information
- From static to dynamic contents,
- From control of the few to the wisdom of the crowds

The main characteristic of Web 3.0 is the use and combination of:

- Cloud Computing and Cloud Environments
- Semantic Technologies
- Social Web Services
- 3D interactive technologies

Up to this point, you could not hear in my talk the buzzword *MOOC.* Now it is the moment to tell you my opinion about MOOCs. I did not include this topic in the seven challenges, because it could be mentioned as an example in all of them.

Coined in 2008 at MIT by Stephen Downes and George Siemens, the term *massively open online courses*, or MOOCs, refers to online courses, that are offered free of charge or at very low fees and that people can take from anywhere across the world.

Now, most MOOCs are courses that primarily deliver content through short video lectures and problem sets. MOOCs are typically unaccredited courses with no transferable credits or recognized degree. Those who complete the course successfully will receive a grade with a statement of accomplishment or completion certificate.

MOOCs have an enormous dropout rate, in some cases as high as nine out of 10 students. For example: a free artificial-intelligence course offered by Stanford University attracted 160,000 students from around the world — 23,000 of whom finished it.

MOOCs have a simple pedagogical approach: Knowledge is transferred from an expert to a newcomer, rather than something that is constructed by the learners by their engagement.

(*From Debbie Chachra*)

Exactly the opposite of what we try to establish with project based learning, problem based learning, lab work (especially in Engineering Education), learning by doing, etc.

I would like to highlight here:

Learning is collaborative! Effective Learning is not a purely solo activity but essentially a distributed one, involving the individual student, other students and teachers in the learning environment and the resources, technologies and tools that are available.

(*Salomon, already 1993*).

However, what makes MOOCs so appealing?

There are about 180 million students enrolled worldwide in about 20,000 tertiary institutions. The demand for tertiary education is growing and enrolments are projected to reach 260 million by 2025.

With the cost of education going up and more students aspiring for quality education, there is growing interest in online courses offered by world-class universities. Teachers at these institutions are often involved in the generation of cutting-edge knowledge.

Accessibility of low- or no-cost knowledge and skills from the world's best is appealing to many aspirants and working professionals who wish to upgrade their skills while working and without losing income.

MOOCs are also helpful to pre-university students who are yet to make up their minds on which disciplines to pursue.

They are also a boon to keen learners who come from families with limited financial resources.

(*Seeram Ramakrishna*)

Yet, there are many unanswered questions regarding this new emerging model. Among them:

- How will students develop the skill (not the knowledge) necessary for the job they will undertake?
- How will the home institution accredit these courses?
- How will student learning be assessed?
- Can all courses be offered this way?
- Can whole degrees be completed with MOOCs?
- What will the role of faculty be?
- How will industry value the new learning models and its outcomes?

(*From a discussion with Lueny Morell*)

However, investors in open courseware are seeing potential commercial opportunities in MOOCs, and their format is still evolving with the participation of more faculty members and world-class universities.

EdX currently offers already courses from six universities and has 700,000 registered students. Partners are, for example, Australian National University, Delft University of Technology, Ecole Polytechnique Federale de Lausanne, Rice University, the University of Toronto, etc.

I think there is room for both MOOCS and other types of learning experience.

Maybe a *blended model* combining online lectures with a teacher-led classroom experience could be a success story.

Students will continue to see the value of a live interaction versus one through a screen.

My Thoughts about the New Aspects in Engineering Education

Moreover, there are some additional new aspects in engineering education.

The question is: *What is engineering?*

We can find many different definitions of engineering. A short definition of engineering might be:

> Exploiting basic principles of science to develop useful tools and objects for society.

This means that engineering is the link between science and society, which can include almost anything that people come into contact or experience in real life. The concept of engineering has existed long before recorded history and has evolved from fundamental inventions such as the lever, wheel and pulley to the complex examples of engineering today.

The history of engineering shows different periods and evolutionary as well as revolutionary developments. Contemporary and future engineering will have an evolutionary part that is characterized by a further development in areas like telephony, computers, energy, and so on.

But on the other hand there are some revolutionary elements; and we are starting now in a new phase of engineering!

The new paradigm of engineering is to offer:

- Services for society and
- Circular solutions for a circular economy

For a long time science and the daily life of the people happened more or less in parallel. Today we have a close interweaving.

By its very nature, engineering is bound up with society and human behavior. More or less every product or construction used by modern society will have been influenced by engineering design.

Up to now, engineering and industry processed resources, designed and produced goods.

Engineers have to re-think and re-organize the production of goods. Already at the beginning of an engineering development task, we have to ask: How can we recycle or renew it after its life cycle.

Re-thinking progress explores how through a change in perspective we can redesign the way our economy works - designing products that can be 'made to be made again' and powering the system with renewable energy.

It questions whether with creativity and innovation we can build a restorative economy. In the course of this, one of the biggest challenges is to reduce the necessary energy.

What does that all mean for engineering education? What are some of the new aspects of today's and future engineering education?

First. We can observe an enormous (and accelerated) growth of the area of engineering. Besides the traditional fields of civil engineering, construction engineering, electrical engineering, etc., new engineering disciplines occur:

- Bioengineering
- Software engineering
- Information engineering
- Data engineering
- Medical engineering
- Neuro engineering
- Gene engineering
- Social requirement engineering (!)
- Systems engineering as integrating discipline
- …

And new tasks requiring new competencies **within** traditional engineering disciplines have grown in number and complexity:

- Online engineering
- Remote engineering
- Virtual engineering
- Reverse engineering
- Sustainable engineering

The field of engineering now covers nearly all areas of society.

Second. We can observe a terrific acceleration of the life cycles of technical (or engineering) products.

The field of engineering has never seen such growth and suffered such reduced times to bring their innovations from concept to market. Competition in the field of technology is now measured in month and weeks.

Third. The focus of the engineering disciplines is shifting from pure technical subjects to subjects directed to Information Technologies and the daily life of humankind.

Fourth. There are serious changes in the social position of learning.

- According to some estimates, more than 80% of all learning occurs on or during the job rather than in tertiary and post-tertiary education!

Learning in the future has to be an integrated part of the job! People of all ages have to renew their knowledge in decreasing cycles. This is what we understand as *lifelong learning.*

- Engineering students have to learn to work in teams. Data from Australian and Portuguese surveys show engineers tend to spend the majority of their working week (around 60%) engaged in activities that involve interaction with others (meetings, supervision, writing reports, etc.), and only around 40% is devoted to technical engineering activity.
- This shows up also in the NACE's Job Outlook survey. Survey participants rated "ability to work in a team structure" and "ability to verbally communicate with persons inside and outside the organization" as the two most important candidate qualities, followed by candidates' "ability to make decisions and solve problems," "ability to obtain and process information," and "ability to plan, organize, and prioritize work."

Fifth. There are also new organizational aspects in engineering education.

On the one hand, engineering issues, either in industrial products or in engineering projects, are quickly becoming increasingly complicated, and most of these issues cross-disciplinary lines.

On the other hand, the working environment is becoming more and more internationalized due to the globalization of the world economy. Products are fabricated by worldwide cooperation, and manufacturing resources are linked by international supply chains. Nowadays, engineers have to know how to work in multi-cultural environments with people from different countries.

This means the next generation of engineers will need to possess the ability to work seamlessly across cultures, have outstanding communication skills and be familiar with the principles of project management, logistics, and systems integration.

Sixth. The size of the systems designed and developed by engineers grows continually. A good example for this is the concept of the *Smart City*, which includes two aspects – the social and the environmental capital.

The smart cities concept is based on regional competitiveness, transport and ICT, economics, natural resources, human and social capital, quality of life, and participation of citizens in the governance of cities.

And the vision is the global village!

Seventh. To face current real-world challenges, higher engineering education has to find innovative ways to quickly respond to the new needs of engineering education, and at low costs.

This means it is necessary to improve the agility of engineering education in the future. One of the approaches in this direction is the creation of virtual educational units, which can be flexible adapted to new requirements in engineering education.

Another conclusion is that engineering education has to focus more on basic knowledge and skills and in this way to prepare for lifelong learning.

Seventh. All these trends result in new questions and the resulting need to evolve educational practices, especially in *engineering pedagogy*. Some of these important questions to consider include:

- What learning approaches have to be used to effectively respond to these changes?
- What are the pedagogies that provide the most effective learning experiences for engineering students of the 21st Century?
- What learning skills in engineering education need to be developed, and how can engineering teachers succeed in guiding their students to achieve them?
- What pedagogical approaches have been found to support the different phases of the present lifelong learning continuum, or is there more research necessary?
- What are the approaches that enable competence in leadership skills in a multi-cultural working environment, and what is the best way for these competencies to be delivered?
- Ambient technology is becoming a reality. What does ambient learning in engineering education look like? How can it be designed, delivered and assessed?

These are some of the reasons why the relevance and importance of engineering pedagogy is growing so enormously.

My Thoughts About the Role of Online Laboratories

Online laboratories are necessary for distance or mobile learning for the same reason laboratory practices are important in traditional educational scenarios. Learners can acquire theoretical knowledge and experience by manipulating or viewing the behavior of real world phenomena.

Online engineering laboratory practice can be delivered by means of online laboratories that permit workers to access knowledge and experience from remote colleagues or institutions who share similar problems. In this way, an individual problem can become a shared problem to be resolved with the experience of homologues for different places. Among other things, remote laboratories are important because they provide real-world results, not simply knowledge or resources. Persons using remote lab resources can view how objects actually behave under a certain set of circumstances, providing them with a better insight as to what needs to be done. Online engineering in the workplace is becoming increasingly important because of the growing complexity of engineering tasks, the need to share resources among different companies (equipment, simulators, etc.), especially for short-term trouble shooting that does not warrant the purchase of equipment, the potential collaboration among workers in different companies who share the same problems and can contribute to collaborative solutions, the increased linkage among SMEs and larger enterprises, etc.

In addition, importantly, online laboratories offer the additional advantage of not being subject to the limitations imposed by time and location, as persons can synchronously collaborate, experience, and obtain results in a collaborative synchronous manner. This, along with expanded access to broadband internet, is transforming the way e-learning is carried out, allowing increased levels of interactivity and providing virtual environments closer to real ones. Virtual environments provide the opportunity for students to freely practice various scenarios in quick succession without the fear of actually damaging resources, which often hinders real-life practice. This 'safe' way of gaining practice also encourages initiative, experimentation and creativity, as students do not have to face real-world practical restraints.

Synchronous active interaction with experiments and problem solving helps individual or collaborative learners directly acquire applicable knowledge that can be used in practical situations, which is why pedagogical theory and practice considers laboratory experimentation an essential part of the educational process, particularly in the sciences and engineering.

Synchronous interaction is also important because it provides immediate feedback so that students can interact with experiments in real-time, thus obtaining numerous potential results, instead of running one experiment and waiting for the results later.

Online laboratories make all this shared use available via the Internet and are becoming increasingly important applications in the new domain of *online engineering.* Online engineering can be defined as an interdisciplinary field utilizing the areas of engineering, computing and telematics, where specific engineering activities like programming, design, control, observation, measuring, sensing, and maintenance are provided to both remote and local users in a live interactive setting over a distributed, physically-dispersed network (for example: an Intranet or the Internet).

The availability of high bandwidth Internet connections worldwide and other derivative capabilities in the areas of real-time communication, control, teleconferencing, video streaming and others have made multi-site collaborative work, utilizing state-of-the art equipment in remote laboratories across the globe a current reality.

Learning situations in laboratories can be highly complex, although they have the advantage of usually being well structured. Particular experiments and learning strategies of specific practices provided in laboratories must be tailored to the knowledge students possess in the theoretical realm and in function of the abilities and competences that are explicitly stated in educational objectives of each individual practice.

Although self-directed learning is the most common learning strategy used, a mix of self-directed and collaborative learning is also very common. This mix in learning strategies is important as it favors both field independent and field dependent learning styles respectively.

It is still difficult to share instrumentation and experiments among laboratories. Each one has its own security policy and adopts its own technology for accessing and controlling real devices. A common integrated framework, offering indexing facilities, unique logins, file sharing and the seamless access and run of experiments, is the main challenge in order to create a network of online laboratories. Grid technologies can be used to set up an effective network of remote laboratories for education purposes by sharing instrumentation and resources. However, the evolution of remote laboratories from the current client/server architecture to grid-based architecture requires well-defined tools for location, security, and integration of resources, and further research is currently being conducted to examine this issue.

As universities and other institutions are likely to develop their own solutions and standards to deliver online laboratories to their users, no trend to a unique standard is observed, creating an obstacle against sharing these online labs. Considering the current scenario, a migration towards standardized solutions for delivering online labs becomes necessary to ensure software reusability and therefore facilitate online labs development and sharing.

At this point, the ISA (iLabs Shared Architecture) comes into play. ISA is a software architecture developed at MIT (Massachusetts Institute of Technology) (see Figure 1), which facilitates a cross institution sharing and management of online labs. ISA provides a framework for the maintenance of a lab session, lab users' management and experiment data storage. It establishes clear rules governing the communication between clients and their respective online lab servers by means of an API (Application programming Interface) based on Web services SOAP calls.

ISA proposes a classification for online experiments. On one side there are the batched experiments and on the other the interactive experiments. Batched experiments are those in which all parameters necessary to run it are specified before execution. On interactive experiments, the user can change the course of the execution at any time.

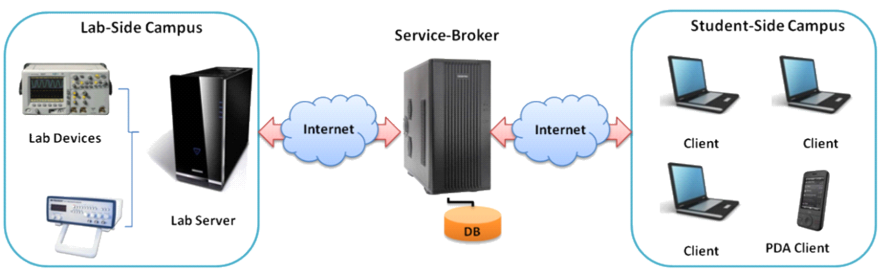


Figure 1. The iLab Shared Architecture.

In this architecture the communication between clients and laboratory is mediated by a middleware server (service broker), a Web application that manages users' accounts and data storage that can provide different clients with access to several different lab servers in a *many to several* mode, and that delegates to the experiment server only the experiment execution.

The interface that provides the communication between clients with service broker and service broker with lab servers is implemented with Web services and is therefore platform independent. That means that clients and lab servers can be developed in any platform supporting Web services.

The iLab Europe started as an initiative from Carinthia University of Applied Sciences in Austria and now includes six partners throughout Europe who agreed to share their online experiments within the network.

The software architecture used to maintain the lab sessions as well as scheduling service and experiment data storage is the iLab Shared Architecture (ISA) described above. ISA has an important characteristic namely its distributed topology, what made it the ideal solution for the implementation of such a network of interconnected online experiment.

ISA has already built in mechanisms that allow set up of trusted connections between its autonomous network nodes (service brokers) so that online laboratories can be seamlessly shared between them. This means that the institutions are free to manage their own online laboratories and their own user accounts and deliver these labs via their own server. In this way, access for their users to their own labs does not depend on the status of other service brokers. On the other hand, in order to be able to use labs from other universities a user has to authenticate himself/herself in the main service broker as depicted in Figure 2. Each institution member of the network is expected to set up one service broker and deliver at least one experiment via this server. This means that for a pool of labs available at one institution it is up to them to decide which labs will be available to the other members of the network.

This topology was chosen because, in this first stage of implementation, it seemed to be the most suitable one from the network management point of view. It is a general consensus that online laboratory providers should manage their own labs and their own users. Users can access the online laboratories available at their institutions either by authenticating themselves in the main service broker or in their institution's service broker. In this way, each service broker from an institution can be considered a subset of the whole iLab-Europe experiment poll.

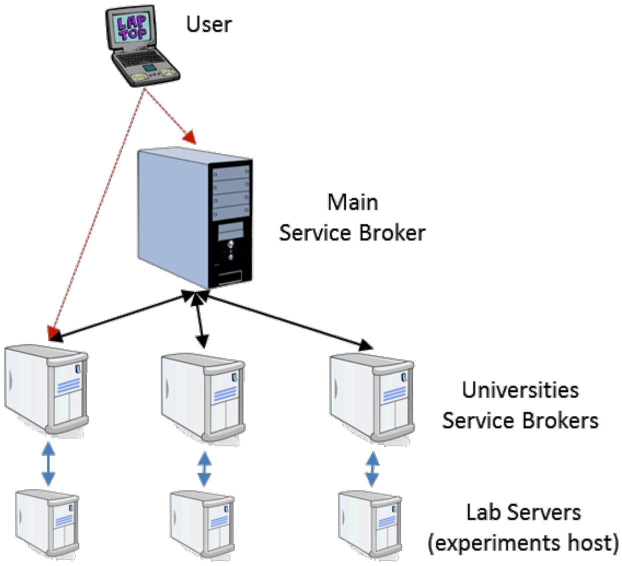


Figure 2. iLab Europe network topology.

In spite of all the efforts and the technology available, the idea of sharing remote or online laboratories has still to mature. If on one hand it is very appealing, on the other it might be complicated to set up all the policies to share these online labs. These constraints are not related to the technical aspects associated to the practice of sharing labs as a number of software architecture focus in providing services for online lab users already addresses these issues. The constraints lie in the lack of an economy of online laboratories and a business model to govern the practice of a cross institution sharing of labs considering implementation and equipment maintenance costs.

The iLab-Europe network is, in this context, a step towards a broader usage and dissemination of online laboratories and helped to raise the issues that must be addressed for the implementation of a more efficient model to govern the practice of sharing labs on a cross institution basis. It has shown that the administrative efforts are high, and it assumes the adoption of a specific technology by the different online lab providers.

The efforts for the future will be to implement a network with such autonomous nodes as a peer-to-peer architecture. However, to some extent, Administrators of each node should be able to decide which resources will be available for others and at which costs, if an agreed business model exists. The client-server model should still be maintained for users to carry out experiments and for any other communication between the lab servers and laboratory client (user). In the proposed architecture, each node should manage its own users. This means that the user database will be maintained as a distributed one. Authentication is necessary only once in one of the network nodes, but available are all resources and services from the whole cloud. Another advantage is if any node of the proposed network happens to be offline, this would have no consequences for the remaining nodes.

Beyond the technical aspects, sharing experiments can offer several advantages, such as providing access to potential expensive laboratory hardware to students from universities with scarce financial resources by means of a cooperative network of remote systems. Furthermore, online controlled systems can be very useful when applied to situations involving the often substantial costs of transporting people or equipment. Different institutes and schools could share experiments and knowledge in a collaborative manner that parallels real-life working conditions. Importantly, online labs can be also used in workplace settings where there is a pressing need to apply these systems to continually provide learning opportunities for workers who must adapt to rapidly changing conditions.

Back to Contents page

A TURNINGPOINT FOR CLOUDY DAYS

Patrice O'Hagan, Account Manager,
Turning Technologies, United Kingdom

Research has demonstrated that engaging students in the learning process increases their attention and focus, motivates them to practice higher-level critical thinking skills, and promotes meaningful learning experiences. Instructors who adopt a student-centred approach to instruction, through increasing opportunities for student engagement, help their students achieve the course's learning objectives through engagement.

Students are under more pressure than ever to achieve, and instructors bear the burden of this whilst ensuring their teaching practices are designed to guarantee success. Instructors must make sure that they engage their students, with relevant course content and structured learning plans and through asking meaningful questions in homework and in class.

Turning Technologies is passionate about creating educational technologies designed to enhance all learning environments and produce real results. Our portfolio of learning tools is designed to inspire achievement each and every day. Easy -to-use solutions enable instructors to ask questions, and gather feedback, whilst providing valuable data to engage, monitor and measure learning progress. We support the entire student assessment process, guiding instructors through the creation of material, presentation of content and in-depth reporting to track success. In using our software and devices, student learning will be supported in creative and innovative ways, when properly aligned with the instructor's learning objectives and course content.

In using our software and devices, instructors will gain:

- 30% increase in productivity
- 67% increase in engagement
- 40% increase in retention
- 61% increase in discussion
- 94% increase in attention
- 91% in learning

Our learning tools allow instructors to manage and deliver content in ways that improves learner success.

Turning Technologies offers many types of response devices, to meet the needs of both instructors and students, including five different types of ResponseCards, and also ResponseWare and vPad – our virtual response solutions that allows students to respond through any web-enabled device. We also provide Interactive Whiteboards and MobiView, which is equipped with the capabilities of a fixed interactive whiteboard, plus the freedom of full mobility and complete lesson control with its one-of-a-kind touch screen.

At present, we offer TurningPoint 5 software, which is an easy-to-use powerful polling solution. The TurningPoint dashboard offers one, simple interface for instant management of polling, content, participants, sessions and reports. Turning Technologies also provides Flow, Workspace and Triton – software all developed for use by instructors to gain student engagement and improve results.

We will soon be moving to a Cloud-based solution, which will leverage our enterprise platform for web-based data, content and organisational management with appropriate layers of security. Employing a cloud interface makes mobile access, remote working and the sharing of information easier than ever and will integrate seamlessly with other solutions to accelerate learner success. TurningPoint Cloud provides secure ways to share files, give feedback and save settings across devices, and it is also fully integrable with LMS such as Moodle and Blackboard.

Turning Technologies is continuously evolving, through listening to the needs and wants of our customers and meeting the changing demands of the educational environment. Instructors are continuously challenged to develop, through changing lesson plans, engaging their students, and effectively monitoring every student's progress. Turning Technologies helps to support instructors at every level through our unique software and hardware solutions. Education is a process of teaching, learning and outcomes related to a particular subject matter, and the utilisation of technology within this process can significantly impact both teaching methods and learning outcomes. Turning Technologies response technology offers a unique ability to efficiently collect predictive student data, whilst simultaneously implementing quality teaching strategies, proven to positively influence learning.

Our learning tools allow instructors to manage and deliver content in ways that improves learner success.

Back to Contents page

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.

Back to Contents page

ICICTE 2015

Plenary Sessions

RIDING THE PERFECT STORM: DESIGNING AND DELIVERING CONTENT FOR TODAY'S LEARNERS

Irina Chernikova and Evangeline (Litsa) Varonis
The University of Akron
United States of America

Abstract

In a time that could be described as a *perfect storm* in higher education, faculty and administration have been exploring all possible tools to attract students and help them stay on a curriculum path so they can graduate within a reasonable time. This paper explores three strategies for riding the storm in the College of Applied Science and Technology of The University of Akron: increased choices in scheduling, redesigning the curriculum, and offering multiple options for mode of delivery. In addition, the pilot of these strategies in a Technical Data Analysis class will be described and evaluated.

Introduction

Declining numbers of traditional-age high school graduates, changing student demographics, and struggle with student retention and success are dominating problems that create what can be termed a *perfect storm* in higher education. Having a diverse ever-changing college population is challenging; it is crucial to understand what current and prospective students want and need to be able to do upon graduation in order to increase retention and encourage degree completion.

As Figure 1 shows, the first-year retention rate for bachelor degree-seeking full-time first-time (FTFT) students enrolled in Ohio varies from 62% to 93% (2010 cohort), while the six-year graduation rates for such students varies from 30% to 81% (2005 cohort). Columns representing The University of Akron, abbreviated "UA," are indicated in orange, with a first-year retention rate of 72% and a six-year graduation rate of 38% (data from U.S. Department of Education).

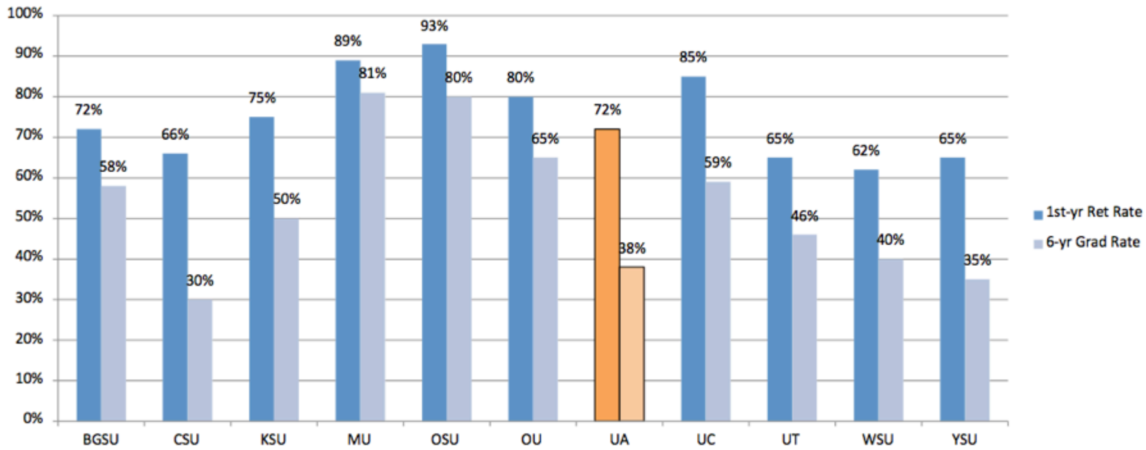


Figure 1. FTFT bachelor degree-seeking 1st -year retention rates and sixth-year graduation rates for Ohio universities.

According to Inside Higher Ed's survey of Chief Financial Officers (CFOs), "Retention is displacing recruitment of new students as institutions' top priority" (Lederman, 2013, para.10). Ninety two percent of the CFOs identified retention as the top revenue producing strategy, beating out increasing the endowment (62%), developing and expanding online programming (58%), and investing more in fundraising (53%) (para. 23). In Ohio, retention is particularly critical as state subsidies depend on successful completion of a course and rise with each year that a student remains enrolled; as a result, a senior generates more financial support than a freshman.

The *2015 Horizon Report* of the New Media Consortium notes, "All over the world, universities and colleges have been gradually rethinking how their organizations and infrastructures can be more agile" (Johnson et al., p. 7). While improving enrollment is a complex task that involves the entire university structure from top to bottom, student retention and course completion have their beginning at the bottom level, including individual programs, departments, and advising.

Many sources show that students are looking for time flexibility in course scheduling and structure and clarity in course content and its delivery. It is also important for students to see logical connectivity among courses while following program curricula and for curriculum designers to think far beyond traditional methods of teaching and learning. Therefore, faculty and administration have been exploring all possible tools to attract students and help them stay on a curriculum path so they can graduate within a reasonable time.

Three strategies have emerged as the most effective ways to make a difference:

1. Creating numerous scheduling choices for students to stay on a curriculum path
2. Redesigning the curriculum with logical connectivity among sequential courses (e.g., a Course contextualization/Linked Courses/Integrated model)
3. Developing a wide spectrum of delivery modes to accommodate learners' preferences and schedules

Such strategies can be easier to implement at a local rather than global level in terms of university administration. This presentation results from the collaboration of two individuals from the same university: a department chair who is also faculty and an instructional designer who is also an adjunct faculty. In the context of the overarching goal of creating a flexible schedule utilizing a variety of course delivery methods (including but not limited to online, hybrid, and accelerated sequels), we will document how we redesigned a traditional face-to-face class in a 300 level Technical Data Analysis for online or hybrid delivery while ensuring accessibility and the achievement of learning objectives.

The College of Applied Science and Technology at The University of Akron

The University of Akron is a public, state university in the state of Ohio with several branches, including the College of Applied Science and Technology (CAST), which is adjacent to the main campus. Originally designated a community and technical college offering associate's degrees, it has evolved to include bachelor's degree programs as well as certificates in departments of Engineering and Science Technology, Business and Information Technology, Public Service Technology, and Applied General and Technical Studies. It also houses two training centers: Fire/Hazardous Materials and Law Enforcement and Criminal Justice. CAST has long focused on preparing learners for technical vocations in fields with a high hiring demand.

CAST was an early leader in developing courses taught in alternative delivery formats. Such delivery methods include distance learning classrooms, which utilize point-to-point and multipoint videoconferencing originally, and online courses, which pre-dated a learning management system (LMS) and were originally offered via e-mail. Alternative delivery methods provide options for learners who may be balancing the demands of full-time work, family, and school.

Strategy 1: Scheduling Choices

UA faculty and administration have been trying all possible tools to attract students and keep them on curriculum paths with the hope that they will graduate within a reasonable time. It has become imperative to recognize and understand what current and future students want and develop innovative opportunities to increase student access to degree and certificate programs that are flexible in time and location. One approach is to create numerous scheduling options varied in time, sequential course arrangements, and delivery options. Understanding that students represent different levels of preparation and learning styles, the administrators of CAST's Department of Associate Studies diversified the course schedule in many directions to create accelerated sequences of different general education courses offering flexible pathways to graduation (Figure 2). This was the most efficient way to utilize students' time. For example, all degrees require at least two writing and two social science courses. As a result, during the traditional 16-week semester course sequences were offered in an alternative eight-week "fast and furious" format with both courses offered back-to-back in the same time slot and at the same place so that students would not experience changes in their schedule and habits in the middle of the semester.

Strategy 2: Redesigning the Curriculum

Today, a major goal of education is the ability to find suitable work at suitable pay upon graduation. Therefore, preparing students for the workforce is a major consideration in curriculum design, but it is not enough to ensure degree completion. Students need to be engaged and persistent in order to remain motivated and therefore succeed. According to Davis, "Most students respond

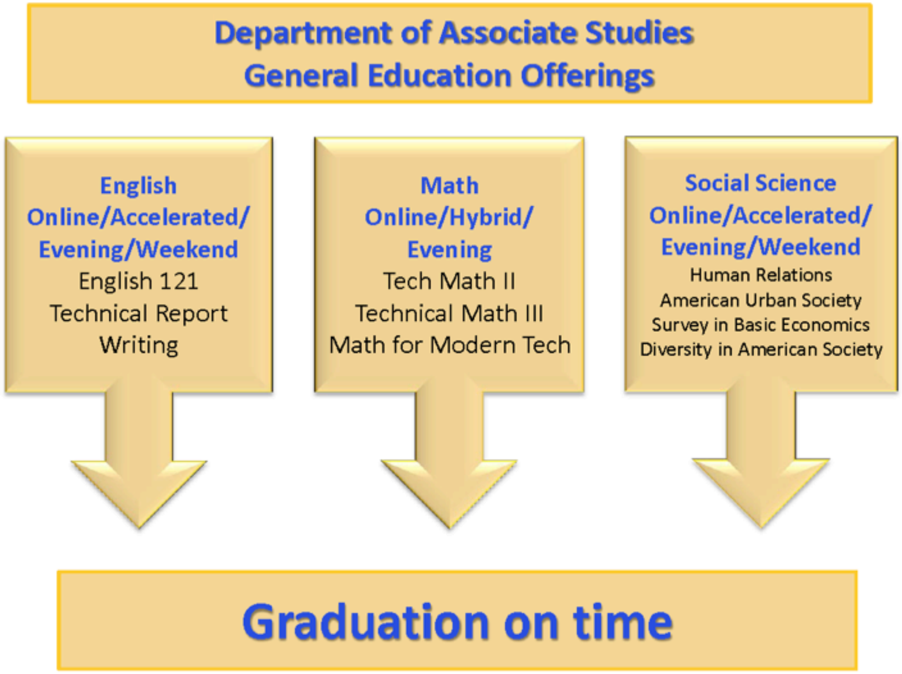


Figure 2. Flexible pathways to graduation.

positively to a well-organized course taught by an enthusiastic instructor who has a genuine interest in students and their learning" (2009, p. 31). However, enthusiasm and expertise are not enough; faculty must also be prepared to help students meet their needs. There are two factors that must be considered when designing curriculum: *what to teach* and *how to teach it*. We have applied these factors in redesigning the curriculum for the sequence Technical Mathematics I-IV as an example of motivating students through "what to teach," as depicted in Figure 3. The figure conveys the fact that the courses are discrete and sequenced as well as the fact that there is scaffolding in the content, as depicted visually in the overlap between the sets of courses from left to right.

We started with asking the following three questions, originally posed by Walvoord (2004, p. 94):

1. Are the learning objectives of the course being met? Are students being inspired and motivated to think analytically and creatively and develop habits of mind appropriate to the discipline?
2. Are the course material, concepts, and activities rigorous, current, relevant for students' needs, and consonant with the announced course description?
3. Do students perceive themselves to be well taught?

Changes have therefore been made at the department level with two directions in mind: (a) smooth connection between all courses in the sequence and (b) including repeated review blocks with material of increasing complexity in each course in order to maintain students' algebraic skills, which usually disappear very fast if not practiced. Thus, teaching goes in two directions: forward with new material and backward with spiral repetition. When courses are logically structured and have overlapping parts, students gain knowledge and confidence that they have mastered skills and this develops their own self-motivation.

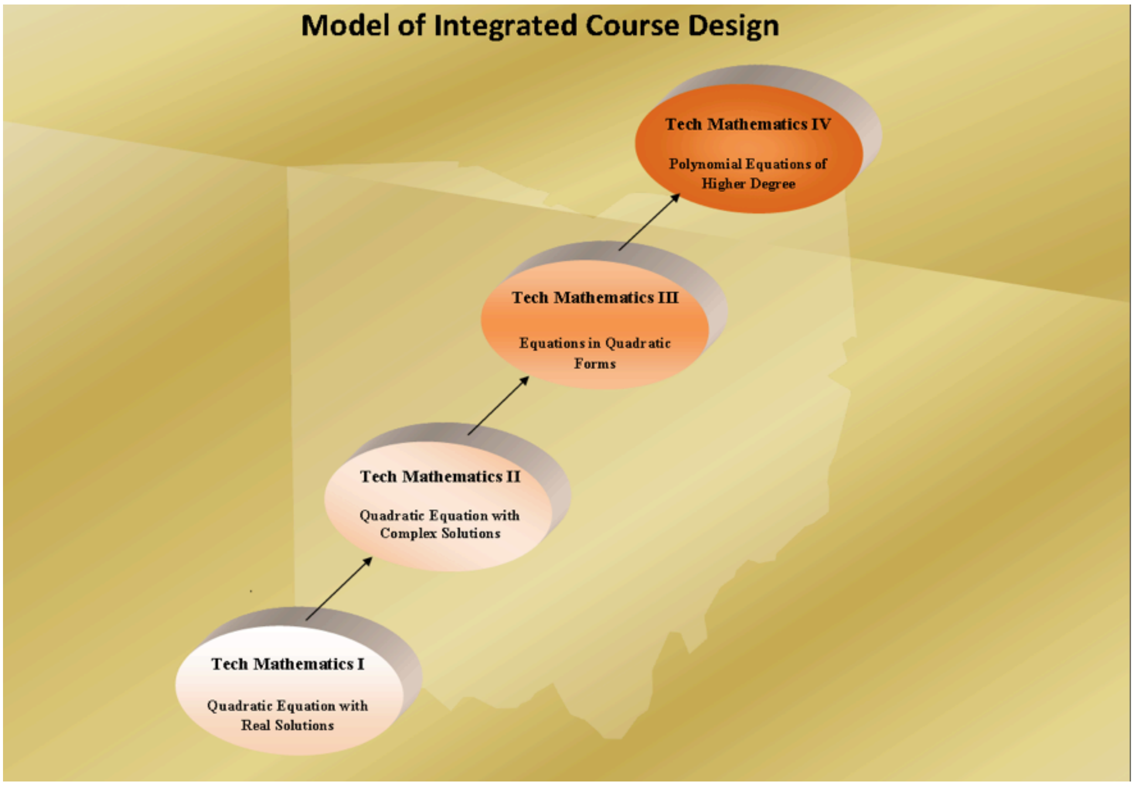


Figure 3. Redesigning the curriculum for the technical mathematics sequence.

Strategy 3: Developing a Wide Spectrum of Delivery Modes

A U.S. census report on enrollment and work status reveals that 19.7 million students were enrolled as undergraduates in 2011, and 72% worked, with 20% working full-time (Davis, 2012, p. 1). Students who are balancing studies with work as well as other aspects of their personal lives can benefit from having options in the selection of courses, especially when one of those options includes online delivery. The Open Education Database summarizes ten advantages to taking online classes (2012), including “Convenience and flexibility” (para. 6) and the opportunity to “Avoid commuting” (para. 10). Many universities have responded to the demand for convenience and flexibility by adding not only online courses but entire online programs; in fact, 69.1% of chief academic officers report that “online learning is critical to their long-term strategy” (Allen & Seaman, 2013, p. 4). While some institutions may envision new programs with entirely online delivery, it is probably more common to have existing face-to-face courses approved by the institution for online delivery, one course at a time.

Transitioning One Course to Online: Technical Data Analysis

In Summer 2014, Irina Chernikova was a member of the first cohort at The University of Akron to complete the two-week full-day workshop “Designing and Developing Your Online Course” offered by Design and Development Services (DDS) through the Institute for Teaching and Learning. This workshop provided demonstrations of LMS tools by the staff of DDS, including Litsa Varonis, and opportunities for faculty to immediately apply new skills by practicing inside a development shell for one of their own courses. Relationships formed between faculty members and DDS staff during the workshop have typically generated continuing partnerships even when the workshop is over, and such was their relationship.

One challenge faced by Chernikova in converting a face-to-face course in Technical Data Analysis to online delivery was the design of the assessments. They are scaffolded to require increasingly complex responses from the learners, and in a paper-and-pencil version students are expected to work complex, multi-part problems and show their work in the space provided. This method allows awarding partial credit for answers that are only partially correct, but also involves time-consuming manual review of each submission.

There were a number of factors to consider in translating the original questions for online delivery:

1. The questions had to measure equivalent performance; in other words, it should be possible to determine if students had met the learning objectives for each unit no matter if they were tested traditionally or online.
2. It should be possible to provide both questions that could be automatically scored, and questions that could be manually scored.
3. The fact that students would not be able to share their work leading to an answer should not affect the outcome of the assessment.
4. Questions had to be accessible to all students, including those with disabilities that might affect the way in which they received information from an image or table.

As an example, consider this question from Quiz #3:

2) (8 pts) The heights (in inches) of 30 adult males are listed below.

70	72	71	70	69	73	69	68	70	71	67	71	70	74	69
68	71	71	71	72	69	71	68	67	73	74	70	71	69	68

(a) Construct a frequency distribution table. **Show how you find the class width W**.
Show all columns (Classes, Frequency, Midpoints, Relative Frequency, Cumulative Frequency). **Use 5 classes.**
Important suggestion: round W up to **2** and start your first class from **66**

(b) Construct a frequency histogram.

This question actually contains multiple sub-parts totaling 8 points, but how points will be awarded is not specified. In addition, it calls for students to explain how they will arrive at one of the responses.

Translating the problem into an online format involved breaking down the task into simpler units that would still allow students to demonstrate their ability to solve the problem. Our mission was to create assignments and assessments that would allow us to verify the process students used to solve complex problems. Answering the questions would allow the students to prove, for example, that they had correctly constructed a frequency distribution table even if they were not required to share it.

In order to make the data available for each of the questions students would have to answer, a *section* was created in the LMS Question Library that would allow the heading and data set to be displayed until students were completely finished with the problem. The data table was recreated instead of being inserted as an image in order to assure that the data could be read by a screen reader. In addition, the problem was broken down to contain 8 separate questions with boxes for students to enter their responses for automatic grading. Students were advised that their answers would be graded automatically and that therefore providing the exact form requested was critical. It is also possible to manually override the automatic score if a misspelled word or extra space renders an answer incorrect.

> Frequency Distribution for Heights of Adult Males [section name]
>
> The heights (in inches) of 30 adult males are listed below.

0	2	1	0	9	3	9	8	0	1	7	1	0	4	9
8	1	1	1	2	9	1	8	7	3	4	0	1	9	8

> Construct a frequency table on paper and answer the following 8 (eight) questions. [Note: boxes are provided for students to write in their responses]
>
> Question 4 (1 point). What is the class width W rounded up?
> Question 5 (1 point). What is the low limit of the second class?
> Question 6 (1 point). What is the frequency of the third class?
> Question 7 (1 point). What is the midpoint of the fourth class? Do not round your result (example of the answer: 4.6)
> Question 8 (1 point). What is the upper limit of the fifth class?
> Question 9 (1 point). What is the relative frequency of the second class in percentage? (example of the answer: 22%).
> Question 10 (1 point). What is the cumulative frequency of the fifth class?
> Question 11 (1 point). What is the sum of all frequencies?

In designing the online version, we decided that it was not necessary to ask every question that had been presented on the pencil-and-paper exam. Instead, students could demonstrate their grasp of concepts and ability to solve problems by correctly answering some of the questions that could be asked about each data set.

Online quizzes with converted questions were first piloted in Spring 2015 with a face-to-face class in preparation for use with a fully online class in the future. Additional online features that were introduced to this class include homework sets and solutions as well as a *Coffee Talk* discussion forum for conversations about course concepts and general communication. In addition, a *Week 0* module was created with a structure identical to that of the other modules containing information and exercises students could practice with before the course began.

In the course of converting the quizzes, we engaged in many discussions about learning objectives, what students needed to demonstrate in order to meet those objectives, how to make images accessible to all students, and how such performance could be equitably assessed online in a manner that allowed for automatic scoring. Some questions became multiple choice; others, like the example above, allowed correct answers to specific questions to represent success in solving a complex problem as a whole. We experimented with "matching," "multiple answer," and "multiple choice" question formats. We also made sure that all images were alt tagged so crucial visual information was provided (e.g., describing a histogram as "positively skewed").

Evaluation of Pilot

Redesigning paper assessment documents such as homework and quizzes into an electronic format is a seriously challenging process at least in two ways: 1) it is necessary to adequately rewrite and organize questions for online delivery; and 2) it is important to carefully design how students can enter their answers. Confirmation of the quality of such transformation requires testing. That is why we offered students in a traditional face-to-face class to be our judges, to help prepare the assessments for the future totally online students. Feeling empowered, they agreed.

The process was the following: students first submitted a paper version of an assignment or quiz, which was graded. Then, they submitted the assignment or quiz online. At first glance, the results of the online quizzes appeared strikingly low. However, there were two reasons for this: first, some questions that ask for written answers require manual grading, and second, there were instances of students misunderstanding of a question or human error in the answer identified as correct for automatic scoring. After responding to the problems that required manual grading and correcting the errors, the results of the paper and online assessments were comparable.

We observed the adequacy of both paper and online quizzes and homework. Students at the same time were checking correctness and understandability of online assignments and offering helpful feedback. For example, they pointed out that some of the "matching" questions were difficult to answer in the original format, and therefore the format was modified so it would be more usable.

Conclusion

Our collaboration on this project began with the very concrete task of converting assessments for online delivery and grew to include theoretical discussions related to curriculum design as a whole. In the safe environment of a face-to-face class, we introduced online course elements, including assessment tools, in order to test them and determine if they could help students achieve course learning objectives in an alternative way. The pilot proved the adequacy of online assessment tools even though the questions asked had to be modified, both to work within the LMS quiz tool and to allow for automatic grading of questions with clear "correct" answers. Additional resources were developed and utilized to enhance students' interaction with content, with the instructor, and with each other, considered a best practice for online course design by Quality Matters (2014). The students were engaged with the process and happy to offer their feedback.

Continued discussion led to the realization that our strategy aligned with two others already introduced in various departmental courses. All three strategies could be implemented together to help address the challenge of guiding students through a curriculum path to degree completion despite the barriers that are common among students enrolled at a public state university. Providing choices in scheduling courses (strategy 1), redesigning the curriculum to offer flexible pathways to graduation (strategy 2), and offering students options in delivery modes (strategy 3) increase the likelihood of student success, allowing us to find a way out of and therefore escape the "perfect storm" that higher education finds itself in today. Continued testing and implementation will give us the information we need to improve and perfect these strategies in order to increase retention and degree completion.

Acknowledgements

We are very grateful to the Spring 2015 students of Technical Data Analysis for engaging with, responding to, and providing feedback on the changes implemented in their course and to Orestes Varonis for his feedback on an earlier draft of this paper.

References

Allen, I. E., & Seaman, J. (2013). *Changing Course: Ten Years of Tracking Online Education in the United States*. Sloan Consortium. PO Box 1238, Newburyport, MA 01950.

Davis, B. G. (2009). *Tools for teaching*. San Francisco: Jossey-Bass.

Davis, J. (2012). School enrollment and work status: 2011. *American Community Briefs*, 11-14. Retrieved from https://www.census.gov/prod/2013pubs/acsbr11-14.pdf

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). *NMC Horizon report: 2015 higher education edition.* Austin, Texas: The New Media Consortium. Retrieved from http://cdn.nmc.org/media/2015-nmc-horizon-report-HE-EN.pdf

Lederman, D. (2013). CFO survey reveals doubts about financial sustainability. *Inside Higher Education*. Retrieved from https://www.insidehighered.com/news/survey/cfo-survey-reveals-doubts-about-financial-sustainability

Open Education Database. (2012, January 12) 10 advantages to taking online classes. Retrieved from http://oedb.org/ilibrarian/10-advantages-to-taking-online-classes/

Quality Matters. (2014). Quality matters higher education rubric (5th ed.) Baltimore: Quality Matters Program.

U.S. Department of Education: Institute of Education Sciences, National Center for Education Statistics. (n.d.) Integrated Postsecondary Education Data System. Retrieved from https://nces.ed.gov/ipeds/

Walvoord, B. E. (2004) *Assessment clear and simple: A practical guide for institutions.* San Francisco: Jossey Bass.

Author Details

Irina Chernikova, PhD
irina@uakron.edu

Evangeline (Litsa) Varonis
varonis@uakron.edu

Back to Contents page

BEYOND CUT-AND-PASTE: CREATING INTERACTIVE ONLINE RESOURCES TO INTRODUCE FIRST YEAR STUDENTS TO ACADEMIC CITATION

Evangeline (Litsa) Varonis, Laura Monroe, April Trowbridge, Katherine Gulliford, Clifford Holcomb, John R. Reyes, and Marty Smith, The University of Akron, and Maria Varonis, Stark State College, United States of America

Abstract

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. This paper reports on the design, development, implementation, and evaluation of the Spring 2015 pilot project.

Introduction

The existence of an international conference on integrity and plagiarism is an indication of the need to address "the importance of academic integrity as a way of life and reinforce the relevance of academic skills in the real world" (Plagiarism Advice Team, para. 4). University students, in particular first-year students, struggle to master the skills needed to participate in academic discourse as members of a larger academic community. Appropriate use of source material and citation is central to developing college-level information literacy and a sense of belonging to such a community.

The skills needed to master citation and avoid plagiarism have always challenged first-year students, in particular international students and first-generation students who have not been exposed to the culture of academic discourse communities. Methods to impart these necessary skills to the first-year students at The University of Akron (UA), including the effectiveness of technology, have been discussed as part of the learning outcomes for the General Education curriculum. While it is a challenge to ensure that all university students are aware of the reasons for citing material and the consequences of not citing, such a challenge might be termed "solvable" as opposed to "difficult" or "wicked" in the terms of the 2015 *Higher Education Edition Horizon Report* released by the New Media Consortium (Johnson, Adams, Becker, Estrada, & Freeman, 2015, p. 2). Therefore, as a result of the campus discussions and the need for a solution, an interdisciplinary team of UA writing and technology professionals, along with four graduate students in Instructional Technology who were taking a class in Instructional Design, collaborated on the creation of an online tutorial to address a solvable challenge by providing training on citation and appropriate use of outside source materials.

This paper will describe our team approach to designing multi-faceted online training modules to introduce students to the expectations of academic discourse, use of appropriate citation styles, and issues related to plagiarism. The modules were structured to permit instructors and students in a wide array of first-year courses to master these skills using interactive activities created specifically to meet the needs of the university's diverse undergraduate population.

The Plagiarism Problem

The existing literature surrounding the discussion of plagiarism shows that there are multiple functioning definitions used in the academic community. These definitions cover a broad range from simple to complex. For example, the definition developed by Fish and Hura (2013) in their study of plagiarism at the university level asserts that "Plagiarism is representing another author's ideas or words as your own in course documents or electronic postings" (p. 35). The University of Akron's *Code of Student Conduct* defines student plagiarism as "student misconduct" with a plethora of serious ramifications for the offender (2015, p. 6).

It is important to note that definitions of plagiarism in higher education include both intentional and accidental plagiarism. Many educators have learned that adopting all-encompassing definitions broadens the idea of plagiarism to include all possible motives, creating the flexibility to meet the problem from various creative angles.

Voelker, Love, and Pentina (2012) make the excellent point that a large majority of the research assumes that students are fully aware of what plagiarism entails. Their studies have shown that students' knowledge of plagiarism is not correlated to their education level, as many educators believe, and therefore students can be largely unaware of when they plagiarize. This is known as *accidental* plagiarism.

As these definitions imply that the act of plagiarism can have multiple motives and a large, fluctuating scale of student awareness, educators have begun to address the problem of plagiarism with both deterrents and non-judicial education.

One of the most common modern plagiarism deterrents is plagiarism detection software, many types of which are available online, such as Turnitin.com. These websites have databases with thousands of articles and will check text content against the databases to search for copied (unquoted) or closely paraphrased material. One of the main advantages of these websites is that students are able to check their own work and the work of their peers, promoting academic accountability and peer feedback. This is particularly helpful in an age where most academic information is transferred through the Internet, and research is completed largely online. The rise of internet research has distorted the already-complicated issue of plagiarism and produced an entirely new, gray field of copyright and ownership. Evering and Moorman (2012) addressed this issue in their article on digital plagiarism, asserting that educators' responses to plagiarism must change with the times. As academia becomes digital, so must the review process.

However, this deterrent method also requires extra time and effort on the part of the instructor. As Kirsch and Bradley (2012) bemoaned in their study of distance education at the University of South Carolina Upstate,

> The explosion of possibilities for plagiarism has turned the educational process into an investigation where instead of improving students' critical thinking and analytical skills, the faculty members have to concentrate on sleuthing and figuring out whether or not students plagiarize their work. (p. 80)

It is evident that the problem of plagiarism does not begin and end with the students' academic ethics or awareness. It creates a ripple effect through the entire community, which must then take responsibility to identify, hunt out, and catch plagiarism before it causes more damage.

This exhausting search has led many universities to include preventative measures of addressing plagiarism, implemented particularly through educating students about their actions and the serious effects of those actions, as well as the consequences.

Educators at Roosevelt University in Chicago developed an online module instructing students using lessons, interactive writing, and quizzes on proper citation and paraphrasing techniques in American Psychological Association (APA) style (Stetter, 2013). The module also had students define plagiarism in their own words before presenting a developed, functional definition. The purpose of this was to assess the students' comprehension prior to participating in and completing the course. For the purposes of their study on the effectiveness of the module, one group of students completed the module in a classroom setting with facilitators, while another group worked independently. This allowed the researchers to see what impact in-person involvement from facilitators had on the students' overall learning experience. At the end of the study, all of the students completed an online survey evaluating both themselves and their opinions on the effectiveness of the module.

The majority of the students, 81%, stated that they "wished that they had been involved in a similar module earlier in their time at the university" (Stetter, 2013, p. 684). This overwhelming response suggests that thorough instruction on citation and plagiarism is not being adequately provided at the college preparatory or early collegiate level. Voelker et al. (2012) make the same assertion in their study on student knowledge of plagiarism: "The field, and the students, would be stronger if an academic honesty module were included in most (if not every) course" (p. 41). Although deterrent methods are enough to scare off some would-be plagiarizing students, they do not impact the much larger population of students who are simply unaware of when they plagiarize.

Toward this educational end, our team prepared an online workshop to instruct students on plagiarism and basic citation. This module can then be integrated into any course where an instructor wishes to provide that aspect of academic honesty education. This report allows us to join the discussion of this issue and to share our experiences of developing a multi-faceted approach to the problem of plagiarism.

Stage 1: Creation of the Project

The individuals who comprised what came to be known as *Team Citation* arrived at the project from different areas of the university. The Coordinator of the Writing Commons, Laura Monroe, was contacted by Dr. Shelley Blundell, Instructional Design/Education Librarian of UA Libraries, to develop online training on citation that could be completed by students outside of class, possibly as a component of first year courses, or embedded in the General Education *LibGuides* available to support students' research. Laura then contacted Litsa Varonis of the University's Design and Development Services for assistance with the creation of the training site in the University's Learning Management System and for another perspective on how to best meet the needs of the learners; Laura and Litsa were previously colleagues, and both had extensive experience teaching and designing curricula for freshmen writing classes. Litsa brought in additional experience with design and course delivery for distance-learning classes and online instruction and certification as a Master Reviewer for Quality Matters (2015), which defines itself as "a non-profit organization dedicated to quality assurance in online education." Also joining the team from the Writing Commons were Maria Varonis, a faculty writing consultant with experience working with first-year and English as a Second Language (ESL) students, and April Trowbridge, an experienced writing tutor. The group met multiple times beginning in January 2015 to brainstorm the topics that should be covered and how those topics would be realized in the course.

The team agreed that the focus should be on guiding students to utilize the fundamentals of citation by helping them identify themselves as members of a larger academic community, who value giving credit where credit is due. Real world examples of plagiarism, academic and non-academic, would be included in order to engage interest, demonstrate how widespread the issue is, and show how serious consequences can be. The training would be written with the assumption that students had limited or no previous experience with citation and were not familiar with the concept of plagiarism; in fact, many international students in particular report that the need for citation and the consequences of plagiarism are totally new to them.

Plagiarism is considered a serious offense at The University of Akron, as it is at most if not all institutions of higher education. According to the University's Code of Student Conduct, plagiarism is defined as a type of academic misconduct:

… including, but not limited to:

- Intentional or unintentional representation of ideas or works of another author or creator in whole or in part as the student's own without properly citing the original source for those ideas or works.
- The use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials. (2015, p. 6)

Students may be reported to the Office of Student Conduct and Community Standards for a suspected violation of the code, with consequences that can include:

- Failure in the assignment and/or course.
- Educational assignments that include researching various academic integrity issues and writing research papers.
- Depending on the nature of the violation and previous history of the student, suspension or dismissal from UA.
  (Alford-Snyder, 2009, p. 1).

The online training was therefore envisioned as a way to both encourage students to identify as members of an academic community and discourage them from engaging in acts of academic misconduct. Originally, it was decided that the material would be divided into seven units:

1. Introduction to Citation: Why We Cite
2. What Is Plagiarism?
3. Mechanics of Citation
4. MLA Style
5. APA Style
6. Other Citation Styles
7. Resources for Citation

After completing the workshop successfully, students would earn a certificate that could be shared with their instructors.

It was further decided that learners would have to show mastery of the concepts in one module before being able to move on to the next. That would be demonstrated through a multiple-choice quiz at the end of each module that could be scored automatically.

A dedicated site was created in the University's Learning Management System, Desire2Learn Brightspace, branded *Springboard* at UA, and the team began to gather resources in a *Scratch Module* for later utilization in specific modules.

Stage 2: Design of the Site
In this beginning stage, the team met face-to-face at the Writing Commons and began to gather resources and create new ones. Resources included video files, audio files, links to news stories about high-profile examples of plagiarism, and a presentation on plagiarism that had previously been delivered to UA faculty and staff through UA's Institute for Teaching and Learning. These resources were collected into the Scratch Module for review by team members before a decision was made on what resources to include and where to place them. In addition, Maria Varonis wrote the opening script for the workshop that placed citation and plagiarism into a context that first-year students would understand and relate to.

Modules were added to Springboard reflecting the topics of the original units. Each module was envisioned to contain:

- An overview and learning objectives for each module
- Instructional materials, including text and multimedia resources
- Opportunities for practice and/or self-assessment
- An assessment that would allow students to demonstrate mastery

Our intent was to complete the design and development of the site in Spring 2015, implement a pilot in Summer 2015, revise as necessary, and offer the training as an online "citation workshop" in Fall 2015.

Stage 3: Development of the Site: Team Citation
In mid-February, Wendy Lampner, the manager of Design and Development Services, who was also teaching an online graduate class in Instructional Design (ID), approached Litsa Varonis to consider allowing a team of ID students to incorporate work on the site into a class project. Her e-mail explained "It would be ideal if we could give the students real-world problems to work on." She further elaborated that she was soliciting instructors with "teaching challenges in any of [their] courses" and willingness "to have a small group of students work on a solution" (personal communication, February 17, 2015). Specifically, we were requested to:

- Describe the instructional problem we were trying to solve.
- Meet with the students once or twice to discuss the project.
- Offer students feedback on drafts or prototypes.

The strategy fit both with our ambitious timeline and with the abstract submitted for our ICICTE presentation, which had been envisioned as focusing not only on the product but also on the team process. Each of the four ID students assigned to our project was a full-time employee of an Ohio K-12 school, and each taught in a different county. Katherine Gulliford, who was the lead for the ID class team, is a high school English Language Arts instructor; Cliff Holcomb is a second grade teacher; Jack Reyes is an Intervention Specialist for elementary and middle school students; and Marty Smith is a math and science teacher for emotionally disturbed high school students. Their initial contact with the original team was via an e-mail of introduction to Litsa Varonis on February 24, followed up by a phone conversation on February 26 and subsequent e-mails to set up an initial meeting date. While we hoped to meet with the ID students face-to-face, at least at the beginning of their involvement on the project, in fact that would prove to be impossible. They had never met each other face-to-face as their program consisted exclusively of online courses. As a result, we met with them exclusively evenings online, utilizing the WebEx web-conferencing system supported by UA. This tool allowed us to see and hear each other as well as share desktops to view documents or the Springboard site as a group.

The ID students were charged to apply the ADDIE model of instructional design originated by Branson, Rayner, Cox, Furman, King, and Hannum, (1975), which in its current format includes analysis, design, development, implementation, and evaluation phases. To implement this model, the students needed to pilot the training during Spring 2015 to complete all phases and meet the requirements for their course. As a result, we needed to adjust our schedule to accommodate their need to complete all of the ADDIE phases by the end of Spring semester.

The first meeting of Team Plagiarism took place on March 2, 2015 in Litsa Varonis' personal WebEx meeting room, the first occasion that the ID students, Laura Monroe, and Litsa Varonis were available at the same time. That meeting focused on the analysis phase of the project as it had already been identified by the original team: the learners; the learning situation; the learning problem; the learning goal, and key learning tasks. During that first meeting, we identified three needs:

- Making material, activities, and assessments more interactive and engaging for students.
- Designing a pathway so students could navigate through the material in a user-friendly format that promoted learning and mastery of the content.
- Identifying a measurable goal as the benchmark for students to earn a certificate after completing the final summative assessment.

We envisioned both self-checks and a summative assessment within each module so that students could practice skills and demonstrate mastery of one topic before gaining access to a subsequent topic. Since many of the summative assessments were developed to contain five questions, it was agreed that the benchmark performance would be 80% on each.

To facilitate continued conversation among the ID students as they discussed incorporating the project into their own class requirements, after the first and subsequent meetings, they continued talking in the WebEx meeting room after the others had left. Our first meeting took place during Week 8 of their 15-week semester, with their final project involving an online presentation on their work during Week 15 and a final paper due the following week.

Meanwhile, the onsite team continued meeting face-to-face to consider resources and provide feedback to the work of the ID students, e.g., to the broad learning objectives drafted for the workshop as a whole, to module learning objectives as they were produced, and to the types of self-checks that would be included. We shared materials in a scratch module within the LMS site for the workshop, including a presentation on plagiarism previously delivered to the faculty (Bove, Qammar, & Varonis,., 2010) that included information that was incorporated into the modules. We utilized e-mail to keep each other informed and to schedule WebEx meetings, though there were challenges in coordinating the schedules of the six individuals—the ID students, Monroe, and L. Varonis—who attended the WebEx meetings. (Scheduling the second meeting, for example, took 17 e-mails.)

The ID students were given the freedom to divide the development tasks among themselves, and each took responsibility for specific modules. We strongly encouraged the use of multimedia as a way to address students with different learning styles and to make the materials more engaging. Jack Reyes registered for a free trial of GoAnimate software to create cartoon-like videos, and as a result of his initial success, a license was purchased to allow the development of more segments. For example, the script developed by Maria Varonis for live actors was used instead in a GoAnimate video.

During this phase, to stay focused on the behaviors we wanted students to practice rather than the ones we wanted them to avoid, our friendly term for the group changed from *Team Plagiarism* to *Team Citation*. It was also decided to drop the module on *Other Citation Styles* in order to stay focused on those styles that first year students were most likely to be required to use.

The MLA Style and APA Style modules were sub-divided into three sections: (a) general formatting, (b) in-text citation and (c) references; each of the sections included readings, activities, and a quiz.

Stage 4: Implementation

As Litsa was co-teaching a small learning community section of UA's first-year course, Akron Experience, she suggested piloting the workshops' implementation with her students. Nine international students were enrolled in the class, which met in a computer lab to guide students in the use of technologies that could help them achieve success in their academic careers. Several of the students had already submitted work that the instructors identified as being plagiarized. These incidents were handled privately, and students were advised they would not receive credit unless they revised and handed in their own work, and also that a repeat incident would result in their being reported to the Office of Student Conduct and Community Standards. During class discussion of citation and plagiarism, a number of students commented that in their own cultures, they were only expected to submit a response to the assignment given, and it did not matter how the information was obtained. They revealed that they had no background at all in providing citation for sources used in assignments and were surprised that incidents of plagiarism could have such serious consequences.

The students were given the option to decide as a class if they wanted to complete a 25-point activity already on the syllabus, which involved attending a lecture and writing a paper about it, or completing the Writing Commons Citation Workshop and earning five points for each of the module quizzes they completed at an 80% level. There were three modules that all students had to access and an additional three in both the MLA and APA tracks, totaling six modules with quizzes in either track. Students were told that they did not need to complete both tracks. This allowed them the option of earning five points for each of five completed quizzes as well as five bonus points for completing the sixth quiz. In addition, they could earn an additional 25 bonus points for completing the project evaluation that was added as a seventh module. The students were unanimous in their decision to opt for the Writing Commons Citation Workshop as a replacement for the original assignment.

Students were given time during class in weeks 13 and 14 to begin work on the modules, both to make sure that the training was working as envisioned and to allow for modifications if needed. The students seemed to respond well to the training and clearly enjoyed playing the games that had been included in each module as self-checks. Most of them completed the modules outside of class. Two American-born student assistants working for Design and Development Services were also asked to work through the modules during down time and to provide feedback. Some students needed to repeat the module-final quiz multiple times to score the threshold 80%, and not all students finished all the modules as a result.

Stage 5: Results and Evaluation

Modules were completed by anywhere from 1 to 11 people, including nine students in the Akron Experience course and two other students that were asked to give it a try. The fewest individuals completed the modules on APA Style, which sequentially followed the track on MLA style. Successful completion of a module was identified as scoring at least 80% on the quiz in that module. The average number of attempts to completion ranged from 1 to 3, though some students did not successfully complete a quiz, and therefore their efforts were not included in this analysis. The quizzes that required the highest average attempts to successful completion were those in the APA module, which averaged 1.4, 2.3, and 3 attempts, and those in the Plagiarism module, which averaged 2.22 attempts. However, the number of those who completed the APA modules was very low, and the APA quizzes were longer than the others, a factor that will have to be addressed before the workshop is made more generally available.

Eight students in the Akron Experience class completed the Student Implementation Survey designed by the ID students. Most of the questions were open-ended and most of the responses were positive. In general, the students found the modules easy to move through, of an appropriate length, and easy to understand; one actually commented that the material was “amazing.” All agreed that the materials were easy to access and that the “attempted levity” made the subject matter “more palatable.”

There were differences of opinion on the review games, the GoAnimate videos, and the PowerPoints, but the selected responses were mostly positive. With respect to the review games: six thought they were “engaging, fun and helped me master the material,” one thought they were “boring and childish, but helped me learn the material,” and one decided they were “a waste of my time.” With respect to the GoAnimate cartoon videos: five thought they were “engaging and a great way to introduce the material,” one thought they were “engaging, but I didn’t learn anything,” one thought they were “boring and childish, but helped me learn the material,” and one thought they were “a waste of my time.” With respect to the PowerPoint presentations: six thought they were “engaging and really helped me stay on track”; one thought they were “engaging but there were technical issues”; and one thought they were “Annoying, because I had to download the PowerPoint in order to go through the self checks.”

Students were also asked to rate their confidence using citation on a scale of 1 (not confident) to 10 (very confident); responses ranged from 4 to 10 with an average of 8.75. Another question on a scale of 1 (low) to 5 (high) prompted students to rate their experience as a whole; scores ranged from 2 to 5 with an average of 3.875.

Finally, students were asked to identify what course component they found most useful: three selected the videos, three selected the PowerPoints, and two selected the study games.

Although the design, development, implementation, and evaluation phases of this project were rushed, both the quiz results and the results of the implementation survey suggest that the workshop holds great promise as a way of providing online, self-paced instruction in citation and plagiarism, matters of great academic importance in higher education.

Lessons Learned

Overall, the multiple components of Team Citation worked well together to create the content of the online citation workshop. The partnership, although comprised of busy individuals from a wide variety of backgrounds, juggled schedules and work flow to move the project forward on a tight timeline.

Communication was key to the project. The graduate students on the design team lived and worked at a distance from the university, so the WebEx meeting space was crucial to provide opportunities for synchronous discussion and planning. However, setting meeting dates and times proved problematic. One suggestion for future collaborations, either local or long-distance, would be to use a scheduler to establish common availabilities quickly and easily. Using Google Docs made sharing materials and drafts easier.

Another important area that needed to be addressed was consistency among modules. Once the content had been created and piloted with the Akron Experience class, Litsa, Laura, and April worked on strengthening organization and checking for consistency across modules. Thematic submodules were created for each module, and each component was edited for consistency and clarity. At the same time, the team members looked carefully at each element of content to check for components with questionable commercial links. Thus, certain elements were dropped and others added.

The biggest lesson learned from this project is timing. The team could have probably used more time to devote to planning and developing the content of each module and more extended time to test and pilot content with target audiences. However, this workshop will be ready for a Fall 2015 launch for first-year students, with the understanding that it is a work in progress and will be open to ongoing revision. If successful, it is likely to serve as a model for similar online training in other areas important to students.

Acknowledgements

We are very grateful to the students who served as pilot testers of the online workshop in citation and to our colleagues and to Wendy Lampner who suggested the collaboration between her students and the original team.

References

Alford-Snyder, M. (2009, March). Plagiarism at UA. *Summit News & Views Newsletter*. Akron: The University of Akron Summit College. Retrieved from http://www.uakron.edu/summitcollege/docs/student-newsletters/SCNVMarch09.pdf

Bove, F., Qammar, H., & Varonis, L. (2010, October). *We live in a 'Cut & Paste' world: What's plagiarism?* Presentation to the Institute for Teaching and Learning, The University of Akron.

Branson, R.K., Rayner, G.T., Cox, J.L., Furman, J.P., King, F.J., & Hannum, W.H. (1975). *Interservice procedures for instructional systems development* (Vols. 1-5). TRADOC Pam 350-30, NAVEDTRA 106A. Ft. Monroe, VA: U.S. Army Training and Doctrine Command.

Evering, L. C., & Moorman, G. (2012). Rethinking plagiarism in the digital age. *Journal of Adolescent & Adult Literacy, 56*(1), 35-44.

Fish, R., & Hura, G. (2013). Students perceptions of plagiarism. *Journal of the Scholarship of Teaching and Learning, 13*(5), 33-45.

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). *NMC Horizon Report: 2015 Higher Education Edition.* Austin, Texas: The New Media Consortium. Retrieved from http://cdn.nmc.org/media/2015-nmc-horizon-report-HE-EN.pdf

Kirsch, B. A., & Bradley, L. (2012). Distance education and plagiarism prevention at the University of South Carolina Upstate. *Journal of Library & Information Services in Distance Learning, 6*, 79-99. doi: 10.1080/1533290X.2012.693903

Plagiarism Advice Team. *Proceedings 6IIPC '14*: *The 6th International Integrity & Plagiarism Conference*. Retrieved from http://www.plagiarismconference.org/

Quality Matters. (2015). Homepage of Quality Matters Website. Retrieved from http://www.qmprogram.org

Stetter, M. E. (2013). Teaching students about plagiarism using a web-based module. *Journal of Further and Higher Education, 37*(5), 675-693.

The University of Akron. (2015). *Code of student conduct of The University of Akron* (Handbook). Akron, Ohio: Author. Retrieved from http://www.uakron.edu/ogc/UniversityRules/pdf/41-01.pdf

Voelker, T. A., Love, L. G., & Pentina, I. (2012). Plagiarism: What don't they know? *Journal of Education for Business, 87*(1), 36-41.

Author Details

Evangeline Varonis: varonis@uakron.edu
Laura Monroe: monroe4@uakron.edu
April Trowbridge: aet23@uakron.edu
Katherine Gulliford: kgg9@zips.uakron.edu
Clifford Holcomb: cmh9@zips.uakron.edu
John R. Reyes: jrr106@zips.uakron.edu
Marty Smith: mls255@zips.uakron.edu
Maria Varonis: mvaronis@starkstate.edu

Back to Contents page

STUDY MATERIALS FOR UNIVERSITY STUDY AND FURTHER EDUCATION: COMPARATIVE ANALYSIS OF LEARNING PREFERENCES IN 2010 AND 2014

Ivana Simonova and Petra Poulova
University of Hradec Kralove
Czech Republic

Abstract

Learners´ preferences in various types of study materials differ reflecting the criteria of learning objectives, forms of education, learner´s age and level of knowledge, time and others. The paper presents results of a survey dealing with comparative analysis of learners´ preferences from three criteria: (a) ways of getting study materials, (b) types of preferred formats of study materials (full-texts, short texts structured for the distance education, presentations, animations, links to sources, others), and (c) using different mobile devices to access the materials. The data were collected in 2010/11 and 2013/14 academic years from 300 students.

Introduction

Individual learning preferences play an important role in the process of instruction, especially if a Learning Management System (LMS) manages it (Šimonová, 2008). A rather wide range of tools is available to designers of e-learning courses, which can accommodate all learning styles and students choose those activities that suit them best. For example, according to Johnston (1996), technical processors prefer graphical presentations of the learning content and practical activities, confluent processors individually create new designs, precise processors emphasize clear questions and answers to them, and sequential processors solve problems step-by-step.

Despite numerous advantages that were detected in the use of interactive multimedia tools, there exist several conflicting ideas concerning practical application of learning styles (Mareš, 1998). The effectiveness of the educational process is determined by many factors, e.g., learner's intelligence, level of knowledge, motivation, self-confidence, and learner's cognitive and learning style. Teacher's teaching style and the matches/mismatches with students´ learning styles affects the efficiency of the educational process to a large extent. Some authors (for example, Felder and Silverman, 1998) say that mismatching can cause further educational problems. It favors certain students and discriminates against others, especially if the mismatches are extreme. On the other hand, if the same teaching style is used repeatedly, students become bored (Gregorc, 1979).

The process of instruction supported by ICT may become suitable and beneficial for learners of various styles. The reason is it offers a wide range of tools and activities that can be tailored to any learning style and used by any instructor's teaching style. The possibility to individualize the educational process from the both students´ and teachers´ point of view (e.g., time, place, pace) is among the valuable advantages of e-learning (Šimonová, Poulová, & Šabatová, 2009).

New possibilities offered by modern technologies produce new questions. Educators face the question of whether the educational process supported or managed by ICT and tailored to the student´s preferred learning style results in more and/or deeper knowledge that students have after the instruction compared to the situation if the learning style in not taken into account.

The Questionnaire Monitoring Preferred Formats of Study Materials

Since 2001, when the process of ICT implementation started at the Faculty of Informatics and Management, University of Hradec Kralove (FIM UHK), students´ feedback was collected. In 2010 a project started aiming at detecting whether students' choice of a certain type of study materials is influenced by the pattern of learning preferences detected by the Learning Combination Inventory by C. A. Johnston (1996), which classifies four types of processors: precise, sequential, technical and confluent ones.

Research 2010

A simple questionnaire consisting of nine questions was prepared for this purpose in which students defined their relation to following types of study materials:

- Books and professional literature
- Electronic study texts
- PowerPoint presentations
- Video-recorded lectures
- Animations
- Self-tests
- Hands-on tasks and examples
- Other supportive materials, e.g., dictionary

Students were asked to define what type of study materials they prefer when preparing for lessons during the term and studying for exams. Single items were in the form of statements and evaluated by a five-degree scale (1 – never, 2 – hardly any time, 3 – sometimes, 4 – almost always, 5 – always).

Examples of all types of study materials were provided so that no misunderstandings could appear. The questionnaire was distributed during the summer term in the 2009/10 academic year to 107 students of the Faculty of Informatics and Management, University of Hradec Králové in study programmes Applied Informatics and Information management, who also filled in the Learning Combination Inventory (LCI). The LCI is a questionnaire detecting students' individual learning preferences. It was designed by C. A. Johnston and consists of 28 multiple-choice questions and three open-ended ones (Johnston, 1996). So consequently mutual relations can be researched among single patterns and preferred types of study materials.

The received results partially proved our expectations.

Students, mainly those in technical specializations, seldom worked with printed sources. In 2010 only 1% of students almost always bought the recommended books, one third (33 %) did this sometimes, and two thirds (66 %) did not buy books at all. This fact could be influenced by the price. Nevertheless, similar results appeared in a question dealing with borrowing printed sources available in university library. Only 7% of students borrow books regularly, half of them (48 %) do this sometimes and 45 % never or hardly any times borrow the recommended books (see Figure 1).

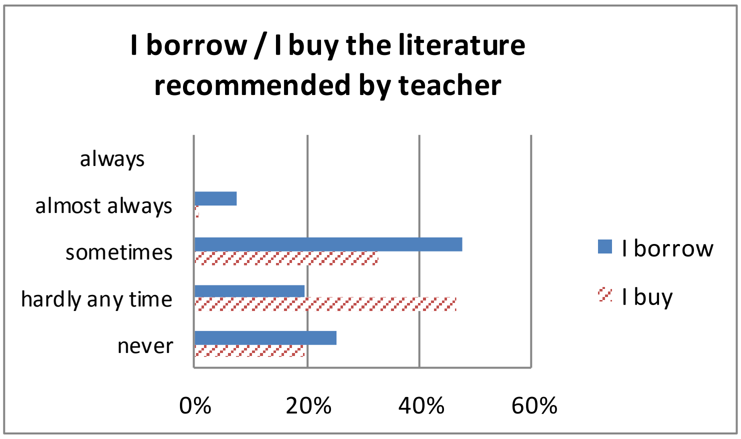


Figure 1. The use of printed books.

These results show the students prefer to work with electronic materials if the teacher provides them in the Learning Management System (LMS), which is not surprising because students participating in the research were on the Informatics study programme.

Nearly all students (93 %) always and almost always use presentations of the topics, 5 % use them sometimes, and only 2 % of students never use the presentations. The vast majority of students (87 %) always and almost always work with electronic study texts, 10 % use them sometimes, 2 % hardly any time, and only 1 % never use electronic study texts. A reason might be that the respondents studied IT study programmes, so the close relation to e-types of study materials was not surprising. Other types of study materials (e.g., dictionary) are used to a considerably less extent: 42 % of students always and almost always use them, another 41 % use them sometimes, and 17 % of students say they never and hardly any time work with other types of study materials (see Figure 2).

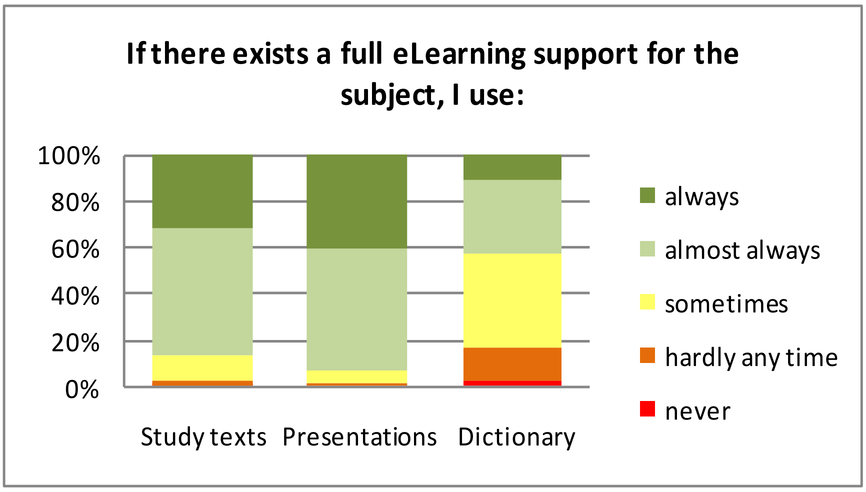


Figure 2. The use of electronic study texts, presentations and other supportive materials.

In some e-learning courses animations, video-recorded lectures or case studies are available to make some difficult parts of learning content more clear and easier to understand. These materials are used less than presentations or study texts. Animations are more frequently used; more than half of students always and almost always use them (53 %) if they are available, one third of students (34 %) sometimes, and only 13 % never and hardly any time work with them. Video-recordings, which are more demanding to be prepared and can be found only in selected e-learning courses, are less popular among students. More than one third of students (38 %) never and hardly any time use them, one third (33 %) sometimes, and even fewer students (29 %) always and almost always work with them if they are available (see Figure 3).

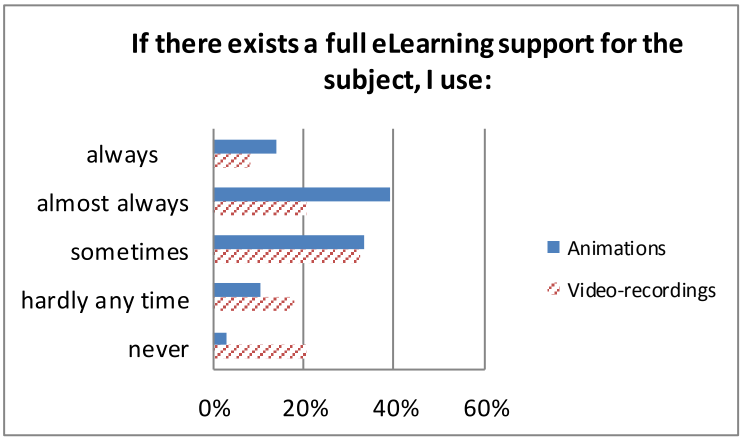


Figure 3. The use of animations and video-recorded lectures.

Designers of e-learning courses include various feedback-providing tools, such as self-tests and numerous hands-on examples or tasks. Although these are to help students understand the problem, they are used less frequently than study texts and presentations. More than two thirds of students (68 %) always and almost always use the provided examples, 28 % sometimes use them, and 4 % never work with them. Self-tests are even less used. More than one fourth never and hardly any time uses them, 39 % sometimes, and only less than one third (31 %) always and almost always work with them (see Figure 4).

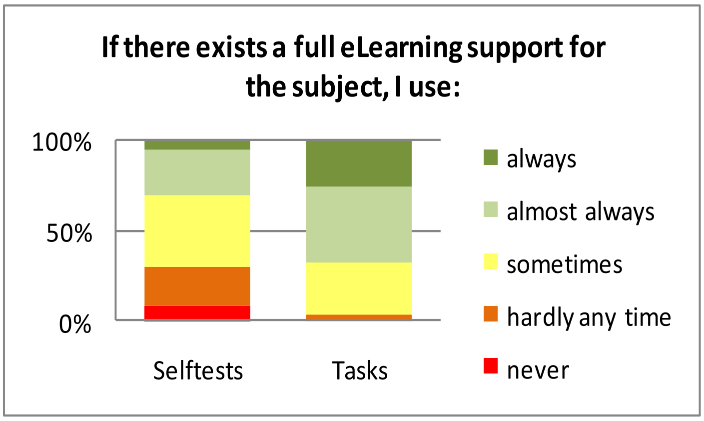


Figure 4. The use of self-tests and hands-on tasks.

Research 2014

Four years later another survey was held at the University of Hradec Kralove, Faculty of Informatics and Management. A total of 203 FIM students (male 60 %; female 40 %) participated in the research who matriculated in 2013/14 academic year in bachelor study programmes of Applied Informatics (AI3), Financial Management (FM), Tourism Management (MCR), Information Management (IM3), follow-up two-year master study programmes in Applied Informatics (AI2) and Information Management (IM2) and doctoral study programme in Knowledge Management (KM) and Applied Informatics (AI). The questionnaire consisted of 22 items; the question on sources that students exploit within their higher education was considered from two points of view: (a) students´ gender (male/female opinions) (see Table 1 and Figure 5) and (b) study programmes (see Table 2 and Figure 6).

QU (a): Which sources of information do you use for your university study? (You can tick all choices)

Table 1

Sources of Information from the Gender View

	All	Male	Female
Personal attendance of lectures	**85%**	83%	87%
I buy textbooks	**30%**	22%	41%
I borrow textbooks from libraries	**53%**	38%	76%
E-subjects in LMS	**91%**	89%	94%
Study materials on university web page	**72%**	76%	66%
Wikipedia	**42%**	50%	29%
Materials available from the Internet (for free)	**77%**	83%	67%
Facebook	**57%**	57%	57%
Discussion groups	**72%**	78%	63%
LinkedIn	**1%**	1%	1%
Google+	**11%**	6%	18%
Other sources	**8%**	10%	6%

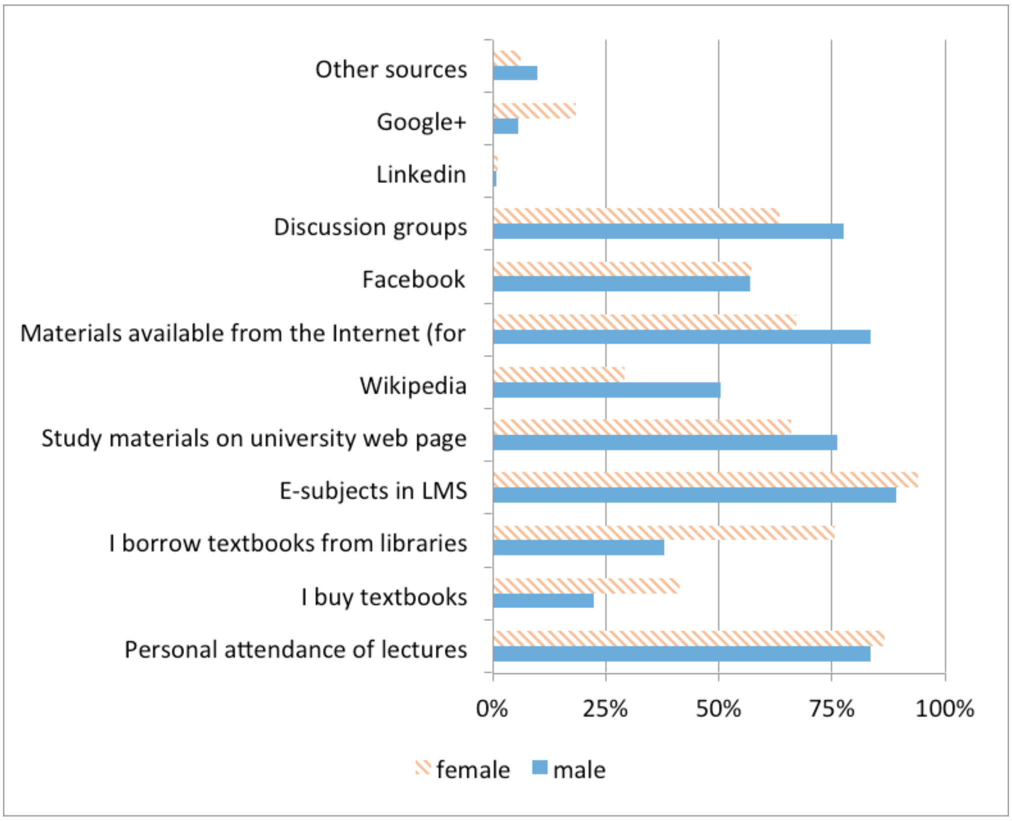


Figure 5. Sources of information form the gender view.

The results show female students much more frequently buy books or borrow them from libraries, but the frequency of personal attendance of lectures and working in online courses in LMS are similar; the visit rate to Social network Google+ is more frequent with the male students. On the other hand, males prefer having study materials directly from university web page, where material were accessible from in the past, from the Internet in general, from Wikipedia, and, what was rather surprising, they are more active in discussion groups within LMS.

QU (b): Which sources of information do you use for your university study?

Table 2

Sources of Information from the Study Programme View

	All	*AI*	*IM*	*Management*
Personal attendance of lectures	**85%**	*85%*	*75%*	*91%*
I buy textbooks	**30%**	*24%*	*39%*	*32%*
I borrow textbooks from libraries	**53%**	*37%*	*36%*	*81%*
E-subjects in LMS	**91%**	*92%*	*95%*	*88%*
Study materials on university web page	**72%**	*80%*	*77%*	*60%*
Wikipedia	**42%**	*60%*	*34%*	*27%*
Materials available from the Internet (for free)	**77%**	*86%*	*66%*	*73%*
Facebook	**57%**	*63%*	*48%*	*56%*

Table 2. *Sources of Information from the Study Programme View* (Continued)

	All	*AI*	*IM*	*Management*
Discussion groups	**72%**	*80%*	*82%*	*57%*
LinkedIn	**1%**	*0%*	*2%*	*1%*
Google+	**11%**	*5%*	*9%*	*19%*
Other sources	**8%**	*11%*	*11%*	*4%*

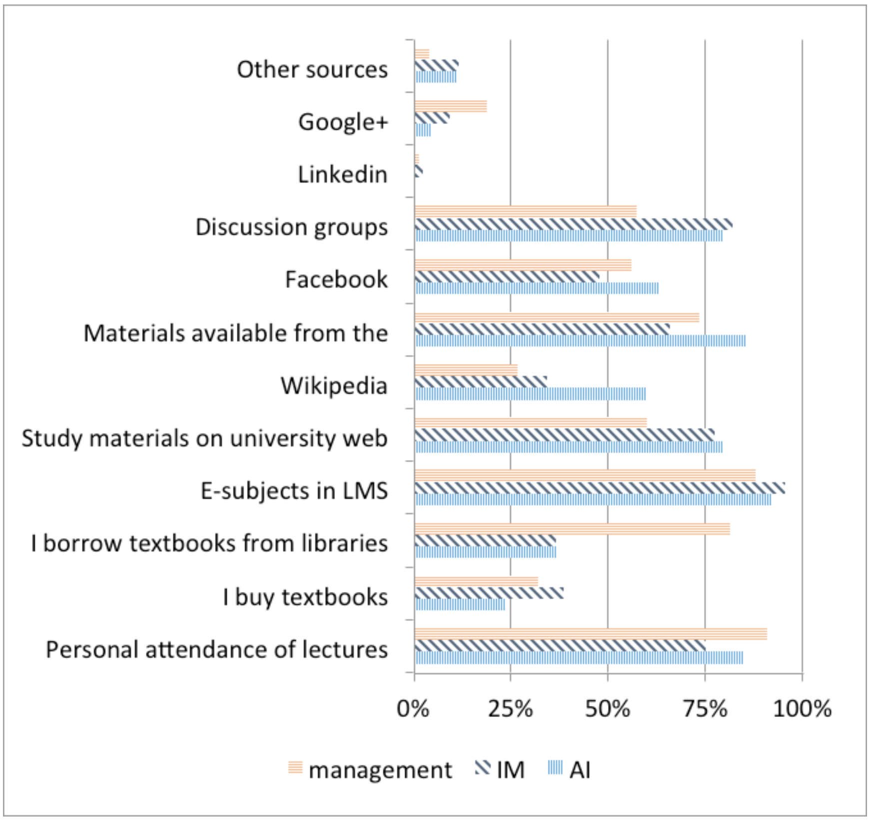


Figure 5. Sources of information form the study programme view.

From the point of view of various study programmes, the management students definitely prefer borrowing books from libraries, as well as attending lectures; they participate neither in social networking activities, nor use Wikipedia very often. As expected, students in both IT programmes strongly prefer using study materials from e-subjects in the LMS, university web page and the Internet in general. More than half of them visit various social networks. These are strong characteristics that deserve to be definitely used for education purposes.

Conclusions

University education, which has been changing under the influence of latest information technology development in the Czech Republic, can be researched from various, different points of view. The comparison of data collected in both surveys showed that a rather large amount of students appreciate the choice of having their study materials in electronic form. The most frequent reasons for their satisfaction with the electronic study materials were:

- They have an anything/anytime/anywhere access.
- They can check and re-check the information already mentioned in face-to-face classes.
- They appreciate not spending time in libraries and shops if electronic sources are available.

Although approximately one third of students still use paper-printed materials (either bought, or borrowed), many more prefer various electronic sources, with the multimedia components if available.

Acknowledgement

This paper is supported by the SPEV project N. 2108.

References

Coffield, F., Moseley, D., Hall, E., & K. Ecclestone (2004). *Learning styles and pedagogy in post-16 learning*. www.LSRC.ac.uk: The Learning and Skills Research Centre. Retrieved from http://sxills.nl/lerenlerennu/bronnen/LearningstylesbyCoffiel e.a.pdf

Felder, R. M. & Silverman, L. K. (1998). Learning/teaching styles in engineering education. *Journal of Engineering Education*, *78*(8), 674-681.

Gregorc, A. F. (1979). Learning/teaching styles: Potent forces behind them. *Educational Leadership*, *36*, 234-238.

Johnston, Ch. A. (1996). *Unlocking the will to learn*. Thousand Oaks: Corwin Press Inc.

Mareš, J. (1998). *Styly učení žáků a studentů*. Praha: Portál.

Poulová, P. (2009, September). Users´ ways of behaviour in elearning courses. In *Information and Communication Technology in Education 2009* (pp. 72-78). Ostrava: Ostravská univerzita,

Šimonová, I. (2008, February). Matches and mismatches in teaching/learning styles. In *Recenzovaný zborník vedeckých prác z medzinárodnej konferencie Multimédia vo vyučovaní cudzích jazykov IV na CD nosiči* (pp. 34-60). Nitra: SPU.

Šimonová, I., Poulová, P., & Šabatová, M. (2009). *On contribution of modern technologies towards developing key competences*. Hradec Králové: Miloš Vognar Publishing House.

Author Details

Ivana Simonova
ivana.simonova@uhk.cz

Petra Poulova,
petra.poulova@uhk.cz

Back to Contents page

SOCIAL ENTERPRISE AND SUSTAINABLE DEVELOPMENT: E-LEARNING AS A TOOL FOR PROFESSIONAL TRAINING FOR YOUTH IN THE GLOBAL SOUTH

Cherie Enns and Nicole Klassen
University of the Fraser Valley
Abbotsford, Canada

Abstract

The research goal of this paper is to initiate the examination of the effectiveness of a mobile e-learning program as a professional training tool for youth in the global south offered through the UN Habitat Youth Fund. The challenges and opportunities are to be considered including the suitability of mobile technology, curriculum content, completion rates, gender balance and as well community impact. The Eminus Academy program offered in collaboration with University of the Fraser Valley, Eliademy learning management system and sponsored by Basf Foundation is a pilot program offering free online courses to youth affiliated with the UN Youth Fund in areas of social enterprise, community mapping, urban agriculture and project management. Youth in this report are defined as the age group 15 to 35 years.

Keywords: e-learning, youth, completion rates, online education, non-formal education, social entrepreneurialism, youth unemployment, UN Habitat Youth Fund.

Introduction

Countries in the global south are facing unprecedented urban growth as rural populations increasingly move to urban centres in search of employment. A significant portion of this growth in urban centres is youth. This reflects broader demographic shifts, as there has been a disproportionate increase of youth relative to the total population over the past decade. This creates a growing need to educate and empower youth with skills that will allow them to succeed in crowded and competitive job markets.

UN-Habitat is continuously looking for new ways to engage urban youth in order to improve their socio-economic status and wellbeing. It is the goal of UN-Habitat to continue to identify innovative ways to address youth development in a multidimensional capacity. Eminus Academy, a collaborative e-learning program promoting sustainable development and social entrepreneurialism in developing countries, is an example of an extension of this mandate.

Eminus is the newest addition to the Training and Capacity Building Module of the Urban Youth Fund programme. It has been developed for youth aged 15 to 35 years living in developing countries that have taken part in the Urban Youth Fund program. The program seeks to integrate the mobile technology, internet-based curriculum and applied empirical learning to provide a dynamic learning opportunity for youth in the developing world. UN-Habitat partnered with the Canadian University of Fraser Valley to provide custom courses in the area of sustainable development, social enterprise and community planning.

The focus of this paper is to begin to examine the effectiveness of a mobile e-learning program as a professional training tool for youth in the global south offered through the UN Habitat Youth Fund. The challenges and opportunities are to be considered including the suitability of mobile technology, curriculum content, completion rates, gender balance and as well community impact.

Background

According to the UNESCO Education Strategy 2014-2021 (2014), among the global trends that support e-learning and mobile based learning is the increased use of mobile platforms, that have jumped beyond desk-top and laptop computers to phones, notebooks, and tablet formats, with the Internet following suit to promote greater access to Wi-Fi rather than costly infrastructure in cable and DSL delivery. According to UNESCOs Steve Vosloo, many of the 3.6 billion SMS-capable mobile phone subscribers in the global south are engaging in 'MEduation experiences (Raftree & Matrin, 2013). For example, Google plans to sell 200 million of its Android phones in Africa and it is estimated that by 2016 there will be a billion mobile phones on the continent of Africa (Fox, 2012).

Globally, the increased information and communication technology has enhanced the ability for e-learning platforms to deliver cost-effective basic higher education by increasing access to it, the quality of the teaching therein, and its relevance in developing lifelong learning. Economic growth, as stated in the strategy, is directly linked to the knowledge economy, which includes entrepreneurial talent and the ability to apply the knowledge and technology.

Five key topics at the *World Education Forum*, held in May 2015 in Incheon Korea, included the right to education, equality in education, inclusivity in education, quality of education, and lifelong learning (UNESCO, 2015). The *right to education* is a fundamental human right, which was further guaranteed at an international level with the Convention Against Discrimination in Education in 1960. *Equality in education* details the right for all people to have access to education -- children, youth, adults, men, women -- which is not depending on culture, income, or ability. *Inclusive education*, which is key to the rationale of mobile learning and e-learning applications, is the adaptation and consideration of the learners. *Quality of education*, also a fundamental principle of mobile and e-learning applications, is responsive and inclusive of the learners' needs and relevance to their context, the needs of individuals, countries, and the global population, and world labour and work trends. Finally, and definitely the most important in regards to mobile and e-learning application, is *lifelong learning* that is diverse with the ability of being context specific to meet the needs of all age groups, and that provides an array of skills that enhance global citizenship, entrepreneurial skills, and core skills as necessary.

In response to growing youth populations in urban spaces, policymakers, development practitioners, and urban planners have called for increased attention to be paid to the plight that young people face in these spaces, as well as the potential demographic dividend that they bring (United Nations Economic and Social Council [UN ECOSOC], 2014). According to the Council, young people in urban centres are more vulnerable than other demographics to the problems caused by urbanization. For example, research shows that young people face greater social, political and economic marginalization in urban spaces when compared to other demographics. The World Bank estimates that, in Africa alone, 11 million youth are expected to enter the labor market every year for the next 10 years (Filmer & Fox, 2014).

With such promising technological innovation and interventions, Eminus e-learning is a much needed and refreshing option that can be offered a long side or as an alternative to the traditional education system. It continues to grow and lead the way in outreach and connectivity, offering students a chance to reach their own potential while also providing the global community the labour force that it has been lacking for so long. Concepts and goals from both *education for all* and the Millennium Development Goals can be realized through e-learning programs, such as Eminus, with improvements in the quality, access, investment, and gender equality within the educational framework.

According to the International Labour Organization (2015), global unemployment rates will continue to increase from 2014 to 2019, as shown in Figure 1. Employment levels vary across regions, with developing countries having the highest rates of unemployment, as seen in Figure 2 below (ILO, 2015). Youth unemployment globally is three times higher than that of their adult counterparts, with 74 million youth (especially women) being unemployed, suffering long-term unemployment and labour market exit, at the start of 2015 (ILO, 2015). Youth unemployment rates, including for youth who have tertiary/post-secondary training, are expected to continue to rise globally through to 2019 with the highest rates of increase (up to 2%) in Central America, Asia, and throughout Africa.

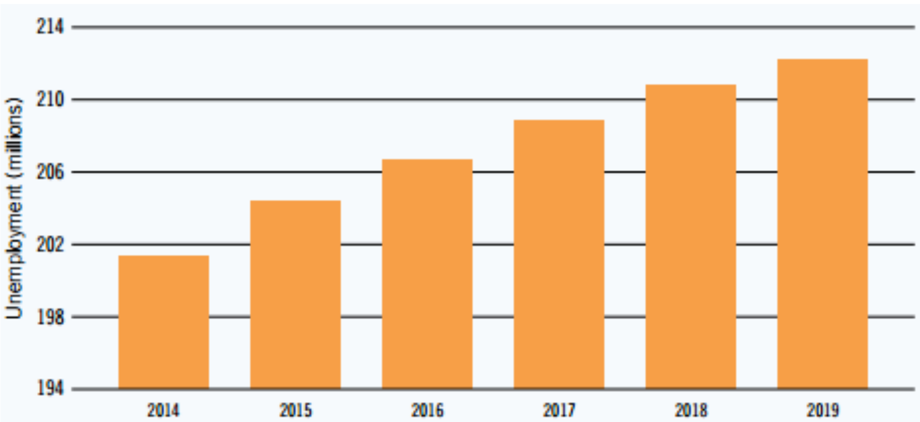


Figure 1. Global unemployment projections from 2014 to 2019 (ILO, 2015, p. 17).

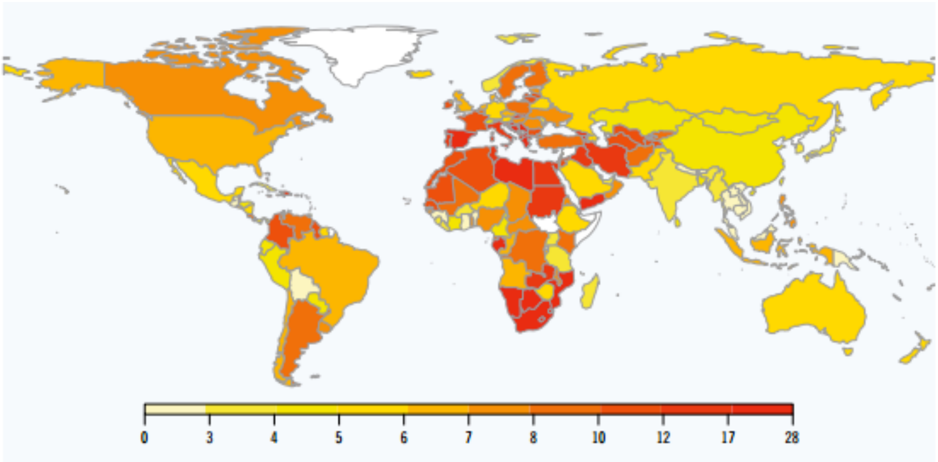


Figure 2. Unemployment rates for individual countries as of 2014; no data is available for white shaded areas (ILO, 2015, p 17).

Without relevant applied education, training, experience and employable skills, many youth will be at risk of unemployment and social hardship. This, in turn, leads to increased crime, mental health problems, violence, conflicts and drug taking among youth populations (ILO, 2010). A lack of access to applied education and difficultly finding employment further compounds the social, political, and economic problems faced by youth in urban centres.

Non-formal Education

Formal education is based on prescribed outcomes, learning objectives, and sequential learning and bound by administrative organization, social norms and laws. Formal education practices include the test-retest method of grading that is also based on attendance, participation, and attitudes.

Eminus offers non-formal education that is not necessarily sequential learning, but has the opportunity to build on insights from previous courses to meet the changing needs and dynamics of the students therein by being more inclusive and relevant. Non-formal education does not prescribe learning outcomes, but general tasks for which the students may participate, students are not required to attend school, nor is the premise of grading based on social norms and standards. The key foundations of non-formal education are: being student-centric, promoting inclusivity, being adaptable, and providing contextually and globally relevant materials. Non-formal learning takes place as part of everyday activities and is outside of formal highly institutional settings.

For most of the developing country youth, formal education is costly, inaccessible, exclusive, and is based on Western educational systems of formal learning and training. The formal education system is limited in its ability to adapt to the needs of the student because it is based on a sequential learning system that has a foundation of cognitive development, which was developed without inclusion of children from different backgrounds, cultures, social factors, and so forth. The administrative bounds that rely on social testing, sequential learning, attendance and cognitive norms, limit the ability of many children, youth, and adults to participate in formal education systems given their specific living situations, country contexts and dynamics, and, for some, economic ability. Therefore, e-learning as a non-formal educational provision increases the opportunity for those bounded by the formal system to access education that is relevant to their specific needs and contexts.

E-learning and its Implications for Eminus Academy Program

E-learning has become an irreplaceable and expanding form of pedagogy that has been woven into many programs and projects. Consequently, current literature on e-learning varies widely from virtual secondary schools, to quantifiable success matrixes, to for-profit workplace training. The emphasis and application of this brief literature review is to provide relevant information that expands on the challenges and opportunities that e-learning programs face, within the lens of international and social development education, as these areas are the focus of the Eminus project. E-learning on an international scale comes with a wide range of strengths, weaknesses, opportunities and threats that will be explored in the following sections.

Strengths and opportunities. E-learning education has substantial flexibility and maximizes use of the Internet in an efficient and cost effective manner. This is true for both learners and facilitators:

> Advantages of e-learning for learners include an increased accessibility to information, better content delivery, personalized instruction, content standardization, accountability, on-demand availability, self-pacing, interactivity, confidence, and increased convenience. E-learning reduces costs, enables a consistent delivery of content, and improves tracking, among other benefits for faculty.
> (Bhuasiri, Xaymoungkhoun, Zo, Rho, & Ciganek, 2012, p. 843).

Cost savings can be realized through reductions in “classroom and facilities cost, training cost, travel cost, printed materials cost, labor cost, and information overload” (Bhuasiri et al., 2012, p. 843).

Mentors and leading educators can easily be sourced into an e-learning program and subsequently allow it to disseminate high levels of quality education around the globe where similar levels of education might typically not be found. This is further iterated by Jones’ work (2013), where he indicated “…learners who received higher supervisor support showed a significantly higher level of learning transfer” (p. 33). Eminus has integrated a mentorship model.

Challenges. Rosenberg (2001) described reasons for low completions rates such as: poor content, unauthentic learning, form over substance, non-versatile learning pace, technology barriers, information becomes difficult to refer back to after training, unreinforced learning, and materials not properly transitioned to technology.

Eminus is trying to address all issues through technology updates, youth input and development of content that is based on relevant and authentic UN Habitat practices and including real world applications in developing or strengthening new or existing social entrepreneurial initiatives. Also, the content is guided by a professor with over 25 years of experience in university level teaching, and courses are then developed and facilitated by highly skilled individuals. This all contributes to good content and authentic learning opportunities. This is important because if the experience isn't authentic, the program will encounter difficulties (Rosenberg, 2001).

It can become difficult to always find the right pace and the right level of flexibility, which allows slower learners to keep up, while allowing faster learners to progress at a pace that doesn't leave them feeling disinterested. Strong, engaging and caring course facilitators have been important for improving course completion rates.

E-learning programs usually require significant startup investment "in technology such as hardware costs, software licenses, learning material development…" (Bhuasiri et al., 2012, p. 843) as well as considerable time (and possibly financial) investment in platform training. However, Eliademy, the online platform behind Eminus, is a free learning management system that is built for teachers. Navigation, uploading, and course editing is very straightforward and easily manageable. It is important that students are not required to always be online and that content is downloadable.

Lack of motivation. Motivation can be strongly affected by increasing content relevance to the end user. If trainees are motivated to learn, they are more likely to be engaged during the training, and, if engaged, more likely to complete the training and achieve the learning objectives (Jones, 2013). Offering course content that is clearly presented as a catalyst for the end results or goals that the student is looking to achieve will increase student commitment, while motive matching, "linking the instruction to the learning styles and interests of the learners," (Jones, 2013, p. 38) creates a more engaging atmosphere for the students. Eminus integrates a mentorship model into the e-learning delivery so to encourage completion and accountability.

Mobile tablet education systems have proven to be feasible and stable, as Eminus even works on most unreliable networks reliably. The tablets are a key piece of technology that will allow students to develop their entrepreneurial skills through a pre-loaded online educational program. This allows for stimulating course structures and effective instructors to be utilized globally. It is important going forward that tablets and/or laptops with Internet time be considered within the youth fund grant for selected youth organizations with accountability related to course completion required.

Through the technology and structure of the program, Eminus can enable young adults to achieve positive change and this can be seen through the success stories and testimonies of students in outgoing, course completion surveys. One student stated:

> Through the programme I was able to take my idea from mere concept to being one step closer to development by writing a business plan and creating a video pitch which would later be selected to receive seed funding from the UN-Habitat. Based on the current development of Link Your Purpose (LYP) I was able to apply for the prestigious German Social Enterprise Fellowship Programme.

E-Learning Impact and Story of Eminus

Global rates of unemployment position Eminus well as an important tool. Views on the growing impact of e-learning and its potential are frequently optimistic. E-learning began with its humble origins of online written outlines, instructional videos, and internet conference calls, and now we can utilize powerful interactive, real-time video, chat, and various instructional platforms that allow instructors and a multitude of students to download and upload content with mobile freedom all over the world (Rosenberg, 2001).

Outcomes. Figure 3 (below) is a link to the Eminus Academy YouTube channel, where program outcomes can be seen in the form of multiple social enterprise student pitch videos as well as two overview videos explaining Eminus. The second link, Figure 4, highlights a specific example that shows a group experience within the Eminus program. These examples further provide an assessment of course content and impact.

www.youtube.com/channel/UC6Dd4dnMHiZ72bUxuyREeuw

https://www.youtube.com/watch?v=VQUEKmTVTqY

Figure 3. (top) Eminus Academy Youtube Channel (Eminus Academy, 2014).
Figure 4. (bottom) Nafasi Experience (Eminus Academy, 2015).

Student responses to incoming and outgoing surveys display the exponential effect of the courses. Many youth take on the course so they can make better decisions in their social enterprises, and to pass on knowledge throughout their organization so, as one student stated in a survey, “The entire group will be able to implement the approaches and skill in the development work that we do." This is due to the unique educational platform that Eminus employs, as well as the nature of the program, allowing a large quantity and variety of youth to participate (as seen in Figure 5) and exponentially increase the social impact of the Eminus courses.

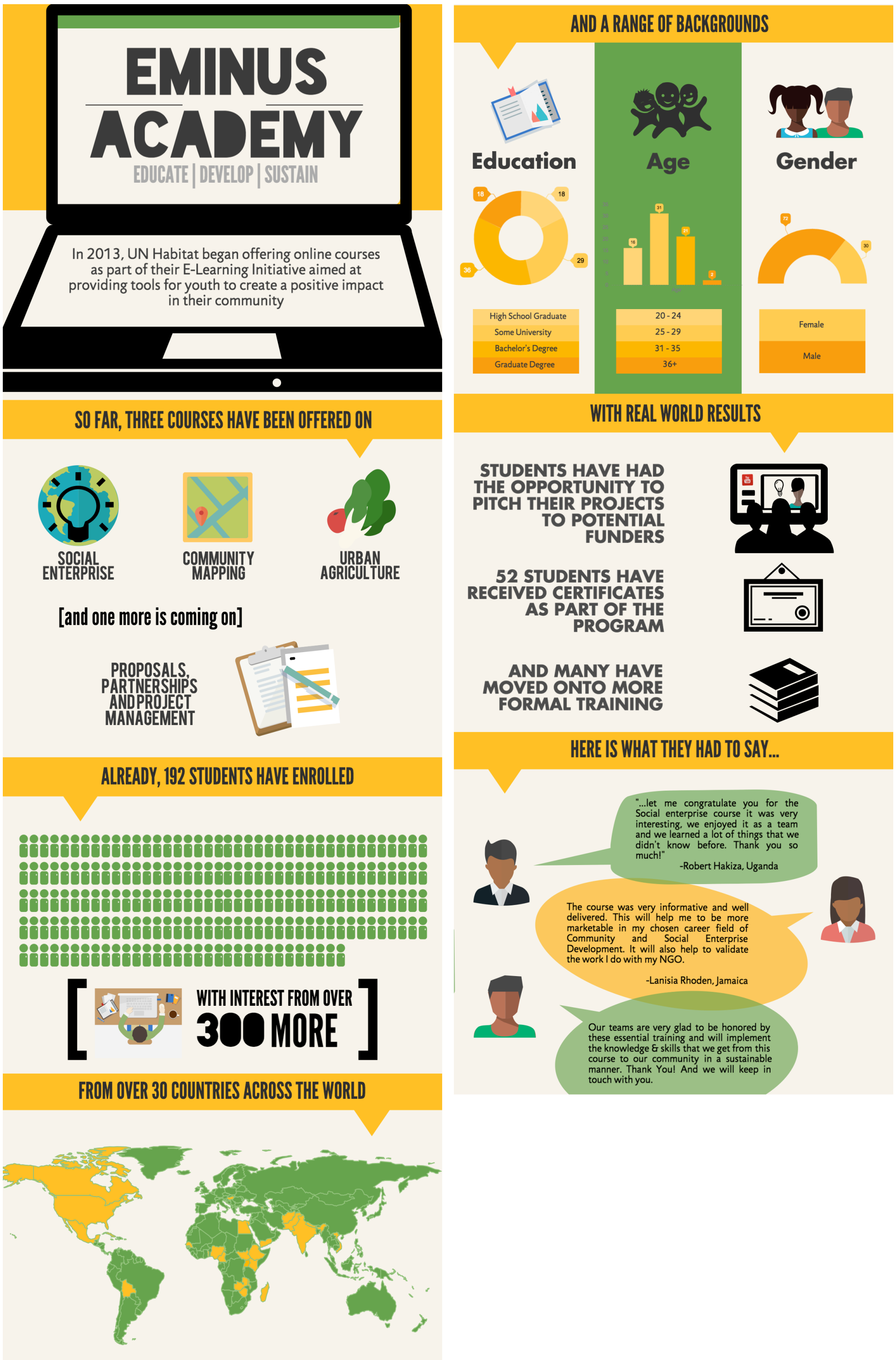


Figure 5. Eminus infographic displaying a brief program overview, demographics, and testimonials.

One of the most tangible outcomes is the certificate of course completion (as seen in Figure 6 below), this not only adds credentials and empowers youth in their careers, but also builds confidence and makes for socially responsible citizens. Many students cite certification as a valuable part of the course, as it is something that they can add to their resume and use to physically demonstrate their training. Course completion certificates are issued for each course completed and a program certificate is issued upon completion of all four courses.

Figure 6. Eminus student with course completion certificate.

The below testimonials are witness to the work being done through Eminus and the effect that program completion has on youth.

- "Thank you a lot for your unreserved considerations, and we have got the Certificate of Completion of your course today. Our teams are very glad to be honored by these essential training and will implement the knowledge & skills that we get from this course to our community in a sustainable manner." Tewabe Worku, Ethiopia.
- "This great idea can enhance the youth opportunity to work towards achieving the millennium development goals from a decision making position, design and implementation of projects, movements, activities, etc., as it gives the tools to do it." Gabriela Mariaca, Bolivia.
- "This certificate is evidence of my experience and knowledge that I can use in my future." Zahra Ahmadi, Afghanistan.

External factors are always present that help or hinder the success of programs. This is no different with Eminus. Eminus utilizes powerful tools that allow for instant international mobile ICT centered on social entrepreneurial initiatives. However, most mobile ICT are internet-access dependent. This proves a challenge in some cases, but solutions are always worked out on a case-by-case basis.

Other factors that could influence course completion include security, health, competency and, of course, facilitators and platform functionality. The completion rate for those enrolling in the courses is just over half (51%), largely due to the many limiting factors. Completion rates for online learning is often less than 10% (*The Economist*, 2014), and with the technical challenges for many youth taking the courses the data suggests our completion rate, at least four times this amount, is good. It is also important to note that completion rates are actually higher than reported as some course members are not participating students, but are only observers and therefore will not complete the course. As the program is still in progress, new data related to course completion and community impact is continually collected and added to the program data collection.

The below paragraphs provide examples of feedback from three students regarding the challenges faced in completing their courses:

- As Karama Team we've been making efforts to complete the first course connected to the UN-Habitat program and round up our business plan and elevator pitch. Unfortunately we have been dealing with some practical limitations; e.g. our camera that we used to take pictures with and simple videos just broke. So we have not been able to complete a filmed 'elevator pitch'. Since we do have the intention to complete the course, we have made a presentation full of pictures from our work and team. It has the same structure as our "elevator pitch.".
- The situation in South Sudan is currently not favorable for working conditions, we would not access offices at times and communication networks would be off most of the time. Also working in remote areas during provision of relief projects affected my attention on the course, but I am glad I have learned a lot.
- It was tailored to suit my time at work. Since it was online, with proper time between each chapter, I was able to properly digest each section of the course and sometimes go further to understand a certain topic. The tablets were actually very beneficial as I was able to download the readings on it and review them when I am at hospital at work between patients' visits.

Conclusion

A careful review of outcomes beyond what can be shared in the scope of this paper indicates that Eminus is providing a link between education and work. The evidence of the project is that young urban people have been able to create employment for themselves and others through the establishment of social enterprises. While youth are involved in content development and delivery, there is not yet gender equality in the program and we are working to address this.

The over 200 participants to date ranged between the ages of 20 to 30 years, the majority within the 20 to 25 years age range. Of the respondents to the expression of interest to the module, 69% were male, while 31% were female. More consideration is to be given to increasing female participation. There have been really significant outcomes for some of the female participants with the courses also opening doors related to further project funding and education. For example, the program has developed social enterprises from youth-led projects, all at a distance, allowing instructors to virtually be in multiple places at once.

While consideration is given to ladder this program into more formal accreditation academic courses, the non-formal aspect of the program is seen as valuable. Eminus statistics with respect to gender, level of education and course completion mirror trends documented elsewhere ("The Digital Degree," 2014).

Outgoing surveys completed by Eminus students, as well as through general correspondence, reveal technological issues as being one of the most frequently cited barriers to consistent participation and timely completion of assignments. E-learning is a tool that has long been required and will have profound effects on education globally for years to come. Flexible, affordable and easy to access education systems allows training opportunities in so many new places. Many youth take on courses so they can make better decisions in their communities themselves, but also so they can pass on their knowledge throughout their organization so, as one student put it, "the entire group will be able to implement the approaches and skill in the development work that we do." The opportunities that carefully planned and well-executed e-learning programs have to impact the world of education are phenomenal.

Concentrated efforts must be made to recognize weaknesses and threats in in educational programs to ensure they are to succeed. Similarly, understanding the strengths and opportunities that accompany e-learning, which are again unique in each situation, will allow for programs to capitalize on these and provide quality results.

Recommendations

Moving forward, open enrollment, combined with an enhanced screening process and mentorship program has been considered for future students within the program to further increase participation and interaction. Participation opportunities also lie in re-involving graduated Eminus students that have interest in facilitating course delivery. For example a doctor from Cairo, who recently finished an Eminus course, would like to develop a course on Ebola protocol for youth organizations.

Providing credentials, in the form of a certificate of completion, has proven to be an excellent motivator for students. Outgoing survey responses indicate that students are appreciative of the course completion certificates and that they feel they have gained a physical indicator that demonstrates their accomplishments and credentials to employers and clients alike. Expanding credentials to become a more formal academic accreditation could build on this success.

Further Research

Further research is warranted in methods of increasing gender balance in participation within similar types of programs, especially in developing countries, beyond being non-discriminatory in entrance requirements and screening processes. Perhaps exploring gender equity and gender equality in developing countries' e-learning programs could provide a basis for achieving improved gender balance.

Acknowledgements

Special acknowledgement is in order for those who contribute in various ways to the success of the Eminus project and the formation of this paper, including those who work within the UN Habitat Youth Fund: Eric Luguya and Judith Mulwan, and Cherie Enns Consulting Inc. members: Cameron Vos, Shana Roberts and Derrick Swallow, as well as all the youth mentors, students and content developers.

References

Bhuasiri, W., Xaymoungkhoun, O., Zo, H., Rho, J. J., & Ciganek, A. P. (2012). Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty. *Computers & Education,* 58843-855. doi:10.1016/j.compedu.2011.10.010

Eminus Academy. (2014, July 28). Eminus Academy [Video file]. Retrieved from https://www.youtube.com/watch?v=aiy2Ot78KPc

Eminus Academy. (2015, May 18). Nafasi Experience [Video file]. Retrieved from https://www.youtube.com/watch?v=VQUEKmTVTqY

Filmer, D., & Fox, L. (2014). Overview: Youth Employment in Sub-Saharan Africa. Washington, DC: World Bank. doi:10.1596/978-1-4648-0107-5

Fox, Z. (2012, June 18). 5 Reasons mobile is the future of sustainable development. Retrieved from http://mashable.com/2012/06/18/mobile-sustainability/

International Labour Office (ILO). (2010). *Global employment trends for youth: August 2010: Special issue on the impact of the global economic crisis on youth*. Geneva: International Labour Office.

International Labour Office (ILO). (2015). *World employment and social outlook: Trends 2015*. Geneva: International Labour Office.

Jones, A. R. (2013). Increasing adult learner motivation for completing self-directed e-learning. *Performance Improvement, 52*(7), 32-42. doi:10.1002/pfi.21361

Raftree, Linda & Martin, Nick. (2013). What's holding back mobile phones for education? *Stanford Social Innovation Review*. Retrieved from http://www.ssireview.org/blog/entry/whats_holding_back_mobile_phones_for_education

Rosenberg, M. J. (2001). *E-learning: strategies for delivering knowledge in the digital age.* New York: McGraw-Hill.

The digital degree. (2014, June 28). *The Economist*. Retrieved from: http://www.economist.com/news/briefing/21605899-staid-higher-education-business-about-experience-welcome-earthquake-digital

United Nations Economic and Social Council (UN ECOSOC). (2014). United Nations Economic Commission for Africa: Sustainable urbanization in Africa.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2015). World Education Forum 2015. Retrieved from https://en.unesco.org/world-education-forum-2015/

Author Details

Cherie Enns
cherie.enns@ufv.ca

Nicole Klassen
Nicole.klassen@ufv.ca

Back to Contents page

UBIQUITIOUS COMPUTING DEVICES IN THE TRAINING OF TEACHER-TRAINERS

Neil Smith, The Open University
Helen Caldwell, University of Northampton
United Kingdom

Abstract

In September 2014, the computing curriculum in English schools changed to one with a much greater emphasis on computer science. However, 66% of existing ICT teachers are non-specialist and require significant continuing professional development (CPD) to deliver this new curriculum. One initiative to provide this is the Computing At School (CAS) Master Teacher programme. This paper describes some physical computing projects that were used in training a cohort of Master Teachers, preparing them to deliver both improved lessons in classrooms and CPD tailored for the requirements of their peers.

Introduction

In September 2014, the computing curriculum in English schools changed to one with a much greater emphasis on computer science, compared to the previous curriculum mainly based on ICT and digital literacy (Department for Education, 2013). Of UK computing school teachers, 66% are non-specialists in computer science who do not have the subject-specific skills or experience to deliver the new curriculum as effectively as they would like (Furber, 2012). One initiative to address this deficit in skill is the Computing At School (CAS) Master Teacher programme (Computing At School, 2015), where technically competent in-service teachers provide professionally relevant professional development to their peers within and across schools.

This paper describes our experience with the CAS Master Teaching training programme, where we train the master teachers. The training involves a combination of technical education and training the teachers how to deliver effective continuing professional development (CPD) to adult learners. We employed a blended learning approach, combining face-to-face sessions, online tutorial support, and guided review of example practice by the teachers in delivering CPD.

We use various physical computing devices in the training to illuminate key computer science principles, as well as show the trainee master teachers how these devices can be used for CPD delivery and directly in classrooms with children. As well as the use of a variety of robots and physical computing projects, we also use the SenseBoard (see below), a novel device developed by the Open University for supporting ubiquitous computing and internet-of-things applications.

Teaching Approach

Training for master teachers is a two-stage process. Level 1 training is focussed on developing subject knowledge expertise (SKE) in the teachers, to ensure they have sufficient mastery of their subject. Level 2 training focusses on how to develop and deliver CPD for other teachers. We were providing Level 1 training.

Our cohort consisted of ten in-service teachers, split between five primary school teachers and five secondary school teachers. (Primary school covers ages 5 to 11; secondary school covers ages 11-18.) The training provision suggested by Computing At School suggested a blended learning approach. All teachers received five days of face-to-face training plus ten hours of online tutorial support; the secondary school teachers received an additional five days of face-to-face training to cover the additional subject knowledge expertise requirements. The online tutorial support was delivered through a combination of video conferencing using Google Hangouts and email. The face-to-face teaching time was supplemented by the trainees undertaking various activities between the contact periods, where the trainees had to perform various tasks such as preparing sample CPD material and reflecting on what they had learnt and how that could be used to improve their practice.

The face-to-face teaching was supplemented by the use of online tools where trainees could develop and share resources created during the training. These resources included learning resources taken from various places online and resources created by the trainees both during the sessions and elsewhere.

Ubiquitous and Physical Computing Devices

Physical computing has recently been seen as a first step in getting novices and children engaged with computer science (e.g., Buechley, Eisenberg, Catchen, & Crockett, 2008, Lau, Ngai, Chan, & Cheung, 2009, Richards, Petre, & Bandara, 2012, Richards & Smith 2010). The use of physical computing devices has several benefits over a software-only approach to education. The physical device offers a tangible focus of attention for the learner, the use of a playful and interactive device can reduce feelings of insecurity in learners, and the physical device can offer immediate and obvious feedback on progress.

As part of the teacher training, we have demonstrated a variety of physical computing devices and outlined their different pedagogic applications for both teaching children and for delivering CPD to teachers (specialist and non-specialist alike). In the remainder of this section, we outline the devices demonstrated. In the next section, we outline how these devices have been used in schools, both by the trainee master teachers and others.

SenseBoards

The SenseBoard (Figure 1) is a tethered device based around the Arduino microcontroller. It was developed for novice computer science students working at a distance in the UK's Open University, as part of the module *My Digital Life* (Richards et al., 2012). We wanted a way of introducing our starting students, many of whom have never before studied any form of computer science, to computing in a gentle and immediate way. The use of physical computing was a natural way to introduce the creative and practical aspects of computer science (Richards & Smith 2010).

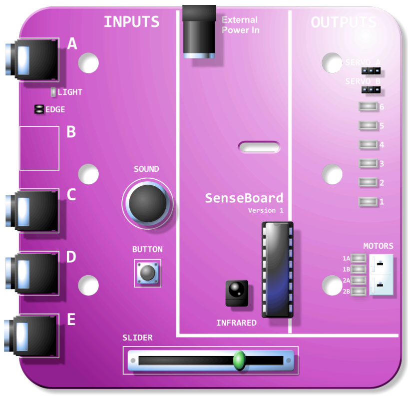


Figure 1. A schematic view of a SenseBoard.

The SenseBoard was designed as a ubiquitous computing lab-in-a-box for teaching undergraduate students at a distance. The SenseBoard's robust construction and ease of use make it suitable for use in classrooms. The accompanying Sense programming language (based on Scratch) allows even young children easily to develop internet-aware physical computing devices.

The Open University teaching context of solely distance learning leads to some interesting constraints on how a physical computing environment can be delivered. One constraint is that the SenseBoard kit supplied to the students should be self-contained; there is no facility for students to pop into a lab and collect additional equipment for specific projects. Another major constraint is that support and troubleshooting of the devices is difficult and often slow. If the device does not work, students, working at a distance, will often spend considerable time attempting to fix the problem before contacting tutors or other support personnel. These contacts are likely to be by telephone (or similar) or email. This is a rather different context from a traditional university, where students use physical computing devices in labs where skilled staff and technicians are available to step in and swiftly resolve trivial, but show-stopping, configuration or hardware errors. The device must be sufficiently reliable to have a very low manufacturing defect rate, survive postage to the student, and continue to function after over a year in the untidy environment of a family home, with all the attendant possible insults from pets and small children that are present in a home environment. Finally, the kit must be cheap enough that it need not be returned to the Open University on completion of a student's studies, as past experience has shown that the cost of receiving and refurbishing the kits is prohibitive.

The SenseBoard has, as the name implies, a number of sensors mounted on the board: a slider, a non-latching push button, a microphone, an infra-red sensor that detects signals from remote controls, and four 3.5mm sockets for plugging in additional sensors. The SenseBoard kit comes with a tilt sensor, a temperature sensor, and a light sensor; students can easily make or connect additional ones, such as pressure sensors and rheostats. The board also has some outputs: mounted on the board is a bank of seven LEDs in various colours, and the kit also comes with an IR LED on a long lead and a stepper motor, both of which can be plugged in to the board. There is scope to connect

DC motors and servomotors, but we do not supply these in the kit. This range of sensors and outputs means the SenseBoard is a flexible physical computing device capable of many uses. Everything that plugs in to the SenseBoard does so with simple non-reversible sockets that do not require the insertion of leads into small holes in a breadboard or the manipulation of small individual components. The SenseBoard connects to a host computer via a USB cable. To keep things simple, the SenseBoard is not capable of autonomous operation and must be controlled by a host computer.

Given the context of students starting computer science studies at a distance, the supplied programming environment also required that students be able to get started easily with the programming environment without being held back by trivial syntax errors common in novice programmers working with traditional textual programming languages for the first time. Therefore, we developed our own programming environment, Sense, based on the popular Scratch graphical, block-based, programming environment (Maloney, Resnick, Rusk, Silverman, & Eastmond, 2010). Sense was based on Scratch 1.3 and extended to make it suitable for undergraduate study. Main extensions were introduction of list variables, inclusion of blocks to control and read the SenseBoard and to read and write text files, and addition of blocks for network communication. Various other changes were made, including addition of more data manipulation blocks and numerous user interface changes.

The network communication blocks allow Sense to read arbitrary content from the Web, but also have dedicated support for reading RSS feeds, exposing the content of the feed as a list-like structure. We also allow Sense to write data to a dedicated server run by the Open University; this data is made available as both a simple web page and as an RSS feed, suitable for reading by Sense. This feature allows for individual students to write data such as logs, for students to view each others' data for collaboration on group projects, and for near real-time communication between students, either for chat, distributed presence, or simple game controls. (The extension of lists was folded back into the main Scratch 1.4 and hence Scratch 2, developed by MIT.)

While the most often used interface for the SenseBoard is Sense, we have also developed a Python library for driving the SenseBoard (Smith & Smith 2015).

Raspberry Pi

The Raspberry Pi (Upton & Halfacree, 2014) is a small, low-cost, single board microcomputer developed to give children a first experience of *unpackaged* computing, separate from the world of apps and ready-made software. To enhance this experience, the Raspberry Pi comes with a set of general-purpose input/output (GPIO) pins that allow it to interface with electronics and microcontrollers. Amateurs and educators have developed a great many projects, and Raspberry Pi (2015) has a curated collection of some simple projects, which illustrate the range of projects that have been completed with the Raspberry Pi.

One such set of projects demonstrated is the Miniband collection of homemade musical instruments (Smith, 2014), consisting of a drum machine, maracas, and a keyboard (see Figure 2 for a schematic of the keyboard). These projects are supplied with instructions for children to develop the instruments themselves, from components and writing the simple Python code required to drive the instrument. Each instrument takes about 90 minutes to complete, with children working in pairs.

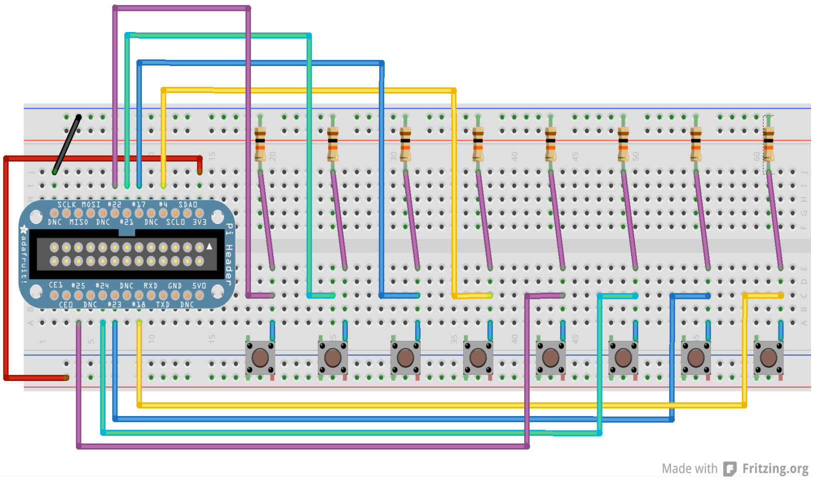


Figure 2. A schematic of wiring for a Raspberry Pi powered electronic keyboard

Junkbots

As well as physical computing devices, we also introduced the trainee teachers to a variety of robots for use in schools. One innovative class of devices is the Junkbot (Turner, 2013; Turner 2015; Turner & Tetley, 2015), which is a general family of small robots made from junk parts, such as drink cans, old DC electric motors, and marker pens (Figure 3). The robots are easily made by children and controlled using ScratchGPIO on the Raspberry Pi.

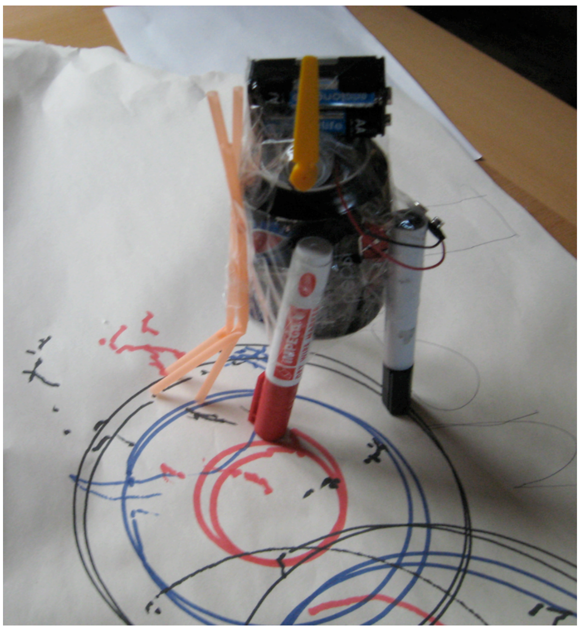


Figure 3. A Junkbot.

Reception by Master Teachers

We demonstrated these devices during some face-to-face sessions with all the master teacher trainees and invited them to experiment with the devices while we were able to provide supervision and advice. We supplied all trainees with at least one SenseBoard. Many already had several Raspberry Pis in their schools. We continued to provide support for trainees via videoconferencing as they developed their own activities using these devices.

Master teacher trainees' reception was positive for all devices presented to them, and they have already taken steps to incorporate the use of these devices into their practice, for both classroom teaching and CPD. Several have developed novel projects using these devices, such as additional musical instruments (including a theremin-like device using a rheostat connected to a Raspberry Pi) and an ambient weather display using the SenseBoard.

School Use

The authors have used most of these devices in a school environment, so we are sure of the effectiveness of them in providing an engaging context for studying computer science. They have also been used by third parties in both one-off workshops and for extended use in classroom settings.

Workshops

The constraints on the SenseBoard design, coincidentally, mean that the device is well suited for use in schools with children of all ages. We have successfully used the SenseBoards in several workshops for schoolchildren, notably the Digital Summer Camp day in 2013, where we introduced several hundred secondary school children to Sense and the SenseBoard through the development of a simple game, Sense Shooter, that used the SenseBoard as a simple game controller for playing a game of target shooting (see Figures 4 and 5). The slider was used to control the gun's aim point, and the microphone was used to detect a loud shout of "Bang!" by the child to fire the gun. Following an instruction sheet, the children had about an hour to build the game from scratch, though using the image and sound templates we provided. The simple and immediate nature of the controller was a great success in the workshop, as was the physical nature of the game controls.

Figure 4. Sense Shooter playing area.

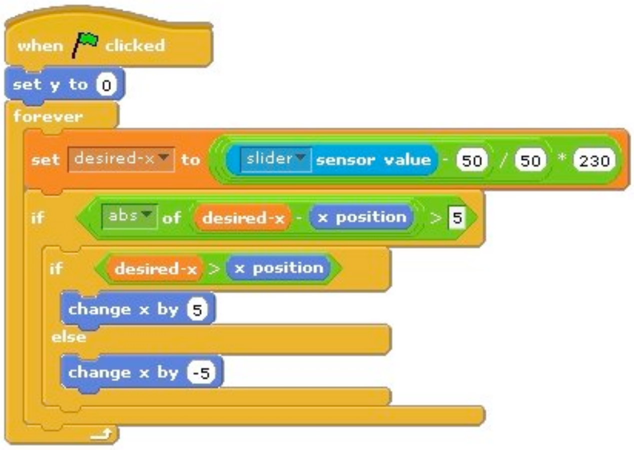


Figure 5. A sample script from the Sense Shooter program, showing the new sensor value block.

Sense has also been used in more extended workshops, where groups of children work together to develop a novel physical computing device for a particular use. Examples of projects that have come from these workshops include a visual fire alarm for the deaf that used the heat and sound sensors to detect a fire, and a sound-activated disco light (using an additional laser pointer bouncing off a home-made glitter ball, moved by the motor when a loud noise is sensed.

Classroom

The SenseBoard has also been used in the classroom in several contexts. Several secondary schools have had sets of SenseBoards for classroom use for several years and are using them across the STEM curriculum as well as in computer science and ICT lessons. They are using the SenseBoards for many of the uses outlined above, including using the sensors for data logging during science experiments, for later analysis.

Another use of SenseBoards in classrooms was as part of the Distance project (Kortuem, Bandara, Smith, Richards, & Petre, 2013), a distributed Internet of Things project across a number of UK schools. Different schools combined data from weather stations, indoor and outdoor air quality sensors, SenseBoards, and online sources of information (such as weather forecasts and traffic reports) to understand the environment within and around the schools. The schools also shared data with each other (via a central data hub) to collaborate and compare results.

It is still early days for use of these devices by the master teacher trainees in their practice, as they have only just completed their training. However, one master teacher has already successfully used the SenseBoard in classrooms and during open evenings for parents.

Continuing Professional Development

The use of these physical computing devices is novel in CPD for adults. Several of the master teachers have developed CPD resources using these devices, with many of the activities based on those included in the *My Digital Life* resources. These have included using the junkbots to illustrate the concept of algorithms to non-specialist teachers, and using multiple scripts in Sense as part of training on multi-threaded programming.

Conclusion

Physical computing devices are a powerful and useful way to entice learners into the study of computer science, and to illustrate and explain some deep concepts in the field. This paper has shown a variety of physical computing projects that are suitable for school children of all ages and which are generally quick to develop in a classroom or workshop environment. We have also illustrated some additional uses of these devices over longer-term periods, such as using the SenseBoard as an environmental condition logger, with results passed to a central server for later consolidation and analysis.

The master teacher trainees have enthusiastically taken up these devices. They have already developed several projects for various devices and are currently deploying them in their classrooms and in CPD.

References

Buechley, L., Eisenberg, M., Catchen, J., & Crockett, A. (2008). The LilyPad Arduino: Using computational textiles to investigate engagement, aesthetics, and diversity in computer science education. In *Proc. SIGCHI conference on Human factors in computing systems (CHI).*

Computing At School. (2015). Master teacher training programme. Retrieved from http://www.computingatschool.org.uk/index.php?id=noe-master-teachers

Department for Education. (2013). National Curriculum in England: Computing Programmes of Study.

Furber, S. (2012). *Shut down or restart: The way forward for computing in UK schools*. The Royal Society

Kortuem, G., Bandara, A., Smith, N., Richards, M., & Petre, M. (2013). Educating the Internet-of-Things generation. *Computer*, *46*(2), 53–61.

Lau, W. W., Ngai, G., Chan, S. C., & Cheung, J. C. (2009). Learning programming through fashion and design: A pilot summer course in wearable computing for middle school students. In *ACM SIGCSE Bulletin, 41(*1), 504-508.

Maloney, J., Resnick, M., Rusk, N., Silverman, B., & Eastmond, E. (2010). The Scratch programming language and environment. *ACM Transactions on Computing Education (TOCE)*, *10*(4), 16.

Raspberry Pi. (2015). Sample projects, from http://www.raspberrypi.org/resources/make/ [Accessed 28/3/2015]

Richards, M., Petre, M., & Bandara, A. (2012). Starting with Ubicomp: Using the SenseBoard to introduce computing. In: *43rd ACM Technical Symposium on Computer Science Education*.

Richards, M., & Smith, N. (2010). Teaching UbiComp with Sense. In: *Proceedings of the 6th Nordic Conference on Human-Computer Interaction (NordiCHI)*.

Smith, N. (2014). Raspberry Pi miniband. Retrieved from http://community.computingatschool.org.uk/resources/1811

Smith, N., & Smith, A. (2015). PySense library. Retrieved from https://github.com/NeilNjae/Sense-Library

Turner, S. (2013). Junkbots. *Higher Education Academy Science Technology Engineering and Mathematics (HEA STEM) Annual Learning and Teaching Conference 2013: Where Practice and Pedagogy Meet*.

Turner, S. (2015). Junkbots. Retrieved from http://junkbots.blogspot.co.uk/

Turner, S., & Tetley, H. (2015). Raspberry Pi Junkbot. Retrieved from http://raspberrypijunkbot.weebly.com/

Upton, E., & HalfacreeB, G. (2014). *Raspberry Pi user guide*. John Wiley & Sons.

Author Details

Neil Smith
n.smith@open.ac.uk

Helen Caldwell
helen.caldwell@northampton.ac.uk

Back to Contents page

SIMULATION-BASED TRAINING FOR GREEK PRESERVICE TEACHERS: DEVELOPING A 3D CLASSROOM ENVIRONMENT FOR PROFESSIONAL DEVELOPMENT VIA PRACTICAL EXPERIENCE

Kalliopi Evangelia Stavroulia
Technological University of Cyprus
Cyprus

Abstract

The last few years, the evolution of technology allowed the development of new and innovative tools to train future teachers. Simulation games gave a new perspective in teacher training by providing an alternative method of gaining an authentic practical experience within a safe virtual environment similar to that of the real world. This paper presents a framework for the development of a 3D virtual classroom environment for the preparation of Greek pre-service teachers.

Key words: teacher training, simulations, pre-service teachers

Introduction

Pre-service teacher education curriculum has received much attention especially after the transformation and modernization of the educational systems due to the evolution of technology. In recent years, the technological advancements gave new perspectives to the traditional teaching and learning, reformed the curricula and increased the presence of technology in the classroom. In this digital classroom environment teachers are no longer the unique source of knowledge and as a result they must develop new and innovative ways of teaching in order to motivate the students and promote the skills the students need for a sustainable future in a constantly changing labor market.

Surveys and case studies indicate that teacher education curriculum does not adequately prepare pre-service teachers to face todays' new demands and changing needs (Ferry et al., 2004; Kervin, Ferry, & Carrington, 2006; Kirby McCombs, Barney, & Naftel., 2006; Mahon, Bryant, Brown, & Kim, 2010; Mavrou & Meletiou-Mavrotheris, 2013). Ferry et al. (2004) report that at the end of their university studies pre-service teachers feel unprepared to confront the challenges of the classroom including behavior management issues, classroom management, student motivation and evaluation. Additionally, Kirby et al. (2006) report several studies according to which graduate teachers do not have a deep understanding of their domain. As a result, new teachers entering the profession are unable to implement effectively their knowledge into their classroom, ignoring the fact that their teaching practice has an impact on student learning (Ferry et al., 2004; Kervin et al., 2006). Furthermore, there is a lack of support for beginning teachers that in combination with the large amount of responsibilities of the classroom leads many teachers to leave their profession during the first five years of teaching (Kirby et al., 2006; Zibit & Gibson, 2005).

Another concern is that teacher training within the university is theoretical (Darling-Hammond , Hammerness, Grossman, Rust, & Shulman, 2005; Woolfolk, 2005), and there is a lack of practice and collaboration between schools and teacher preparation programs, depriving pre-service teachers from important resources and mentoring (Kirby et al., 2006). The acquisition of teaching skills for pre-service teachers cannot be achieved without their practice in real classroom settings (Ferry et al., 2004; Kervin et al., 2006). However, due to the cost of practicum experience most teacher education departments have only few hours of practice in schools that in most cases has the form of observation and not of actual practice (Katsarou & Dedouli, 2008; Woolfolk, 2005). According to Mahon et al. (2010), school availability problems make it difficult to find real classrooms and active teachers as mentors for all pre-service teachers, and, therefore, teacher preparation programs are disconnected from the school context. Moreover, Kirby et al. (2006) argue that active teachers do not like to be observed by teacher candidates in their classroom and as a result teacher candidates lack of feedback and mentoring that could prepare them deal with the challenges that they face in the early stage of their career.

In Greece, there is a lack of practice for student teachers in most of the departments with the exception of the departments of primary education, mainly because ministerial decisions have been issued for the cooperation of primary education departments with primary schools. Moreover, new teachers do not have a deep understanding of their domain, and in many cases they have limited knowledge in pedagogy using outdated teaching approaches and techniques (Katsarou & Dedouli, 2008). As a result, candidate teachers experience emotions of embarrassment and insecurity as they feel that their skills are insufficient to meet the needs of their profession. The Pedagogical Institute-PI (2009) of Greece and Karagianni (2012) also recognize that the basic undergraduate education of teachers does not correspond to the real challenges they face in today's classrooms due to the rapid evolution of science and technology. At the same time, another challenge that teachers face in today's classrooms is the diversity of the student population that is characterized by different cultural backgrounds and language, different levels of knowledge and different learning needs (Koutsothanasi, 2010). Undoubtedly, there is a lack of connection between theory and practice in teacher training, and the training programs do not adequately prepare pre-service teachers for their everyday teaching reality.

The last few years many efforts have been made to enrich teacher education programs with technology-based approaches because of their ability to provide future teachers a realistic educational experience that will contribute to the acquisition of cognitive, social and emotional skills that they will transfer and apply in their future classroom (Foley & McAllister, 2005; Gibson, 2011). The PI (2009) of Greece also suggests the use of active methods for teachers' training such as simulations and role-playing games that support the exchange of experiences, inquiry-based learning, active participation and the development of critical reflection (Katsarou & Dedouli, 2008). Today, with the new technologies a new dimension can be given to the educational approaches proposed by the PI. Teachers can be trained with the use of computer digital games and simulations that create authentic learning experiences.

The main objective of this paper is to report the significance of using virtual classroom environments in the preparation of future teachers as identified within the literature and to present the idea for the development of a prototype virtual classroom environment to address the needs of Greek pre-service teachers. A classroom simulation adapted to the Greek educational system can support the professional development of Greek pre-service teachers preparing them to face today's dynamic and constantly changing classrooms.

Training Teachers via Simulated Virtual Classroom Environments

Over the last few years there is a growing demand for the use of virtual worlds and simulations to support teacher preparation due to their ability to provide realistic three-dimensional environments that offer advanced authentic, engaging, interactive and immersive learning experiences (Ferry et al., 2004; Kallonis & Sampson, 2010; Klinakis, 2012; Wedig, 2010). Nevertheless, research in the development and implementation of simulations in teacher training curriculum is still in its infancy (Ferry et al., 2004; Mahon et al., 2010). However, the limited research that has been conducted to evaluate the use of simulations in the preparation of future teachers demonstrates that they can be powerful pedagogical tools in pre-service teacher education (Ferry et al., 2004).

Classroom simulations can address the lack of practical skills in teacher training and can bridge the gap between schools and universities. They "provide opportunities for experiences that simulate those of the real world" (Kallonis & Sampson, 2010, p.37), allowing pre-service teachers to experience authentic real-life scenarios, most of which they would probably not encounter during their traditional classroom practice. Moreover, Sapre (2015, p. 56) argues that simulations are "safe and controlled" conditions that promote teaching skills through preplanned "artificial circumstances" that allow teacher trainees to experience possible problems that will arise in their real future classroom and search for the solution. Within the simulated environment, pre-service teachers will be forced to act under pressure, make decisions related to issues such as student behavior and classroom management issues and see the consequences of their decisions both from a teacher's and a student's perspective (Ferry et al., 2004).

For Foley and McAllister (2005) the use of simulations will be beneficial for pre-service teachers, as they provide them an engaging and immediate learning experience within a realistic school context. Simulations allow the users to learn by experimentation, reflect on the different situations, understand the impact of their actions and evaluate their teaching promoting their professional development (Danielson, 2011; Foley & McAllister, 2005; Jones, 1995). Moreover, classroom simulations can serve as a mentoring tool, allowing pre-service teachers to receive feedback, support, and advice that they need in order to become effective practitioners (Ferry et al., 2004; Ming See, 2014).

Another significant advantage of classroom simulations in teacher preparation programs is that they allow mistakes. The users learn from their mistakes and they can re-play the simulation again in order to improve their performance. Additionally, the use of virtual classrooms addresses the issue of student safety as the consequences of the mistakes made by the teacher trainees within the simulated environment cannot harm real life students (Brown, 1999; Hunt & Brent, 1996). Furthermore, classroom simulations provide candidate teachers the ability to be trained at any time of the day, become familiar with students' various behavioral characteristics and different learning styles and re-play the simulation activities in order to explore alternative decisions (Ferry et al., 2004; Hunt & Brent, 1996; Sarpe, 2015). Simulations overcome the boundaries of the traditional classroom practice where it is not possible to repeat the lesson once is taught while there is always the possibility of affecting negatively the students.

Virtual classroom environments can also be used for the continuing professional development of experienced teachers; however, many of them are not yet familiar with the digital technologies (Kallonis & Sampson, 2010). Undoubtedly, teaching a generation of digital native students requires teachers to upgrade their skills and digital literacy in order to remain completive and guide their students to conquer knowledge and develop the 21st century skills.

One simulation game that has been used to enhance teacher's training is simSchool classroom simulation (www.simschool.org). SimSchool is a dynamic web-based classroom simulation that offers pre-service teachers the opportunity to experience real life classroom situations in a virtual environment. During the game, players can experience a variety of virtual students, they must analyze the student's needs, choose the tasks that match their needs and interact based on the student's response to the different tasks given. The player's decisions during the game affect student's academic and behavioral responses. Through the different scenarios teachers can be trained, experiment on the different teaching methods and approaches, evaluate themselves and reflect developing their teaching expertize.

Research in the use of simSchool reveals the potential of using classroom simulations in teacher training. The results by Mavrou and Meletiou-Mavrotheris (2013), report that for pre-service teachers virtual classroom simulations are a safe environment where they can practice and develop their teaching skills before entering a real classroom for the first time. Moreover, this safe environment provides pre-service teachers the room for error but without the risk of affecting negatively real students (Bush & Hall, 2013; Christensen et al., 2011; Mavrou & Meletiou-Mavrotheris, 2013). Additionally, research results indicate a positive impact of simSchool in pre-service teachers' self-efficacy, reflection skills and development of teacher identity (Bush & Hall, 2013; Christensen, Knezek, Tyler-Wood,& Gibson, 2011; Foley & McAllister, 2005).

Simulations do not aim to replace real classroom experience but to complement it, by allowing inexperienced teachers to spend more time in a safe environment that represents real-life situations. Technology can be used to empower the knowledge, skills and competencies of future teachers in classroom and behavior management but can also familiarize them with new technologies. Research so far indicates the potential of classroom simulations as effective teaching and learning tools that can provide future teachers valuable learning experiences.

Description of the Project

The purpose of the proposed project is to address the lack of practice in teacher training and improve the practical training of Greek pre-service teachers in behavior management issues by providing them real-life scenarios within the framework of a safe simulated classroom environment. The simulated environment aims to enhance the practical and professional skills of pre-service teachers via repeatedly active learning and experimentation. Through the simulation software future teachers will be able to experience various different behavior problems similar to those of a real classroom setting but with room for error and without the risk of harming real life students.

The classroom simulation is a first person simulation, and the user will take the role of a secondary education teacher. Throughout the simulation the users will confront various problematic student behaviors that active teachers often face within the classroom, including bullying behavior, hyperactivity, aggressive behavior and disrespect, to which they must respond. For each challenge users will have a selection of alternatives and will have to choose what they consider as the appropriate course of action each time.

It is essential that the proposed simulated classroom environment ensure that pre-service teachers will be trained in situations similar to those of a real-classroom setting. Therefore, an attempt will be made to develop the virtual students and the problematic behaviors based on the experiences of active teachers in order to offers pre-service teachers the opportunity to experience actual real life situations and gain knowledge that they will be able to transfer to their classroom tomorrow. It is important to involve active teachers during the development process, in order to explore and understand the real needs of teachers and simulate real incidents that have happened in their classroom. Moreover, active teachers will provide significant impact on how to confront unplanned events that occur during the lessons.

The scenario of the game and the selection of alternatives will be based on the literature review and on the guidance from active teachers. The implementation of active teachers' experiences within the simulated environment will provide pre-service teachers a valuable support and mentoring tool that will help them respond more flexibly to the challenges that they will confront in the classroom. Finally, it is important to develop a simulated environment that meets the needs of Greek teachers, as each educational system has its own curricula and strategies in order to respond to society's' demands. The implementation of a classroom simulation designed based on the needs of a different educational system might not ensure high quality learning experiences for Greek pre-service teachers.

Simulation Development

One important aspect that had to be taken into account for the design of the virtual classroom was that it had to be realistic and similar to a real Greek classroom, in order to create the users a strong sense of presence that is the illusion of being an active part of the computer-generated virtual environment. For this reason, the model of the virtual classroom was designed based on photographs that were taken from real classrooms (as shown in figure 1) and on the specifications of the company Buildings Infrastructures (http://www.ktyp.gr/en/) that is responsible for constructing Greek public buildings including schools. The models were developed with Maya Autodesk student version and were imported in Unity game engine (see Figures 2, 3 and 4 below).

Figure 1. Real classroom environment.

Figure 2. The virtual classroom environment in Unity.

Figure 3. The virtual classroom environment in Unity.

Figure 4. The model of the virtual teacher.

Conclusions and Future Directions

The proposed prototype classroom simulation aims to support the training of Greek pre-service teachers. Within this safe environment future teachers can be trained in different problematic behaviors, experiment, make decisions and explore the consequences without the fear of harming a real student, reflect and evaluate themselves developing their teaching expertize.

Practicing in a virtual classroom will reduces the time and cost needed in live training but will also help future teachers to understand todays' classrooms, their students and the impact of their decision making on their students' performance. Moreover, classroom simulations offer the users the ability to re-play repeatedly, experience the same or different circumstances and experiment in the use of different strategies to solve the problem.

Additionally, with the various scenarios pre-service teachers can experience a large amount of problems that will arise in their future classroom, something that would be impossible in live training where the working hours are limited. But most importantly the skills and knowledge gained thought the simulation training could be transferred and implemented in the real classroom setting. Unfortunately, at this stage the classroom simulation is under development.

After the completion of the prototype, but also through the development process pilot, tests will take place in order to investigate the potential to train pre-service teachers in behavior management issues within a simulation-based environment.

References

Anjanette, B. M. (2001). Reduce your losses: Help new teachers become veteran teachers. Retrieved from http://files.eric.ed.gov/fulltext/ED460121.pdf

Brown, A.H. (1999). Simulated classrooms and artificial students: The potential effects of new technologies on teacher education. *Journal of Research on Computing in Education, 32*(2), 307-318.

Bush, L., & Hall, J. (2013). Rethinking pre-service teacher training: Lessons learned with simSchool. In R. McBride & M. Searson (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2013* (pp. 2550-2553). Chesapeake, VA: AACE.

Christensen, R., Knezek, G., Tyler-Wood, T., & Gibson, D. (2011). SimSchool: An online dynamic simulator for enhancing teacher preparation. *International Journal of Learning Technology*, *6*(2), 201-220.

Danielson, C., (2011). Evaluations that help teachers learn. *The Effective Educator*, *68*(4), 35-39.

Darling-Hammond, L., Hammerness, K., Grossman, P., Rust, F., & Shulman, L. (2005). The design of teacher education programs. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world* (pp. 390-441). San Francisco, CA: Jossey-Bass.

Ferry, B., Kervin, L, Cambourne, B., Turbill, J., Puglisi, S., Jonassen D., & Hedberg, J. (2004, December). Online classroom simulation: The 'next wave' for pre-service teacher education? In R. Atkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone*: *Proceedings of the 21st ASCILITE Conference* (pp. 294-302).

Foley, J. A., & McAllister, G. (2005). Making it real: Sim-school a backdrop for contextualizing teacher preparation. *AACE Journal*, *13*(2), 159-177.

Gibson, D. (2011). A complex systems framework for simulating teaching and learning. In S. Freitas & P. Mahard (Eds.), *Digital games and learning*, (pp. 63-77). London: Continuum International Publishing Group.

Hunt, N., & Brent, R. (1996). Developing simulations for teacher education. In B. Robin et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 1996* (pp.

645-647). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Jones, K. (1995). *Simulations: A handbook for teachers and trainers* (3rd edition). UK: Routledge.

Kallonis, A., & Sampson, D.G. (2010). Implementing a 3D virtual classroom simulation for teachers' continuing professional development. In T. Hirashima, A. F. Mohd Ayub, L. F. K. Wok, S. L. Wong, S. C. Kong, & F.Y. Yu (Eds.), *Workshop Proceedings of the 18th International Conference on Computers in Education* (pp. 36- 44). Putrajaya, Malaysia: Asia-Pacific Society for Computers in Education.

Karagianni, E. (2012). *Attitudes and perceptions of primary teachers about training in the prefectures of Attica and Evrytania: Comparative evaluation* (in Greek) (Unpublished master's thesis). Xarokopio University, Athens, Greece.

Katsarou, E., & Dedouli, M. (2008). *Training and evaluation in education* (in Greek). Athens: PI-Pedagogical Institute of Greece.

Kervin, L. K., Ferry, B., & Carrington, L. (2006). ClassSim: Preparing tomorrows teachers for classroom reality. In C. Crawford, C. Carlsen, K. McFerrin, J. Price, R. Weber & D. Willis (Eds.), *Society for Information Technology & Teacher Education Conference* (pp. 3204-3211). Chesapeake, VA, USA: Association for the Advancement of Computing in Education.

Kirby, S., McCombs, J., Barney, H., & Naftel, S. (2006). *Reforming teacher education: Something old, something new*. Santa Monica, CA: RAND Corporation.

Klinakis, D. (2012). *Using virtual worlds for training primary school teachers* (in Greek) (Unpublished master's thesis). Department of Digital Systems, University of Piraeus, Greece.

Koutsothanasi, X. (2010). *Attitudes and opinions for secondary education teachers relative to the management of student's behavior problems in the classroom* (in Greek)(Unpublished master's thesis) Xarokopio University, Athens, Greece.

Mahon, J., Bryant, B., Brown, B., & Kim, M. (2013). Using Second Life to enhance classroom management practice in teacher education. *Educational Media International*, *47*(2), 121-134.

Mavrou, K., & Meletiou-Mavrotheris, M. (2013). Flying a math class? Using web-based simulations in primary teachers training & education. In S. Mukerji & P. Tripathi (Eds.), *Handbook of Research on Transnational Higher Education Management* (pp. 391-417). Hershey, PA, USA: IGI Global.

Ming See, N. L. (2014). Mentoring and developing pedagogical content knowledge in beginning teachers. *Social and Behavioral Sciences*, *123*(20), 53-62.

Pedagogical Institute of Greece (PI). (2009). Proposal for teacher's training (in Greek). Retrieved July 11, 2013 from http://www.pi-schools.gr/paideia_dialogos/prot_epimorf.pdf

Sarpe, A. (2015). A study of application of training in simulation teaching of B.Ed. teacher –trainees. *Renewable Research Journal*, *3*, 56-60.

Wedig, T. (2010). Getting the most from classroom simulations: Strategies for maximizing learning outcomes. *Political Science & Politics*, *43*(3), 547-555.
Woolfolk, A. (2005). *Educational psychology* (9th ed.). Boston: Pearson Education.

Author details

Kalliopi Evangelia Stavroulia
stauroulia_ke@yahoo.gr

Back to Contents page

PRE-SERVICE TEACHER PERCEPTIONS OF ICT TEACHERS

John Hunt
University of the Sunshine Coast
Queensland, Australia

Abstract

What does an ICT teacher look like? Using the ideas pioneered by Goodenough and Chambers, pre-service education students were initially asked to draw an ICT Teacher. In 2013, the task given was: Draw what an ICT Teacher looks like, sounds like and feels like. This elaboration on the task produced remarkably different results. The pictures produced focused on teacher attributes not previously evident: qualities such as open-mindedness, compassion and understanding, collaboration and sharing became evident. This paper examines four years of data and draws messages that can inform teacher educators and demonstrates views and perceptions of the qualities and attributes of ICT Teachers.

Introduction

This study examines data from four years of exploring pre-service teacher beliefs about ICT Teachers. In 2011 and 2012, participants in an ICT course were asked to 'Draw an ICT Teacher'. In 2013 and 2014, participants were asked to 'Draw what an ICT Teacher looks like, sounds like and feels like'. The change in task in 2013 was quite accidental. One student in the group asked for clarification of the task. The author's response, seeking to be economical with information and not wishing to influence participants' drawing, restated the task as draw what an ICT teacher looks like, sounds like and feels like. The use of this description of the task was related to recent work in classes about 'deep thinking', an outcome of the Y-chart strategy (looks, sounds and feels like). This restatement created a significant shift in participant response, the subject of this paper.

Theoretical Underpinning

Four notions underpin this study: (a) the Draw a Man Test by Goodenough (1926), (b) the Draw a Scientist Test (DAST) (Chambers, 1983), (c) the Draw a Scientist: Checklist (DASTT-C) (Thomas, Pederson, & Finson, 2001), and (d) a graphic organizer (the Y-chart). While Goodenough's test was primarily targeted at exploring intellectual growth in young children, Chambers' test sought to identify students' perceptions about science and scientists. Norman (1983), explains that mental models (pictures) reflect beliefs acquired through observation, instruction, or inference. In further literature, Goodman (1988) suggests that teachers are influenced by images from the past. His research suggests prior experiences have a significant impact on one's professional perspectives. The later DASTT-C elaborated on the original thinking of Chambers and provided a more substantial tool for the analysis of student images. Y-charts are commonly used in schools to probe for deeper understanding of ideas.

The use of images in each of these tasks provided an opportunity for students (pre-service teachers) to make their thinking visible, that is, the ideas in their heads, those pre-conceptions that had been influenced by past experiences and which have created numerous stereotypical notions of what science and scientists are, or in this instance, what ICT teachers are. Drawing pictures in this way is an often-used strategy in *constructivist* classrooms, where the teacher seeks to know (and understand) what the students already know.

In Chambers' (1983) original work, he identified seven stereotypical images of science and scientists. These are:

Table 1

Stereotypes of Scientists (Chambers, 1983)

1. Clothing: lab coats etc.	5. Symbols of research: laboratory equipment (beakers, test tubes, etc.)
2. Facial hair: beards and moustaches	6. Products of science: rockets
3. Eyeglasses	7. Captions: Zap, Eureka, etc.
4. Symbols of knowledge: books, and more recently the Internet	

The DAST-C (2001) research elaborated on these seven features, providing a further eight clusters of stereotypical conception (or alternative conception).

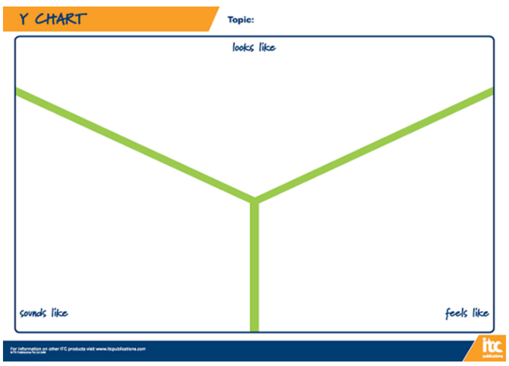
Table 2

Stereotypes of Scientist (Thomas et al., 2001)

1. Male gender	5. Mythical stereotypes
2. Caucasian	6. Indications of secrecy
3. Indications of danger	7. Working indoors
4. Light bulbs	8. Middle aged or elderly males

Data from 2011 and 2012 were examined using variations on these frames and will be discussed later.

The use of the Y-chart normally uses a matrix (see Figure 1). In this exercise, students were encouraged to use graphics and annotations to show their thinking.



(Used with permission from ITC Publications)

Figure 1. Y-chart matrix.

Frangenheim (Rodin Publications, 2002) describes the Y-chart in this manner:

> Teachers have been using the Y Chart as an effective tool in the classroom for many years. Essentially it serves as an analytical tool since students and teachers strive to discover more and more about a topic using the sensate approach of what does this topic Look, Sound and Feel like (and even taste and smell and move like). It is usually completed as a pre-product stage or a brainstorm exercise from which one can start creating a product such as a written report, bubble maps, Power points, interviews and more. (47)

The Y-chart in the task about ICT Teachers connects with a deeper and more cognitive side of the participants' thinking. Using a Y-chart for this task is analogous to asking participants to analyse and create (Higher Order Thinking Skills or HOTS in Bloom's language), whereas the original task, Draw an ICT Teacher, maps back to the Lower Order Thinking Skill (LOTS) of remembering. In this instance (original task), the conceptions held by a participant about ICT teachers are used to create a *brain dump* about ICT teachers. These conceptions have been formed over many years and replicate the experiences the participants have themselves had. The second task, using the Y-chart, challenges participants to think about the same issue in a different way.

In Figure 2 the two different tasks are placed on Bloom's ladder at levels of different complexity.

Higher Order thinking	**Creating**: requires generation of ideas and using them to create and design objects and solutions	
	Evaluating: requires judging information using some criteria or standard	*Revised Task 2013-2014: The use of a Y-chart provides opportunity for participants to engage at one or more of these levels*
	Analysing: requires examining specific parts of information to "see" the underlying ideas	
Lower Order Thinking	**Applying:** requires using information	
	Understanding: requires understanding information	
	Remembering: consists of memorizing or identifying facts	*Original Task 2011-2012: Draw an ICT Teacher is operating at this approximate level*

*Figure 2***.** Task analysis using Bloom's Revised Taxonomy.

The Research Questions

This study explores and discusses, using retrospective insight, two questions:

1. *What images do pre-service teachers hold of ICT Teachers?*
2. *To what extent can the data available be used to design/develop a valid measure of perceptions about ICT Teachers?*

Methodology

This study uses a qualitative methodology during data interpretation and broadly seeks to answer the larger questions: *What is going on here? What are the consequences and messages to be drawn?*

From a retrospective position, much of this work has been accidental, but insightful. Students (in teacher education courses) in four ICT classes, and over a four-year period, were asked to draw their perceptions of ICT Teachers. The ages of the students ranged from 18 to 51 years of age. This was a brief introductory activity to a 40-hour intensive class conducted over five days. After 20 minutes to complete the task, the images were returned to the instructor of the class. The only identifier required was an indication of gender. The next 30 minutes were then spent discussing the artifacts submitted, using a document camera to project onto the lecture theatre screen. Students were encouraged to pass comments on the work of their peers. In 2011 and 2012, there was considerable debate about the stereotypical images portrayed and it was evident that notions of, for example, gender, images of technology, maleness, facial hair etc. prevailed.

The author examined the images by year and by gender for all four years. Tables were constructed to analyze data for the first two years and to plot it against the modified frames of Chambers (1983) and Thomas et al. (2001). Data from 2013-14 was more problematic as a frame did not exist to undertake this examination. These data were also examined by gender. Initially these data appeared to fall into two clear categories:(a) descriptions of teachers and students and (b) ICT artifacts. Further analysis revealed that this was a superficial classification and the groupings could be expanded to four major clusters with a number of subsets.

Data Collection and Analysis

In 2011, there were 55 participants (Female= 34; Male=13; Unknown=8). Significant features from these data were:

- Acknowledgment by females (n=25) and males (n=5) that ‘hair style’ was a concept associated with the notion of an ICT Teacher (see Figure 3).
- Twenty two females associated ‘maleness’ with being an ICT Teacher
- Three females suggested ‘agedness’ was a factor in their conceptions
- Nineteen females and 10 males noted eyeglasses.
- Symbols of technology represented included: computers; tablets; mobile phones; MP3 players; the Internet; television; pencils in pocket; smart-boards; computer graphics; communication tools

More open responses/observations from females in 2011 included commentary, such as teachers were:

- Nerdy; Hacker; Computer savvy; Studious
- Serious; Boring/dull
- Highly organized; Logical
- Passionate; Smart; Intelligent; Informed; Engaging
- Unusual; Geek; Awkward; Technology T-shirt
- Creative; Talented; Imaginative; Open-minded
- Modern
- Outgoing
- Formal; Formal clothes

The more open responses/observations from males (2011) included:

- Tie
- Good attitude
- Modern 21st century
- Creative

Data from 2012 was not dissimilar. It is interesting to note that in both 2011 and 2012, participants are starting to look at the personal qualities of teachers, shown in the open responses above. Examples of ICT Teachers from 2011 and 2012 are shown in Figure 3.

.

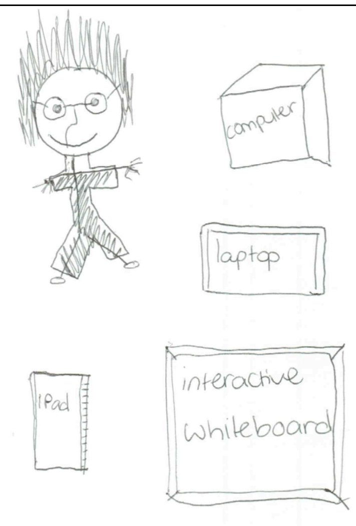
Female	Male
	

*Figure 3***.** Images from the 2011 ‘Draw an ICT Teacher task.’

Data from 2013 and 2014 is where the shift in student perception starts. Participants were noted to focus more on the teacher and teaching than the artifacts of ICT.

Examination of the work from 2013 and 2014 has allowed the development of a four-level framework (Table 3).

Table 3

Classification of 2013-14 Images

1. Teaching practice
   a. Teaching practices
   b. Collaboration
   c. Approaches to problem solving
   d. Classroom management
   e. Knowing the learner
2. Connectedness
   a. Connections: networks
   b. Connections: across curriculum
3. Attributes of the teacher
   a. Personal qualities
   b. Appearance
   c. Focus on language
   d. Teacher-Student interaction
4. ICT Artifacts: these could be classified into ICT types

The commentary below expands on some of the information in Table 3.

1. *Teaching practice*: this included Teaching practices; Collaboration; Approaches to problem solving; Classroom management; and Knowing/Understanding the learner: knowing what they already know (constructivism)
2. *Connectedness:* This included connections to networks (local, national and global) and connectedness of the curriculum (relevance and authenticity)
3. *Attributes of the teacher*: Personal qualities of a good teacher; Appearance; Focus on language; Appearance; Teacher-Student interactions
4. *ICT Artifacts*: The artifacts noted could be classified as computers/tablets, audio/video devices, communication tools etc.

The examination in 2013 and 2014 explored 55 student images. The fourth level of this frame, ICT Artifacts, drew considerably fewer ideas than in the previous two years. Data and images from the 2014 tasks showed the most significant shift.

First the images:

.

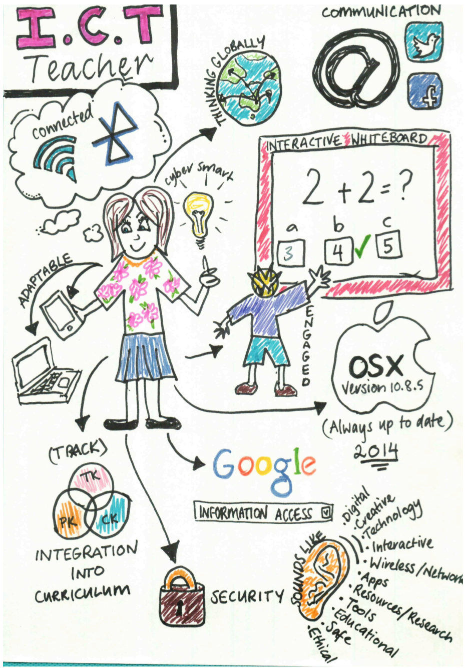
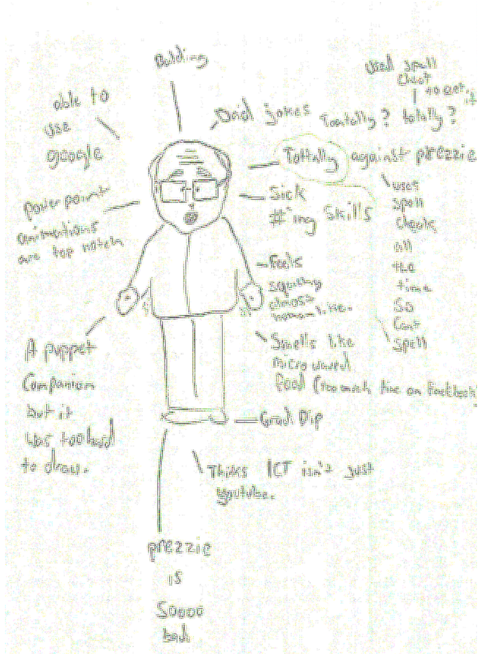
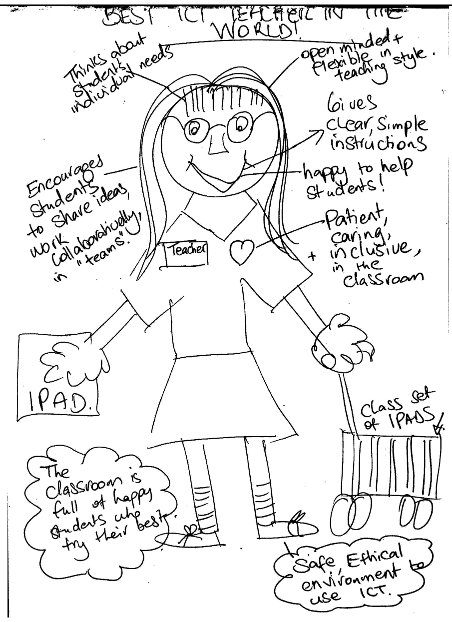
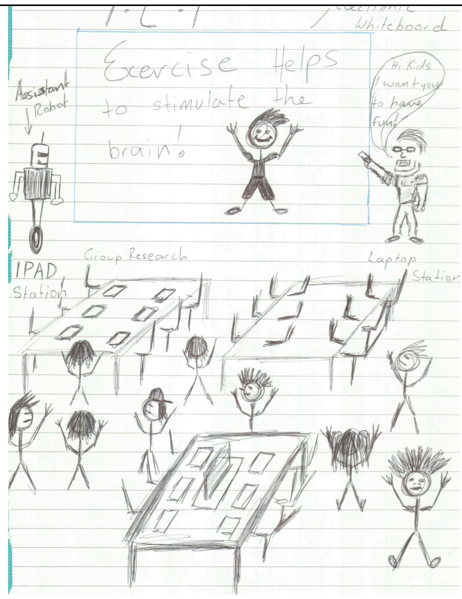
<table>
<tr><th>Female</th><th>Male</th></tr>
<tr><td>
</td>
<td>
</td></tr>
<tr><td>
</td>
<td>
</td></tr>
</table>

Figure 4. Images from the 2014 ‘Draw what an ICT Teacher looks like, sounds like, feels like’ task.

As is well illustrated in the four images of Figure 4, aggregation of the data from the 2013/14 tasks (Table 4) indicates the themes that were constantly re-occurring.

Table 4

Data from 2013 and 2014

Female 2013/14 n=42	Male 2013/14 n= 23
Knowing the learner and how they learn best • understands the learner, works at their ability level • is inclusive • understands ICT integration • fosters creativity • encourages mobile learning	*Knowing the learner and how they learn best* • uses eLearning • encourages mobile learning
Collaboration • uses collaborative practices • encourages group work • encourages discussion • works collaboratively and shares	*Collaboration* • students collaborate through technology
Approaches to problem solving • challenges students • encourages discovery	*Approaches to problem solving*
Classroom organisation • focused on seating plans • is surrounded by students • roams the class and is never still	*Classroom organization* • Is surrounded by students:
Connectedness • supports connectedness, engagement and communication • is connected to the world • is relative to today's students	*Connectedness* • anywhere, anytime computing • uses blogs • uses online learning spaces • uses the cloud • encourages digital interactions • conducts virtual experiments
Attributes of the teacher • is dedicated and less formal • fun and boring at the same time • uses a quite different language • has a trendy appearance • is up to date • reflects on teaching practice • has 21st century skills • understands digital pedagogies • understands safety and ethics • is always positive • compassionate and caring	*Attributes of the teacher* • is a mentor/guide • is knowledgeable, geeky, and a guru • uses clear and concise language • is adaptable and open-minded • looks like anyone else • is friendly and encouraging • is innovative and highly connected • learns and listens • is cyber smart • is compassionate and caring • is self reflective
ICT artifacts: Computers/laptops/tablets; smart phones; data projectors; interactive whiteboards; the Internet; video/audio devices;	

Discussion

In revisiting the research questions, what has been learned?

Research Question 1. *What images do pre-service teachers hold of ICT Teachers?*

The ideas held by pre-service teachers about ICT teachers appear to be an artifact of the task or question posed. In the data analysed, for 2011 and 2012, there is a clear focus on technological artifacts used by the teacher and class, whereas in 2013 and 2014, there is a shift towards notions that focus more on the teacher as a person, including what good teaching should look like. This suggests that researchers need to be clear as to what they are seeking to investigate and how the data collected is interpreted. The information obtained using the Y-chart organizer provided a better (and deeper) idea of pre-service teacher thinking than can be obtained using the standard 'Draw a picture of …' tool.

Research Question 2. *To what extent can the data available be used to design/develop a valid measure of perceptions about ICT Teachers?*

There appears to be doubt over the ability of the previous iterations of Draw a man/scientist/ICT teacher task to inform teacher educators about 'what is truly inside students' heads. This seems well served by data that shows that the question or task given is a determinant of the conceptual outpouring. It is argued that the original Draw an ICT Teacher task is closed and encourages participants to draw on previous conceptual ideas (shallow knowledge, LOTS). The use of an extended and deeper probing question (open, HOTS) suggests that what participants present is an artifact of the question. Closed questions are symptomatic of how pre-service teachers (and teaching faculty) have been taught and is thus replicated in the proposed task. It may also be true that this is how many researchers themselves have been taught and that the use of such open questions does not come easily.

The use of open questions has revealed much about the personal qualities shown in pre-service teacher beliefs about ICT teachers, together with notions of what good classrooms and good teaching and learning practices look like. The evidence analyzed is rich in a different set of conceptual ideas held by pre-service teachers, ideas that have been developed through deeper thinking.

Conclusion

To better understand what pre-service teachers bring to classes, combining the traditional Draw an ICT teacher task with the ideas created by drawing what an ICT teacher looks like, sounds like and feels like, might achieve better outcomes. Combining the two may serve a dual purpose: the latter provides teaching staff with notions of what pre-service teachers perceptions of ICT teachers and their tools are, whilst the second task reveals much about the qualities of effective teachers using ICT. A better task description would be to combine the two notions and ask pre-service teachers to: *Draw and use pictures to show what an ICT teacher looks, sounds and feels like, as well as showing the tools they use in their classes.*

This notion will be the subject of future research.

References

Chambers, D.W. (1983). Stereotypic images of the scientist: The Draw a Scientist Test. *Science Education, 67* (2), 255–265.

Frangenheim, E. (2010). *Reflections on classroom thinking strategies* (9th ed.). Brisbane, Australia: Rodin Education Consultancy.

Goodenough, F. L. (1926). *Measurement of intelligence by drawings*. New York: Harcourt Brace.

Goodman, J. (1988). Constructing a practical philosophy of teaching: A study of pre-service teachers' professional perspectives. *Teaching and Teacher Education*, *4*, 121-137.

Norman, D. A. (1983). Some observations on mental models. In D. Gentner & A. L. Stevens, (Eds.), *Mental models* (pp. 7-14). Hillsdale, New Jersey: Erlbaum Associates..

Thomas, J. A., Pederson, J. E., & Finson, K. (2001). Validating the Draw-a-science teacher test checklist (DASTT-C): Exploring mental models and teacher beliefs. *Journal of Science Teacher Education*, *12*(3), 295-310.

Author Details

John Hunt
JHunt1@usc.edu.au

Back to Contents page

TEACHER EDUCATION AND CONSTRUCTIONISM WHEN TEACHING WITH DIGITAL TECHNOLOGIES

Anthony Jones
International Centre for Classroom Research (ICCR)
University of Melbourne
Australia

Abstract

Today's university graduates might be avid users of social networking communication, but this does not make them skilled users of IT. It is probable that there is little transfer of social media technological skills into teaching with IT in schools. The concepts of *constructionism* are appraised, and reports on changes to classroom pedagogical theory and practice using IT are reviewed. A trend towards emphasising the technology rather than the pedagogy used or the content taught is noted. The trend is linked to a project that involved introducing constructionist principles and practices to a cohort of prospective secondary teachers. This paper is an initial report of that project.

Introduction and Setting

In common with other developed countries, education authorities in Australia have made significant investments in promoting effective teaching with computers and other digital technologies. While expenditure figures are not available, considerable expenditure is implied by the fact that in Australian schools "on average, every three students had access to one computer" while the international average was 18 students to a computer (De Bortoli, Buckley, Underwood, O'Grady, & Gebhardt, 2013, p.116). Although there has been research into teaching strategies with digital technologies (for example Webb, 2002; Mishra & Koehler, 2006), many researchers and practitioners feel there is a lack of useful documentation on practical classroom strategies.

A survey of Australian teachers in 2010 found that the average age of primary teachers was 42.1 years and secondary teachers 44.5 years (McKenzie, Rowley, Weldon, & Murphy, 2011, p.24). This appears to imply that few current Australian teachers experienced learning with computers when they were students, and so they lack personal experiences to draw on when they teach with technology. This is very different to a range of subjects they would have studied for up to thirteen years at school. As a result, teaching with digital technologies is conceptually different to teaching in any other mode or subject area for many teachers.

This paper discusses reasons for considering the reconceptualization of pedagogical decision making for teaching with digital technology and then reports on some experiences of pre-service teachers. Pedagogical models advocated by Cope and Kalantzis (2000), Haydn (2014), and Webb (2002) form the basis for this discussion, but all of these can be traced back to research reported by Harel and Papert (1993). This will be expanded on in the later section focussing on constructionism. It was hoped that such a reconceptualization would provide an analytical framework that focused on the structure of classroom teaching practice involving IT. It was also hoped that the framework would offer an interpretive research tool with which to better understand classroom practice involving teacher use of digital technology. In the research project it was found that pre-service teachers experienced difficulties following constructionist principles with IT, at least partly because personal experiences were far removed from constructionism. Because there is no world-wide agreement on terminology, the terms *digital technology*, *information and communications technology* (ICT), *informatics,* and *information technology* (IT) are used interchangeably, as are *beginning* and *pre-service* teachers.

Pedagogic Strategies and Teaching with IT in Schools

Using meta-analytical methods researchers including Tamim, Bernard, Borokovski, Abrami, & Schmid (2011) have analysed research into IT and education that has been reported over several decades. In general the research has indicated that IT can alter the traditional balances and interactions between teacher and learner and make learning more effective, but with some caveats. Among suggested positive effects that IT can have on learning are stimulating the development of intellectual skills; contributing to ways of acquiring knowledge, skills and attitudes; increasing interest and motivation; and enhancing concentration and time on task. However, these benefits from classroom use of technology are dependent on teacher skills with the technology and teacher attitudes to using technology for teaching, which in turn are dependent on the professional education of the teacher in this area. Gobbo and Girardi (2002) also noted a connection between teachers' personal theories of teaching and skill in using technology and believed that these correlated positively with how teachers described their pedagogical style and their views on epistemology.

In their OECD project report on a project that included case studies from 23 countries, Venezky and Davis (2002) found that "successful implementation of IT depends mostly upon staff competence in the integration of IT into instruction and learning" (p.11). They reported that while it is rare for technology by itself to act as a catalyst for school change, technology is a potent lever for planned change implementation. Discussing the WWW and education they stated that a "quality issue relates to the pedagogy employed in educational sites on the WWW" (p.33), and noted that teachers who are neither aware nor competent with pedagogical strategies appropriate for using technology to enhance teaching and learning are unable to make effective use of what is available on the WWW.

Multiliteracies augment the traditional text-based literacy with literacies related to images, sound, and technology, and can be considered as the new forms of literacy now considered essential for citizens in a technological society. The New London Group (Cope & Kalantzis, 1996) created a theoretical underpinning for a pedagogy of multiliteracies and proposed four components for multiliteracy pedagogy: situated practice, overt instruction, critical framing, and transformed practice. In a related but different area, Kress and others have investigated the effects of technology and policy on teaching secondary school English using the descriptor *multimodality* (Jewitt, Bezemer, Jones, & Kress, 2009).

Webb (2002) studied teacher pedagogy in subjects that used and taught about IT. She noted reports indicating that teachers were unable to develop adequate levels of IT knowledge and skills in their students, while other reports suggested general agreement (at least across Europe) about the content that could be taught at most levels of schooling. “However these specifications are restricted to what is to be taught and make few suggestions as to what pedagogical skills teachers need to teach these courses” (Webb, 2002, p.239).

Instead of defining pedagogy in relation to teaching IT, Webb considered the processes that make up pedagogical reasoning by comparing features of two existing frameworks and found much that was complementary. It should be remembered that most pedagogical models applied to teaching with and about ICT originated in non-ICT contexts, such as Shulman’s (1987) model of pedagogical reasoning, which described processes used by teachers in the planning, teaching and evaluating of lessons and identified the need for teachers to possess knowledge about learners, the curriculum and associated resources, and about pedagogy. While Shulman’s pedagogical content model emphasised pedagogy, some later models seem to shift the emphasis to technology (Mishra & Koehler, 2006; Polly & Brantley-Dias, 2009). As will be discussed later, this technocentric perspective appears to be in opposition to the principles of constructionism.

Constructionism

When considering pedagogy from a constructionist perspective it is interesting to note that the term *pedagogy* does not appear in the index of either Papert (1980) or Harel and Papert (1993). Both these seminal texts concentrate on learners and learning, and both contain discussion of teachers and teaching with IT. Constructionists argue that constructionism is a framework for action, with many going further and arguing that a framework is insufficient on its own. From its beginnings in the 1960s, Papert, Feurzeig and the other developers of Logo wanted to use technology to change learning in schools. Papert contrasts instructionism and constructionism claiming that there is a difference “that goes beyond the acquisition of knowledge to touch on the *nature of knowledge* and the *nature of knowing* (Harel & Papert, 1993, p.8). Feurzeig has argued that the dichotomy between instructionism and constructionism exposes weaknesses in some common classroom practices where students are told and get little opportunity to construct knowledge for themselves. He noted, “Constructionism is not a rejection of instruction. Learning requires both instruction and construction. They are mutually supportive learning components” (Feurzeig, 2010, p.4).

Edith Ackermann, another early user of Logo, examined the shared concepts of Piaget’s constructivism, Papert’s constructionism, and Vygotsky’s socio-cultural theories. She claims that constructionism “spreads light on how ideas get formed and transformed when expressed through different media, when actualized in particular contexts, and when worked out by individual minds” (Ackermann, 2010, p.4), and also:

> With Papert, we suggest that diving into the unknown, at the cost of experiencing a momentary sense of loss, is a crucial part of learning. Without immersion there is no empathy, and without empathy there is no way to feel for others or grasp a situation from-within. (Ackermann, 2010, p.7)

To conclude this section we note the arguments of Haydn (2014) in his review of problems associated with pre-service teachers effectively integrating IT into their pedagogical practices. He strongly argued that it is "not about students developing advanced technological capabilities" (p.458), but rather about their perceptions and approaches to IT in their classroom. In particular, he claims that there is a need to move away from being primarily concerned with pre-service teachers developing basic skills, because successful education in this area is "not a list of skills but about attitudes to ICT, open-mindedness, willingness to try things out, develop critical appreciation of the potential of various ICT applications" (p. 460).

Studying Teaching with IT

For several years the researchers from the International Centre for Classroom Research (ICCR) at the University of Melbourne have collected data by video-recording mathematics lessons using multiple cameras across different cultures and countries. In the next section there is a brief discussion based on observations from a typical lesson in a specialist IT room, before changing the focus to an attempt to apply contructionist principles when the learning environment is any classroom environment where students have computer access. The main reason for this choice is that it appears more difficult for teachers to apply constructionist strategies in an environment in which students spend most of the time as individuals interacting with a computer. When students are away from computers, it is feasible for teachers to employ a variety of pedagogical strategies, but this changes as soon as students begin to work as individuals at a computer. The pre-service teachers who participated in the project reported that this is what they observed and experienced at the schools they were attached to – instructionist approaches used by teachers with little or no opportunity for students to construct knowledge for themselves.

Experienced IT Teacher in a Computer Room

Several years ago a series of Year 10 IT lessons were video-recorded at a secondary school in Melbourne (Jones & Martin, 2006). Two cameras were used to record lesson events. One camera followed the teacher as she/he moved around the room. The teacher carried a wireless microphone that allowed all comments to be recorded. A second camera was set up in a corner and provided a panoramic view of the computer room, and provided an indication of what students were doing. For this project the actions and words of the teacher were considered the primary source of data, so the image of the teacher occupied the whole screen. A small window at the top left corner of the screen showed the panoramic view of the students.

This manner of research – focussing on the teacher – is being replaced, with more emphasis being placed on how and what students learn with and through

IT. At the conclusion of the project, the researchers believed they had a comprehensive record of events in these lessons, but these did not identify or help explain the pedagogical approaches employed by the teachers. The next section details a planned attempt to encourage pre-service teachers to follow and understand some constructionist principles when teaching with IT.

Constructionism as an Overt Practice in Pre-service Teacher Education
As Logo began to be used more widely in the 1970s, Papert and the other developers clearly saw Logo as a means to involve users in computer programming at all levels from beginner to expert (Abelson & diSessa, 1980; Harvey, 1985). Others, including Papert, Harel, and Resnick saw programming in Logo as an aid to enhancing learning in areas not at that time linked to computer use, and at all levels from kindergarten to university. Around the time desktop computers became available for school use Papert stated:

> In my vision, *the child programs the computer* and, in doing so, both acquire a sense of mastery over a piece of the most modern and powerful technology and establishes an intimate contact with science ... mathematics … and intellectual model building. (Papert, 1980, p.5)

A consideration of the lesson analysis presented above raises several questions, including: “Do teachers in training know anything about constructionist principles, and how can they be introduced to them?” Studying classroom activities and lesson events might report on the actions of teachers. However, it does not inform observers about the pedagogical approaches employed by the teacher.

A group of prospective secondary school teachers in the Master of Teaching course at the University of Melbourne came into contact with a different programming environment in a constructivist manner. These beginning teachers had completed an undergraduate degree and tended to possess a good knowledge of IT in general, gained from personal use in university study and work experiences. However, this bears little relation to the knowledge required for teaching with IT in secondary schools. They have even less knowledge and experience of how to teach in any mode other than the typical lecture, tutorial, workshop approach used in most tertiary studies.

In an attempt to provide a constructionist-like experience to these beginning teachers, a weekly workshop in a computer room explored the use of Scratch to create digital stories. As secondary teachers, they will be expected to teach two subject/curriculum areas. Using Scratch they developed a multimedia product that could be used in the teaching of any non-IT subject. This point is important, as the focus was to be on teaching and learning across the secondary school curriculum. In the first week the twenty-seven beginning teachers and the tutor introduced themselves to each other and then discussed their perceptions of, and attitudes to, classroom programming activities. Unsurprisingly few reported knowledge of a programming language. A very brief summary of the development of Scratch was presented, with links being made to the statement by Feurzeig (2007, p.7) that for the creators of Logo the “intent was not to teach programming as a subject in its own right, but to exploit programming to teach mathematical thinking. A stronger claim would have been to teach generic (i.e., domain-independent) thinking skills.”

Following the introductions the tutor demonstrated a short Scratch program that contained some basic animation and sound. As the demonstration was in presentation mode, the students were not aware of either the format or process of the Scratch coding. Through directed questioning the tutor focused the discussion on what elements in the limited programming they knew that might have been used in the demonstration. The students were also asked whether they thought secondary school students might be able to create multimedia products and whether such an activity would engage them. They were also alerted to the fact that the new Australian curriculum that was being developed would contain computational thinking as part of digital technology.

Students then downloaded and opened the Scratch program from the subject page on the university LMS. The downloaded program opened in the default small stage mode, which displayed commands, scripts, sprites, stages, and a small screen. The tutor briefly showed how to start and stop a program and then suggested they explore as much of Scratch as they could in fifteen minutes. Another sharing of ideas and experiences, including some students using a computer connected to a data projector to show what they had found, followed this. This concluded the first one-hour session. The computer room was free for the next hour, and it was suggested that this was a good time to make notes and store information that could be useful in the future.

In the second session students were presented with the challenge of controlling a sprite (Scratch screen object) as though it was a car to be parked in a parking lot. They were shown two examples, but without access to the Scratch programming. A basic method of controlling a sprite from the keyboard was demonstrated and discussed before the students were encouraged to spend about ten minutes exploring ways of developing other control instructions. This was followed by a discussion in which students were asked to demonstrate what they had been doing, and to discuss and recommend things to try. The students then returned to the task, and were encouraged to share ideas and findings with others. All sessions concluded with a plenary session in which the question was asked, “What have you learned today?”

Students were emailed before the next session asking them to think about how they might have a series of animations activated by the mouse, a task based on an idea suggested by Romeike (2008). The second session began with a brainstorming discussion of the task, particularly what might be possible in the Scratch environment. Students then investigated what was available in Scratch and shared their findings with the group. An interactive whiteboard was used, which assisted students to suggest connections or re-arrangements of ideas. Except for the final five minutes, students worked on their individual projects for the remainder of this session. The session concluded with a whole class discussion of what had been discovered and what worked or didn’t work.

The next session commenced with some students sharing features they had added to their project since the previous session. Discussion was then directed towards creating a multimedia story in Scratch. When consensus had been reached on what this might entail in the context of middle secondary years, an adaption of an Aesop fable was downloaded from the Scratch website and shown. Issues including story planning and techniques for animation, changing sprite shapes, changing backgrounds, and adding sound and text were investigated. Students were left with the task of preparing an outline or storyboard of a text-based story they would convert into multimedia format.

At the start of the fifth session several students shared their plans for a multimedia story. It was agreed that everyone would approach the task from the perspective of a teacher wanting to make a demonstration for use with a class at Year 9 or 10 levels at the school they were attached to. Apart from sharing ideas and progress at the start and conclusion of sessions five and six, students worked at creating their multimedia story.

As the weeks passed, the students were guided through a range of experiences based on constructionist principles. Later, approximately two weeks prior to the commencement of a three-week practicum in a school, students were formally introduced to constructionist ideas and asked to reflect on differences and similarities in the way they acquired knowledge about Scratch and other programming languages.

The students and the tutor were aware that it was unlikely for opportunities to arise during this teaching practicum to try out some of the constructionist ideas that had been discussed. However the students were asked to reflect on the approaches they used in the lessons they taught, whether IT was involved or not, and consider whether they had used any constructionist ideas. They were also asked to reflect on the use or non-use of technology in the lessons they taught, especially considering whether technology could have been used to improve their teaching and the student learning.

Conclusion

The review of research presented earlier appeared to show two disturbing trends. First a tendency to for teachers to focus on technology rather than either pedagogy or content, and second that instructionist approaches were much more common than constructionist approaches in lessons using IT.

Today researchers have access to equipment for video-recording many aspects of classroom teaching. A small project that utilised this technology, but did not clearly enable teaching approaches to be discerned, was briefly discussed. Prior to investigating constructionism in school classrooms it was decided to explore aspects of learning constructionistly with a group of pre-service teachers. Interviews and discussion with these participants showed that their IT for learning experiences were wholly instructionist in nature.

Research reviewed for this paper suggested that beginning teachers come with knowledge and skills in technology that do not translate easily into classroom practice, and also that much school IT use is teacher-centred and instructionist

in style. These fit with the key question asked by Haydn (2014, 467), "To what extent can student teachers demonstrate that they are able to make use of the potential of new technologies to improve teaching and learning?"
The two examples presented suggest there is much to be investigated and analysed. In the future it is hoped to conduct research using the ICCR facilities in order to more thoroughly investigate the place of constructionist approaches to teaching with IT in school classrooms.

References

Abelson, H., & diSessa, A. (1980). *Turtle geometry: The computer as a medium for exploring geometry*. Cambridge, MA: MIT Press.

Ackermann, E. (2010). Constructivism(s): Shared roots, crossed paths, multiple legacies. *Proceedings of the Constructionism 2010 Conference*, Paris.

Cope, B., & Kalantzis, M. (Eds.). (2000). *Multiliteracies: Literacy learning and the design of social futures.* London: Routledge.

De Bortoli, L., Buckley, S., Underwood, C., O'Grady, E., & Gebhardt, E. (2014). *International Computer and Information Literacy Study 2013: Australian students' readiness for study, work and life in the digital age*. Camberwell: ACER.

diSessa, A., & Cobb, P. (2004). Ontological innovation and the role of theory in design experiments. *Journal of the Learning Sciences*, *13*(1), 77-103.

Feurzeig, W. (2007). Toward a culture of creativity: A personal perspective on Logo's early years, legacy, and ongoing potential. *Proceedings of the Constructionism 2007 Conference*, Bratislava. Retrieved from http://www.eurologo2007.org/proceedings/KP-Feurzeig.pdf

Feurzeig, W. (2010). Demystifying constructionism. *Proceedings of the Constructionism 2010 Conference*, Paris.

Gobbo, C, & Girardi, G. (2002). Teachers' beliefs and the integration of ICT in Italian schools. *Journal of Information Technology for Teacher Education*, *10*(1-2), 63-87.

Harel, I., & Papert, S. (Eds.). (1993). *Constructionism* (2nd ed.) Norwood, NJ: Ablex Publishing Corp.

Harvey, B. (1985). *Computer science Logo style*. Cambridge, MA: MIT Press.

Haydn, T. (2014). How do you get pre-service teachers to become 'good at ICT' in their subject teaching? The views of expert practitioners. *Technology, Pedagogy and Education*, 24(4), 455-469.

Jewitt, C., Bezemer, J., Jones, K., & Kress, G. (2009). Changing English? The impact of technology and policy on a school subject in the 21st century. *English Teaching: Practice and Critique*, *8*(3), 8-20.

John, P., & Sutherland, R. (2004). Teaching and learning with ICT: New technology, new pedagogy? *Education, Communication & Information*, *4*(1), 101-107.

McKenzie, P., Rowley, G., Weldon, P., & Murphy, M. (2011). *Staff in Australia's schools 2010: Main report on the survey*. Camberwell: ACER. Retrieved from http://research.acer.edu.au/tll_misc/14

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017-1054.

New London Group (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review*, *66*(1), 60-92.

Papert, S. (1980). *Mindstorms: Children, computers and powerful ideas*. New York: Basic Books.

Polly, D., & Brantley-Dias, L. (2009). TPACK: Where do we go now? *TechTrend*, *53*(9), 46-47.

Resnick, M. (1996). Distributed constructionism. *Proceedings of the International Conference of the Learning Sciences*, Northwestern University.

Romeike, R. (2008). A creative introduction to programming with Scratch. In M. Kendall & B. Samways (Eds.), *Learning to live in the knowledge society* (pp.341-344). New York: Springer.

Shulman, L. (1987). Knowledge and teaching: foundations of the new reform. *Harvard Educational Review, 57*(1), 1-23.

Tamim, R., Bernard, R., Borokovski, E., Abrami, P., & Schmid, R. (2011). What forty years of research says about the impact of technology on learning: A second-order meta-analysis and validation study. *Review of Educational Research*, *81*(1), 4-28.

Venezky, R., & Davis, C. (2002). *Quo vademus? The transformation of schooling in a networked world*. OECD/CERI. Version 8c.

Webb, M. (2002). Pedagogical reasoning: Issues for the teaching and learning of ICT in secondary schools. *Education and Information Technologies*, *7*(3), 237-255.

Windschitl, M. (2002). Framing constructivism in practice as the negotiation of dilemmas: An analysis of the conceptual, pedagogical, cultural, and political challenges facing teachers. *Review of Educational Research*, *72*(2), 1312-175.

Author Details

Anthony Jones
a.jones@unimelb.edu.au

Back to Contents page

RETHINKING EVALUATION'S PRACTICE IN ACADEMIC TRAINING TO MEET DAY-TO-DAY CHALLENGES: BRIDGING THE GAP BETWEEN EXPECTATIONS AND REALITY

Lamia Badra-Belaziz
ELICO EA 4147
University of Clermont 2
France

Abstract

Evaluating a training offer has been seen as an evidenced practice in higher education for a long time in France. Its objective has been mainly the same: meeting both students' demands and market demand. But this objective has been hardly achieved because solutions and recommendations for implementation often come late and prove inadequate for the changing needs. A qualitative study conducted for ten years shows that the evaluation grids and methods had been routinely applied without carrying out a flexible, standardizing and adaptable evaluation process. The results of this study will be presented and discussed in this paper.

Introduction

It is quite frequent that I build evaluation grids and implement methods without any preliminary attention to the term, as if its meaning was obvious. It is the case of the evaluation principles and practices that have been seen as evidence in higher education for a long time in France (Jeanne, 1988).

However, it seems simplistic in the current French context of higher education especially where teachers are meeting hard time. I can quote mainly here, the deficit position of some universities or the melting pot policy adopted by other universities to resolve this problematic situation. These challenges require rethinking about evaluation practices to: (a) determine whether the training is what it is expected to be, (b) see how goals and objectives are effectively accomplished over time, and (c) identify the strength and weakness of this training offer.

These are some appealing topics that concern many teachers in higher education today that I will study in this paper. How well is training in higher education performing? And what makes training effective according to market demand?

I address these questions in this paper basing on the case of the Book Trade Information and Communications Department in the University of Clermont2. The purpose of the paper is twofold: identifying the principal evaluation processes and criteria to establish according to the state of the art and studying the degree of these processes are used in the context of training in higher education.

The paper is divided into three parts. Part I deals with the main characteristics of an evaluation process that could fit with the French context of higher education. Then, it analyzes the expertise and practices pursued for evaluation, describing the institutional evaluation actors involved in this practice and determining their target values and their used methods. Part II deals with the impact of this process on teachers who follow it and complete the required data. Based on the results of a survey described in this part, I carried out a diagnostic in Part III that could support the university to deal with the challenges of the 21st century.

What are Training's Core Values in an Ever-Changing World?

Several theories and disciplines call into question the definition of evaluation and accord to this concept a central place in the performance improvement process, each one according to its angle of approach. Also, the literature reveals that evaluation is part of another concept rich in sense - that is value. In the following section, I will determine the possible values that academic training could have. I do not intend being exhaustive nor presenting these approaches in detail, but I intend to present significant examples to fully illustrate the complexities and the intricacies of the evaluation exercise.

First of All, Let’s Talk About Values!

Etymologically, the concept of *value* whose use dates back to 1080 is defined as the quality attributed to a particular object. Thus, a valuable object is appreciated by its scarcity and its utilitarian dimension (Rey-Debove, Rey, & Robert, 2013, p. 35).

Through the evolution of philosophical reflections on this concept (from Plato to Heidegger going through Kant), I see that individuals are not dissociable from their universe and can only make plausible judgments. Also, philosophers considered that facts give meaning to values, which are naturally normative and common.

The semiotic approach contests metaphysical thought by questioning the power of individual’s intuition and the ability of knowing the absolute alone. This approach shows the plurality of meanings of the same sign and notes that the words are in themselves neither true nor false because their meaning depends on the contexts to which they refer.

I base our thoughts here on the work of Eco that consolidated the assumptions of CS Peirce (as cited in Everaert-Desmedt, 1990), who takes into account the context of signs' production and reception. In this regard, Eco and Sauvage (2010) explained that the value of an object is determined by its *volitional* and *representative content*. Thus, a sign has ultimately a sense within the context in which it forms part. Eco and Sauvage indicated that it is the role of culture that determines the meaning of signs defines its content and sets its value.

In other studies value is essential and has a specific role, but remains relative and even ephemeral. In a sociopolitical approach, for example, the value is considered as an end point to which individuals refer as it takes the form of prescriptive codes that describe the real world and direct the actions of these individuals (Bougle, 2033).

According to Sfez (1996), the relationship between governors and governed arises from a common consent on the immanence of values and a reciprocal attachment for their applications.

In public policy specifically, values represent the references that public policy should apply. These references define the cognitive dimension of leaders' actions for which citizens had voted. Then, failing to reach a conviction policy, problems may lead to the dissolving the reference's system in force. In other words, the absence of values could cause serious repercussions on citizens themselves that may evolve in an uncertain and complex environment.

From an economic perspective, values form a part of ethical principles that are shared by employees. These values that direct the decisions to take and the actions to implement are embodied in an organizational system. This system gathers all the objectives that should be reached from the long-term to the short-term (Crowther-Heyck, 2006). Then, values are not determined immutably because the meaning of an object differs from one context to another. This is due to the evolving nature of the facts that are in a perpetual motion according to Simon as cited in Fiol (1993).

Finally, the notion of value is defined and discussed in information sciences. Many researchers have argued that it reflects the challenges of information society (Hassan, 2008). Since the revolution in information technologies, other researchers have examined information systems and proposed different methods and recommendations to evaluate these systems. Some researchers talk about information practices to substitute the way the set of sources, tools and cognitive skills work. These latter are effectively mobilized in the process of production, research and treatment of information (Chaudiron & Ihadjadene, 2010). In addition, Halavais (2009) showed how to use search engines and analysed the social and cultural values that might have an influence on the access to information literacy.

This state of the art shows us that value systems are complex constructions that would vary across space and time (Brisson & Meyrestein, 1995). So, one could not assign them a metaphysical or final foundation. However, the analysis of Boudon (2007) leads to the conclusion that the founding values are possible if the judgments assigned to an object or a fact are based on a deep knowledge of the context and an agreement with the group to which individuals belongs.

Accordingly, I can suppose that the evaluator cannot appreciate a training offer until he/she has properly determined the sense of this practice, that is to say, the values of training. I presume also that it has no meaning to evaluate an academic training offer without having a common agreement about the objective of this practice. So how is evaluation effectively carried out in France?

A Short Account of the French Higher Education System

For a long time, the French higher education system was heavily centralized as most of French universities have been funded by the state budget. These universities are mainly public institutions and the state controls almost all the activities such as the duration of studies, the titles of awards, the appointment of teaching and the administrative staff (Comité national d'évaluation, 2004). Besides, these universities work closely with the Ministry of Higher Education and Research.

Other French prestigious colleges called the *Grandes Ecoles*, have their own governance structure and depend on other ministries (Agriculture, Culture, Defense, Equipment, Industry, Justice, Health, Prime Minister)

In addition, there are two main offers that characterized the French higher education system: (a) traditional academic studies that offer a full range of academic qualifications up to, and including doctoral studies, and (b) professionally oriented programs that provide long- or short-term training. I can quote here, the Instituts Universitaires de Technologie that offer a two-year short cycle higher education program leading to the award of a *diplôme universitaire de technologie*, called DUT.

Also, students can enroll as full-time or part-time students in French universities. Depending on their situation and knowledge, they can follow either initial research training (specifically intended for young people) or lifelong learning and career training. The latter offer includes unemployed, officials and temporary staff in active employment and retired officials with different career profiles.

Recently, the Universities Freedom and Responsibility Act passed in August 2007 has provided essentially new governance and greater financial autonomy to universities (Aghion & Cohen, 2004). So these institutions have full responsibility for managing their personnel and their buildings and get funding through a block grant. Meanwhile, the state continues to control the activities and the results and outcomes of universities in France.

The Academic Training's Core Values in France

The goals of French universities are multiple[1]: (a) carrying out research, (b) producing knowledge, (c) training the elite, (d) supporting research of quality, and (e) replying to a real need in training and recruitment policies (Schwart & France, 1987; Fautrat & Toulgoat, 2003).

These goals represent the main values of universities in France. Thus, training evaluation should be closely linked to these values. However some economists such as Aghion and Cohen (2004) believe that the role of the university is to support economic growth. They propose to stop the assumed separation between research and education, and to give universities the means to support innovation. This position was more or less assumed by the governments of the last twenty years.

Conversely, student or teacher unions defend a vision of the [2]university as a place of knowledge open to all, a place where knowledge should remain open and democratic. They must become harbingers of the new paradigm of knowledge and citizenship. In addition, universities are mainly public institutions in France that have a set of public values[4] which are the direct use of public benefits, created by the government, the impartiality and equity of the production and distribution of service, and the guarantee of citizens' satisfaction.

Above all this value gives new meaning to work, which is defined by the results it produces. As Chênerie said: "Higher education is becoming more and more expensive, and the Government is continually solicited to increase its endowment, hence its legitimate demands to know what is going on in universities and what is the quality service" (2005, p.12).

These experts who really have a focus on this question consider values as a means to promote the participation of academics to achieve the same objective: improving education and research. From this point of view, evaluation will be built around common values shared by all in universities and should not be regarded in isolation. More generally, the implementation of such a system is designed to foster the exchange, to enable an agreement on improvement areas and, ultimately, to facilitate professional development.

The Institutional Evaluation Process: A General Overview

Before describing the organisation of the evaluation process carried in France, I shall note the growing interest of the French government over time about evaluation. This interest was reinforced since its practice became compulsory in universities in 2007. The French government intended reforming the management structure of universities by granting them more autonomy and a new budgeting system[3].

First, it has implemented changes in the university system to bring it up to the highest international level. Second, it has driven a real political assessment and assigned the task of drawing a neutral and unbiased expertise in evaluation instances. I will cite in the following section the main evaluation instances.

Evaluation Instances in Higher Education: History and Current State

The instionnal evaluation started with the creation of the National Evaluation Committee (CNE) in 1987. It reviewed and evaluated periodically the activities of all the universities in the areas corresponding to the mission of public higher education (initial and continuing training, scientific and technological research and the development of its results, dissemination of culture, international cooperation and scientific and technical information dissemination[4])

The CNE' analyses cover all actions and means used by institutions within their scientific and educational policy. These analyses are registered in public reports and presented by institution and by theme.

This Committee's activities are published in an annual report addressed to the President of the Republic. Also, it rises every four years a summary report on the state of the higher education submitted to the president. Then the aim of the CNE is to ensure that the scientific and pedagogic polities carried by universities respect the shared vision of public value as defined and cope with the evolution of needs and expectations.

As a member of the European Association for Quality Assurance in Higher Education (ENQA), the CNE contributes to the Quality Convergence Studies (QCS) carried by the European Community and gives its expertise about evaluation.

Over the past years other evaluative organisms part of big research organizations, mainly the CNRS[5] and the INSERM[6], have emerged.
The CNRS is the National Scientific Research Council that sets up an observatory of research, development and innovation. Founded in 1939, it constitutes the largest French public scientific research organization. Legally, it is a under the administrative control of the Ministry of Higher Education and Research. Its main mission is to coordinate the activities of laboratories in order to get higher performance in scientific research. Both institutions aim to evaluate the quality of research and the production of researchers.

The INSERM is the Frensh National Institute for Medical Research created in 1964 that is under the dual auspices of the Ministry of Health and the Ministry of Research. It is recognized by its advancements in biology and biomedical research.

Another organism called C.N.U.[7] evaluates the new candidates appreciating their research activities in order to establish national qualification lists for access to the status of teacher-researchers.

Methods and Tools
According to the CNE, the evaluation process is both quantitative and qualitative and is based on the constant communication betIen evaluator and evaluated. Its aim is to evaluate the pedagogic quality and verify the consistency of courses compared to their objectives. Checking the internal consistency betIen type of training is recommended too.

The CNE offers internal and external evaluations and covers three complementary aspects: the training policy, the scientific policy and the management of the university. It recommanded the following evaluation criteria: (a) the readiness of the course, (b) the rate of success, (c) the professional integration rate, (d) the clarity and relevance of courses, (e) The interest focused on students, and (f) the quality of methodological assistance.

Surely, several interesting initiatives have followed over the last fifteen years to establish the evaluation process at universities, but these are worthy of improvement (Chênerie, 2005). Since the implementation of the law on the autonomy of universities, some fifteen faculties in France faced severe financial difficulties and have massively reduced their means. Indeed, the

crisis of 2009[3] revealed some problems and bad results observed in French universities. IAmong them are: (a) the low success rate of undergraduate students, (b) the difficulty of graduates to find jobs, (c) the disconnection betIen universities and research organizations, (d) the competition between universities and business schools, and (e) the frequent paralysis of universities' management.
Many reports, such as HCEE's report published in 2002, indicate paths for reflection and action on the evaluation of performances of universities for training to achieve the assigned objectives. But how do teachers perceive the evaluation system?

How is the Actual Evaluation System Perceived?

Despite the growing attention to institutional evaluation, information dealing with teachers' opinions about this system is very scarce. How do they really perceive the system?

I chose to have a focus on this topic because I believe that it is a strategic one: First, teachers participate in the evaluation process, as they complete the grids and provide all the required data for measurement. Second, they are directly concerned by evaluation while being more and more evaluated in their training and research. So, they are in constant contact with institutional and political actors who are interested in the university evaluation. Besides they know the objectives of this process and try to apply the required methods. What does evaluation mean to them? How do they behave with the evaluation process? And do their opinions and practices converge with institutional recommendations and objectives?

Methodology and Protocol of the Research

At the beginning, I addressed three main issues: How is the institutional evaluation system really perceived? How much did training improve through the results of the evaluation in response to the needs of private and public companies in Clermont-Ferrand? How did rethinking evaluation practice make it more effective?

In order to find elements of responses to these questions, I conducted an exploratory study that consisted of interviews with teachers' managers whose role was crucial; they had to gather the data and send the results of their evaluation to the CNE. I wanted to see their real practices and knowledge about evaluation. I also implemented a quantitative study that took the form of questionnaires filled out by teachers and employers of the graduates of the Department of Book Trade Information and Communications. Our purpose here was to see the reality on the ground since the implementation of the institutional evaluation system. I sought to understand what those interviewees thought about the quality of the training offer.

I preceded in this case study by steps:

1. Details are collected on the number of participants and their degree of involvement in the evaluation project.

2. Observations from participants are solicited at each special focus group in which I participated.
3. Feedback was obtained by conducting several rounds of telephone or in-person interviews.

Participants and Process

The study was conducted from September 2004 to February 2015. At the end of each year during this period, 100 persons completed and returned the questionnaire: 50 employers and 50 teachers that gave courses in the department.

The interviews and observation notes were conducted within the department at the place of work of interviewers. I carried out a total of 50 interviews lasting an average of two hours. 40 Teachers and 10 teachers' managers were interviewed. These persons were chosen because they were involved in the evaluation process when they were responsible for doing it. First I transcribed all interviews in Word format and then classified the information by themes. Data coding was done via the qualitative data analysis software NVivo 9. Throughout, I acted as Reeves-Sandy (1979) recommended: "Participant observation demands complete commitment to the task of understanding. The ethnographer becomes part of the situation studied in order to feel what it is like for people in that situation" (p.537).

As I am part of the teaching team, daily immersion into the department facilitated the initial contact with the respondents and the identification of what make sense and determines the practices and representations of our selected sample. Meanwhile, publishing the interviews that I have conducted was problematic because confidentiality was indispensable for information collection. Thus I will only mention in this paper the items collected without identifying authors.

The Main Findings

Evaluation Meanings

According to our survey results, evaluation remains prominent. All the teachers' managers ensure that they are accountable and have to demonstrate the validity of their results in terms of services' quality and management. It is also seen as a set of measurement tools and methods to implement in order to establish comprehensive self-assessment of their training.

In addition, participants attached great importance to the performance evaluation. But mastering performance levels remains problematic for many. They admit that their evaluation approach is empirical rather than scientific. In addition, the evaluation methods used are quantitative rather than qualitative. The frequency of evaluation is constant and annual for the teachers' managers (90%). To their mind, this criterion addresses the issue of student satisfaction and the quality of training and coaching.

Besides, their evaluation approach is based in most cases on previous professional experience, and it is hardly standardized. Their common practice is to write statistical balance sheets and activity reports to justify the validity of the expenditure management and reporting on the impact of the training on offer to enrolled students.

According to them, the challenges and the major problems encountered in the evaluation are various. First, they lack information and training for the evaluation and management concepts. They admited that they often had trouble completing the self-evaluation records sent by the evaluation's institutions. Then they need support tools that facilitate the task and encourage them to evaluate more frequently.

According to the results of the investigation, the practice of evaluation is mostly unsatisfactory (87.9%). Only 12.1% are satisfied with their practice. Some respondents mentioned the need to develop information and decision support that provide a standard range of performance indicators and generate upon request charts and graphs. The requested features are the collection and data processing and the presentation and publishing of results.

On the other hand, I observed that the practice of evaluation focuses on effectiveness. Most of teachers' managers carried out a complete examination of this performance criterion. They selected three main indicators: the success rate, professional insertion and satisfaction rate of enrolled students. They said that they did not look at the other criteria because they had been not asked to do so.

In addition, they did not have information allowing them to evaluate the cost-effectiveness. They explained that they have neither the legitimacy nor the means nor else the time to do it. They also preferred to concentrate their attention to the quality criterion that represents to them the main value at which they are all attached.

Furthermore, they recognized the importance of reflection on relevance and impact of their training offer as they closely follow the political orientations and participate in decisions taken about it. But they placed these criteria in second place, as they did not have enough time. Most of those surveyed highlighted the difficulty in evaluating medium and long terms actions. They spend much of their time to solve everyday problems and therefore lack hindsight to conduct a thorough analysis of the evolution of student profiles' and labor market needs. According to them, the university must recruit competent persons to carry out a great monitoring work that would study the societal, political and economic aspects. They believe that their help will be really valuable.

Finally teachers are wondering about the meaning of their job. They see that the search for performance is a priority today. They require a revaluation of their scientific and technical skills and better recognition about the effort it provides in evaluation practices

Evaluation Practices

The overall evaluation organization in the department is split according to the three sectors of the course put forth by the department: Tourism, performing arts and book trade. According to the teachers' managers interviewed, the department does not have a unit dedicated to evaluation. The work of collecting and processing data is distributed between them. Each one is free to choose the method and data collection and processing but must follows these criteria: objectivity in the treatment of the results, completeness and newness of data collected.

They said that they behaved differently. The methods used to check the opinion of students on training Are different. Some teachers's managers sent anonymous questionnaires to their students and discussed them with students' delegates to gain more precision about unsatisfied points. Others directly chose the second option. But, all of them applied the same process as they interacted with teachers to get their views on the running of their courses and the difficulties encountered and /or observed in students during each semester. Besides, the most used sources of information are informal. These are mainly feedback from students and stakeholders.

This situation represented a weakness to 90%. They believed that applying benchmarking in this field leads to a better position itself and judged its performance as an expectation of the supervisory authorities. HoIver, the disparities in work habits and in human and material resources prevented them from doing so. The remaining 10% considered this step useless.

Meanwhile, most teachers' managers considered that the practice of evaluation was not inserted fully into the context of a formal planning system in which objectives and timelines are predetermined. They admited that their evaluation practice was done every time the guardianship required results and that they are less motivated to evaluate themselves. This requires a lot of time. Moreover, they admited that the evaluation is a difficult practice to be folloId even if they recognize its importance. Furthermore, they considered it a secondary and extra work that obliged them to suspend for a while their main pedagogical activities.

Despite these limitations and difficulties, they think that their current practice led to a prospective reflection on the evolution of their training offer

About the Training Offer

The following highlights survey respondents' recommendations about ways to improve the training in the Book Trade Information and Communications Department.

Nearly half of teachers (65%) and employers (63%) declared their satisfaction with the training offer and students' skills. Both recommended reinforcing the time allocation for general subjects and improving the knowledge of students in communication skills so that they might know how to market themselves. Participating teachers and employers also acknowledged the lack of academic supervision, but differed in their evaluation. In fact, most employers evoked mainly the limited knowledge of students about the current and coming challenges of the profession and problems in mastering methods and professional techniques, while the teachers I surveyed contended that the training did not inculcate the students enough with a sense of initiative. They believed that the volume of courses devoted to new technologies and methodology are insufficient. This is also true for the number of internships. Yet, they felt the urge to listen and interact more with employers to identify their needs and adapt their offer.

Regarding the outlook for training, the opinions of employers and teachers diverge too. Employees want a better integration of versatility and multidisciplinary in teaching. For teachers, it is essential to improve the scientific and academic research so that it would be better recognized and therefore accelerated

Of the employees, 65% did not know enough the university objectives but they are attentive to the training quality in which they wish get more involved. Of the teachers, 35% required further developing the culture of students self-training while the remaining 45% considered it very important to be more open to the employment market and strengthen partnerships.

Conclusion

After redefining the exact role of evaluation based on academic works that determined the concept of *value*, I understand that evaluation tends toward a relative objectivity because it is conditioned by the changing values it stands for and facts it represents. This theoretical basis had led us to question precisely about the possible values of the university in France, which I dealt with in the second part of the paper. First I studied the overall context of university evaluation and described the role of French evaluation instances that equipped universities with a favorable framework to follow their policies and improve their training. Then I saw how teachers' managers behave within this framework and what teachers and employers thought about the evolution of the training offer.

Our Diagnosis

While carrying the case study, I learned a great deal about the reality of evaluation practice in universities, and I identified some shortcomings related to this practice. I observed that its use and periodicity stay the same and that this can be summed up in a single sentence: Complete pre-filled forms when national authorities in charge of evaluation and control are asking for them.

Without questioning this fact, I think that It is useful to make an additional effort to demystify the concept to persuade teachers about its benefits. Indeed, I saw that training managers are conscious of the limits of their evaluation practice because of the overwork incumbent upon them and the lack of information about the evaluation system. Thus, their motivation regarding this system was not favorable.

I believe that this fact is due to the difficulty of defining evaluation as a concept, a tool and a product. Indeed, teaching staff need better knowledge about the goals and the potential procedures of evaluation for two main reasons: first, teachers should appropriate the evaluation system to better defend their policy and negotiate new projects, and second, they should modernize the management of their pedagogic activities to ensure making the right decision. As they did with students, teachers should regularly follow the evolution of the university environment that it is shaken by a widespread economic crisis and deep socio-political changes.

Consequently, I believe that teachers should be formed to practice a *normalized* evaluation process, based on performance indicators, that follows their activities, taking into account the evolution of their environment. They should be sensitive to the benefits of this practice that enables them to identify the Strength, weaknesses, Opportunities and Threats (SWOT) at the right time. In other words, the SWOT analysis enables them to respond to the question: How Ill are I doing?

In addition, teachers should master the performance indicators to:

1. Measure the effectiveness of their services.
2. Measure the efficiency in terms of resource utilisation within the organisation.
3. Recognize in the mid-term the degree of relevance of their actions to the general mission and policy of the university.
4. Know how to measure the outcome of their actions on society.

Moreover, I believe that teachers should consider evaluation as a new scientific know-how to acquire as important as teaching. So it may be more appropriate to include this topic in initial teacher preparation programmes and propose for those who are in practice adequate support for appropriate evaluation principles and tools.

In addition, decision making in universities today, requires the participation of companies. I saw in the case study that employers do not have the same interests or the same opinion on the training and the labor market. The university should associate with them further and not only contact them when they are asked to account for their decisions and actions. This fruitful cooperation leads to ansIrs to these questions: What are the core competencies required in the field at mid- and long- terms? What is the relevant offer to choose?

In sum, implementing structural changes and breaking entrenched patterns will not be easy because there may be resistance from people who are reluctant to change the ways in which they work in order to make more transparent their actions.

If we are to be constructive, we must set up a dialogue with not only all those involved in the project of the evaluation system, but also with those concerned with the training offer's quality. In that regard, instilling a culture of evaluation will entail changing modes of thought, attitudes and action of all the actors.

Furthermore successful collaboration comes from taking time and energy to understand others and be understood. The support of authorities is crucial here so that teachers may embrace change, respond, and adjust their offers to a rapidly changing world while maintaining and refining their values.

Selected Online Resources

1. https://www.u-picardie.fr/labo/curapp/revues/root/28/nemitz.pdf
2. http://sciencescitoyennes.org/
3. http://www.20minutes.fr/france/173269-20070801-loi-autonomie-universites-definitivement-adoptee
4. https://www.cne-evaluation.fr/fr/progra/som_guid.htm
5. http://www.cnrs.fr/comitenational/evaluation/eval_acc.htm
6. https://www.eva2.inserm.fr/EVA/jsp/Glossaire/index.jsp
7. http://www.cpcnu.fr/

References

Aghion, P., & Cohen, L. (2004). Éducation et croissance. Paris, France: la Documentation française, 2004.

Blaser, K. (2006). *Herbert A. Simon: The Bounds of Reason in Modern America* by Hunter Crowther-Heyck. *International Social Science Review*, *81*(1/2), 78-79.

Boudon, R. (2007). *Le sens des valeurs*. Paris, France: Presses universitaires de France.

Bougle, C. (2003). *Leçons de sociologie sur l'évolution des valeurs*. Chicoutimi: J.-M. Tremblay. Retrieved from http://www.uqac.ca/zone30/Classiques_des_sciences_sociales/classiques/bougle_celestin/lecons_socio_valeurs/lecons_socio.html

Brisson, L., & Meyerstein, F. W. (1995). *Puissance et limites de la raison: Le problème des valeurs*. Paris, France: les Belles lettres.

Chaudiron, S., & Ihadjadene, M. (2010). De la recherche d'information aux pratiques informationnelles. *Étude de Communications*, 13-29.

Chênerie, I. (2005). Petite histoire de l'évaluation dans les universities. Retrieved from https://sup.ups-tlse.fr/documentation/docs/fich_101.pdf

Comité national d'évaluation. (2004). De Berlin à Bergen nouveaux enjeux de l'évaluation. Dijon, 10-11 juin 2004. Retrieved from https://www.cne-evaluation.fr/WCNE_pdf/Colloquecne.pdf

Crozier, M. (1990). *L'évaluation des performances pédagogiques des établissements universitaires*. Paris, France: la Documentation française.

Eco, U., & Sauvage, H. (2010). *De l'arbre au labyrinthe: [études historiques sur le signe et l'interprétation] essais*. Paris, France: B. Grasset.

Everaert-Desmedt, N. (1990). *Le processus interprétatif: introduction à la sémiotique de Ch. S. Peirce*. Liege, France: Editions Mardaga.

Fautrat, S., & Toulgoat, C. (2003). *L'évaluation des enseignements: Manuel d'aide à l'évaluation d'un enseignement*. Champs-sur-Marne: Université de Marne-la-Vallée.
Fiol, M., & Solé, A. (1993). La question du management selon H.A. Simon. *Revue Française de Gestion*, June, August, 67-80.
Halavais, A. M. C. (2009). *Search engine society*. Cambridge, UK: Polity.
Hassan, R. (2008). *The information society: Cyber dreams and digital nightmares*. Cambridge, UK: Polity.
Jeanne, L.-R. (1988). Comité national d'évaluation. Où va l'université ? Rapport du Comité National d'Evaluation. *Revue Française de Pédagogie*, *84*(1), 85-88.
Rey-Debove, J., Rey, A., & Robert, P. (2013). *Le petit Robert: Dictionnaire alphabétique et analogique de la langue française.* Paris: Le Robert.
Schwartz, L., & France, C. (1987). Comité national d'évaluation des établissements publics à caractère scientifique, culturel et professionnel. (1987). *Où va l'Université ? rapport*. Paris, France: Gallimard.
Reeves-Sandy, P. (1979). The ethnographic paradigm(s), *Administrative Science Quarterly*, *24*, 527-538.
Sfez, L. (1996). *La symbolique politique*. Paris: PUF.

Author Details

Lamia Badra-Belaziz
Lamia.badra@univ-bpclermont.fr

Back to Contents page

INNOVATIVE ASSESSMENT AND PERSONALISED FEEDBACK IN HIGHER EDUCATION

Jill Barber and Steven Ellis
University of Manchester
United Kingdom

Abstract

Since adopting summative on-line examinations in 2005, we have increased the range of question types to include short essays and questions incorporating chemical structures and now achieve time savings of up to 90% in the marking process. Online assessments allow two novel forms of feedback: (a) an anonymised spreadsheet containing all the marked exam scripts is made available to all students and (b) *Smallvoic*e, a novel app, provides confidential personalised feedback. Feedback statements, though written by the instructor, are selected by a computer in response to various aspects of a student's performance. There is evidence of improved student satisfaction and improved learning.

Introduction

Decades after the introduction of online assessment, it is still practised by a small minority of higher education institutions (Bull & McKenna, 2004). Nobody doubts that online assessment is possible –we all take part in surveys powered by such apps as Survey Monkey - but there is widespread doubt that it is secure, flexible or reliable.

An online assessment must of necessity be mounted on a server ahead of the examination period; this means that it can, in principle, be hacked. There is a body of literature devoted to the security of online assessments (Apampa, Wills, & Argles, 2009). Of course, it is, in principle possible for students to break into a university safe containing paper-based examinations, but this is a familiar risk, one that we are content to live with. Even though university online security systems are generally of a very high standard (universities maintain personal and often medical data), it is much easier for academic staff to imagine their students as computer hackers than as safe breakers.

It is still widely believed that a computer based assessment is limited to multiple choice and related question types. Of course, these types of question are very valuable and can be automatically marked, but even the most rudimentary assessment software allows for free text entry, permitting short answers and even essays to be submitted and marked online. There are even interfaces that permit submission of drawings.

Reliability is, however, most academics' major concern around e-assessment. Computers are inherently unreliable. A typical 50-seat computer cluster in a university might be expected to have two or three computers out of commission for various reasons at any one time. This is a level of unreliability we would find unacceptable in our cars or washing machines. The fear is always of a computer failure mid-assessment, so that student work is lost. Some of the published literature incorporates elaborate schemes for backing up student work on paper (Aojula, Barber, Cullen, & Andrews, 2006).

Further, an online assessment produces dependence. An academic conducting a paper-based assessment maintains the impression or illusion of control. The photocopied examination papers are retrieved from a safe shortly before the examination, and physically handed out to students. Invigilation requires no very special expertise; we understand what is going on. Academics conducting online examinations become dependent upon IT staff, whose expertise is usually quite alien. Attempts to guide academics through the process serve to reinforce dependence (Willis et al., 2009).

All these impressions of online assessment are uncomfortable, and it is all too easy to defer the transition to online assessment.

Security, Flexibility and Reliability:
The Manchester Experience 1998 – 2004

In 1997 we began a project entitled "What makes a student succeed?" (Sharif Gifford, Morris, & Barber, 2003, 2007a, 2007b), requiring the use of several assessments in the first week of the MPharm course. The results were used to assign students to foundation groups, and the assessments were therefore high stakes, though not summative. The start of this project coincided with the university's introduction of so-called CBA (computer-based assessment) software, which was a modification of the commercially available Questionmark software.

Security 1998-2004

Students sat the password-protected tests in university computer clusters. Passwords were issued immediately prior to the tests, which were invigilated and conducted under standard examination conditions (no books, paper, coats, etc., permitted). There is no evidence of any security breach at any point.

Flexibility 1998-2004

Question types were limited to automatically-marked multiple choice, text match and numerical questions. While this was adequate for the purpose of assigning students to foundation groups, it would not permit a full range of assessments in a Pharmacy programme to be conducted online.

Reliability 1998-2004

During this period, all our worst fears about computer reliability were realised. The testing proceeded smoothly only in 2002. In every other year there was a failure of some sort.

- **1998** Many students were unable to register on the university IT system, were unable to access the online tests and sat paper versions.
- **1999** Guest logins were developed to solve the previous year's problem, but the traffic on the university network was so great at the start of the semester that login was unacceptably slow.

- **2000** The CBA servers were replaced and logins were staggered; unfortunately a scheduled change in the university computer image resulted in a widespread crash, affecting half the computer cluster.
- **2001** The university suffered a major virus attack, and the tests were conducted on paper.
- **2003** While everything went well at the point of testing, there was an error in the recording of results by the software, and it proved impossible to assign the marked tests to the correct students.
- **2004** The computer cluster was housed in a 19^{th} century building in a city known for its rainfall – a flood in the cluster resulted in the tests again being carried out on paper.

In 2004 it was clear that the support for CBA software was inadequate for summative assessment.

Security, Flexibility and Reliability: The Manchester Experience 2005 – 2012

In 2005, we began to explore the use of WebCT (later to be superseded by Blackboard 8 and Blackboard 9) for summative assessment. This was prompted by an increase in student numbers in a first year Cell Biology and Biochemistry class to over 200. The teaching time on the unit was 48 hours, but the paper-based assessment was taking 60 hours to mark. The paper-based assessment was replaced by an online examination in which the questions were all automatically marked, a mixture of multiple choice text match questions. Human intervention in the marking process was now minimal, with less than one hour required.

Security 2006 – 2012

We were satisfied that students would not be able to access the assessment prior to the examination, but at the beginning of this period we were concerned that students might be able to access unauthorised websites during the assessment. Invigilators were trained to check the computer taskbars for minimised icons and to investigate any that looked suspicious. The architecture of the clusters also gave cause for concern – these had been designed for teaching and private study, with collaboration encouraged. Invigilators also had to be wary of students looking at one another's screens.

Flexibility 2006 – 2012

During this period, we gradually increased the range of question types available. Short answers and even short essays are supported by the Blackboard 9 assessment software. These can be marked either online within Blackboard or by downloading a csv file and marking in an Excel spreadsheet. Marking in a spreadsheet is undoubtedly quicker than marking online because students' answers to a particular question are arranged in a column; scrolling from one answer to the next is much quicker than closing one file and opening another.

We developed a bank of chemical structures such that the answer to a question could be a chemical structure. Then 153 structures were classified according to the heteroatoms (atoms other than C, H, N, O) they contain, the number and size of rings and functional groups. Filters allowed students to select appropriate structures quickly (see Figure 1).

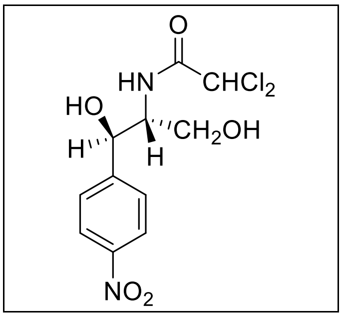


Figure 1. Chloramphenicol: the structure contains two chlorine atoms, one six-membered ring and an amide function.

Reliability 2005 – 2012

Both the university IT systems and Blackboard proved very reliable during the period up to 2012. We developed various pieces of bespoke software that allowed us, for example, to upload examination papers directly from Word, incorporating diagrams and chemical structures.

During the January 2013 examination period, several examinations were hit by a failure to save answers, affecting about 17% of students. This was tracked to a failure in the six Blackboard servers to transfer load effectively when traffic was high. The problem took several weeks to identify, at which point it was quickly corrected.

Discussion

Security of online examinations remains a concern. Nevertheless, this is a concern that universities have so far proved able to meet. As of 2013, online examinations did not provide the flexibility of question type that we ultimately require, but neither were they restricted to multiple choice questions. Reliability remains the key issue that prevents many academics embracing online assessment (Warburton, 2009). Online examinations present a new range of challenges and when something goes wrong, it is seldom the same as what went wrong in the previous year. As a consequence, academic staff lose control of the examination, and this is unnerving.

The Advantages of Online Assessment: Accuracy, Speed and Feedback

The 2013 failure resulted in a significant loss in confidence in online assessment, and a reduction in the number of examinations conducted online. It prompted a reconsideration of the advantages of online assessment, as well as the development of additional security features.

Accuracy
The advantages of online assessment have been clearly outlined by McGee Wood, Sargeant, & Jones, (2005) and latterly Briggs (2015). The first and indisputable advantage is that computers are good at adding up – they total marks awarded quickly and accurately. Although academics like to think they are good at adding up, the evidence (Aojula et al., 2006) is that they are not. Andrews (2005, personal communication) demonstrated that the error rate is typically 5% in a moderately complex assessment. It is therefore imperative that an assessment that is marked manually be totalled at least twice.

Speed (and accuracy)
Nobody disputes that computers write legibly. A second advantage of online text-based examinations is that students' handwriting is often difficult to decipher. It is much faster marking typescript, which is inherently legible. McCann (2010) has demonstrated that these obvious advantages may not be sufficient to persuade academics to invest the initial effort in mastering the logistics of e-assessment.

The real insight made by McGee Wood et al. (2005) is that computers are good at finding script. Figure 2 shows a question, answered by many students, with the answers arranged one above the other in a spreadsheet.

The half-life of celecoxib is normally around 8 hours but can increase to around 13 hours in hepatic impairment. What range of time would you expect it to take till steady state plasma levels are reached? (1 mark)	**q42/1**
40 to 65 hours.	1
5 half lives so 40-65 hours	1
24-39 hrs.	0
24 hours	0
40 hours to 65 hours	1
40-65 hours	1
As a steady state takes around 5 half lives so for this patient the steady state would be achieved at around 65 hours.	1
In a healthy patient it should take 40 hours. In a patient with hepatic impairment, it will take 65 hours.	1

Figure 2. Example of an online examination question and its marking.

When answers are arranged in this way, there is no time spent rifling through answer books trying to find the answer to a particular question. Academics who mark on a spreadsheet normally estimate time savings of a factor of between 2 and 10, depending upon the length of the typical answer (the time savings are less with longer answers where more time is spent marking and less is spent finding the answer). That most of the time saving arises from finding the script quickly is evidenced by a direct comparison. In Blackboard, it is possible to download the students' answers as a csv file, but it is also possible to mark directly onto an online document resembling an examination script. The former is much faster, perhaps by a factor of 2.

Less immediately obvious is the fact that the same spreadsheet format permits improvements in accuracy of marking. After marking a question, it is easy to sort the spreadsheet by mark and to confirm that answers achieving the same mark are comparable. This can almost never be achieved in a paper-based examination.

Feedback

Marking on a spreadsheet leads to such confidence in consistency of marking that complete transparency is possible. Beginning in 2008, after securing the permission of the students, we stripped all identifiers from the marked examination spreadsheet and made it available to all the students who had sat the examination; essentially students saw Figure 2, but extended for all questions. Thus students could not only see where they gained or lost marks, but could see a range of very good answers for each question.

Students are often unconvinced that time savings for staff (even the massive savings afforded by online assessment) are of any benefit to them. They do not accept that time saved marking will be fed into teaching. They do, however, appreciate the feedback, and focus groups return to this point frequently.

More Feedback – The Smallvoice App

It is quite common for a student to approach an academic following an assessment and to say, “Where did I go wrong?” Armed with an online assessment, the academic may scan the row corresponding to the particular student’s assessment and offer some analysis.

Typical comments include:

- You haven’t answered all the questions.
- You haven’t revised a particular topic
- Your English is poor

Very often, even usually, such analysis could just as well be given by a well-programmed computer, as in the examples above. We therefore developed Smallvoice.

Smallvoice provides rapid, automated, completely personal feedback on performance to students in large classes. It analyses many different aspects of a student’s performance and synthesises accurate, confidential advice. Smallvoice is a freestanding tool, able to integrate with commonly-used data systems around the world.

Smallvoice analyses an examination paper (either a computer-based examination paper or a transcript of marks from a paper-based examination) in the same way as an instructor might analyse a paper following an examination. It reports on a student’s performance in different topics (for example different diseases), different question types (e.g., factual recall, multiple choice, critical argument). In addition it analyses performance in ways that are much easier for a computer program than for an instructor. It incorporates a powerful algorithm for discrimination values, so is able to comment on whether a student fared batter in the easier or more difficult questions relative to the rest of the class. It correlates performance in summative assessment with attendance and with performance in past formative and summative assessments. Students receive a detailed email showing where they are in the class, trends in their performance, and incorporating links to sophisticated statistics about individual questions. The feedback is made up of text inputted by the instructors and is therefore personal in tone; it is at its most powerful when used to congratulate good students, to encourage average and weaker students and to give advice about preparation for future learning.

Smallvoice hugely increases student satisfaction. We have received numerous emails of appreciation from students, and a Feedback score of 4.69 /5 in the university's course evaluation questionnaire in the pilot course unit. We have also seen average marks rise 10-20% between successive examinations following feedback. Smallvoice lends itself to feedback that advises students about improving performance, which (like the personal tone) is a hallmark of current perceptions of good feedback (Price, Handley, Millar, & O'Donovan, 2010; Boud & Malloy 2013).

Sample Output

This is an example of part of the feedback used to support the end of semester one examinations for fourth year students. Smallvoice can also be used to give very fine-grained feedback (for example a discussion of individual questions in a single course assessment.

Dear [Forename],
Here is some feedback following your semester one exams. Your weighted mean for semester 1 was 65.4% and the mean for the cohort was 67.2%. Your position in the group was therefore 98=. This was a good solid 2.1 performance in semester one. Well done! Your semester 1 mark is significantly higher than your year 3 mark so very well done!

The second year contributes 10% to your final degree classification and the third year contributes 20%. In the fourth year so far you have completed 50 credits out of 120, that's another 29.2% of your degree. 40.8% remains.

Table 1 shows you the average mark you need in semester 2 to get each class of degree.

Table 1
Averages required for the rest of your degree

to get a first you need	to get a 2.1 you need	to get a 2.2 you need	to get a third you need
80.1%	55.7%	31.2%	6.7%

Do remember though, that the average is not quite the whole story. You have to pass all the modules!

Table 2 shows a summary of your module marks compared with the class averages. Your mark in Law was especially commendable.

Table 2:
Summary of your module marks

Module	Law	Dispen sing	Social Pharmacy	Micro-biology	Neuro-pharmacol
Your Mark	80.9	79.2	63	68	58
Your Position	47=	112=	128=	64=	20
Number in class	170	170	170	152	29
Class mean mark	75.2	81.5	69.9	64.8	61.0

You're progressing very well. Good luck with the rest of the semester.
Best wishes
Jill and Steve

The Future of Online Assessment

Given the advantages of online assessment to both academic staff and students, progress in delivering secure, flexible, easily-managed and (above all) reliable assessment has been disappointing. The delivery of online assessment requires an enormous amount of care, and the support of local in-house IT experts.

Examination infrastructure
To ensure security during examinations, the University of Manchester has developed computer clusters specifically for examinations. Computers are widely spaced and screens cannot easily be seen by a student's neighbours. A specific *examination desktop* is loaded onto the cluster machines prior to the examination period and websites outside Blackboard cannot be viewed.

This feature has led to the development of a novel online open-book examination format, in which students are able to access specific materials contained within the same Blackboard folder as the examination.

The conduct of online examinations is now coordinated by a specific member of the Examinations Office. Protocols for paper-based examinations have evolved over many decades to accommodate several examinations taking place in the same very large room. Online examinations present a new paradigm. A single examination may be housed in several different remote rooms. Ensuring consistency between rooms is a significant challenge, requiring efficient communication between several rooms (carried out via online messaging).

Load testing
The 2013 failure prompted us to develop load testing protocols to be carried out ahead of every examination period. The intention during load testing was to provide evidence that the current deployment of our virtual learning

environment was fit for purpose and that there was a relatively low risk of encountering any load related issues during the setup or running of our online exams. Several clusters of desktop machines were used in the testing with a combined provision of approximately 400 machines. A version of the Mozilla Firefox browser was modified so that it could simulate individual student activity during setup and running of an online examination. This browser was started on each machine so that the behaviour of 400 virtual students could be arranged and synchronised during the period allocated for testing.

Two tests are conducted on the Blackboard infrastructure. The first introduces gradual load (achieved by conducting a real exam on each PC) onto Blackboard up to the maximum PCs available across all the clusters used. When this capacity is reached, the exam is allowed to continue for approximately 15 minutes to test for sustained load on Blackboard. The second test starts all the exams together to simulate peak load of the system.

The virtual learning environment configuration at the University of Manchester is currently composed of 10 application servers. The advice from our hosting partners has been that this configuration is over specified for our actual use. The intention of load testing was to prove that the servers would cope without failure with the load being generated during examinations and equally important that they would comfortably do so. Whilst it is often difficult to correlate load and system utilisation, one measure that can be used is the number of queued processes within the processor of an application server. The larger the number the more likely there is to be service degradation, or service loss (either partial or full). If a sustained load of "20" was observed, an investigation was triggered. If an application server reached a value of "50," an automated procedure would take it out of the processing pool so that no additional load would be transferred to it. During both tests undertaken during our recent load testing, the maximum number of queued processes observed was "6," with a typical value being between "1 and 3."

Load testing is, we believe a necessary prelude to online examinations.

Downloads

Downloading examinations in csv format also requires specialist tools. Blackboard, for example, enables html, which is not rendered directly. In general, this is removed manually.

More inconvenient still is that students occasionally use a character, such as a hyphen, as a bullet point. Excel recognises this as a delimiter, and a student's answer may be truncated as a result of its use. The solution is to brace each answer inside | characters, which can be achieved in a number of ways, by opening the csv file initially in a program other than Excel.

Drawing tools

In Pharmacy and related subjects, online assessment will only come of age when drawing diagrams and chemical structures within the assessment are enabled.

Discussion

Online assessment has the potential to be enormously powerful, saving time, giving improved accuracy and transparency and greatly facilitating feedback. Holmes (2015) and others have also pointed to the frequent use of simpler e-assessments as a means of improving student engagement.

Despite nearly two decades of experimentation, however, it is still not for the faint-hearted. Commercial packages require sophisticated in-house support and supplementation if they are to be used reliably at high volume. Accuracy, speed and feedback are still achieved at the expense of security, flexibility and reliability.

References

Aojula, H., Barber, J., Cullen, R., & Andrews, J. (2006). Computer-based, online summative assessment in undergraduate pharmacy teaching: The Manchester experience. *Pharmacy Education, 6*, 229–236.

Apampa, K.M., Wills, G., & Argles, D. (2009) Towards security goals in summative e-assessment security. Internet technology and secured transactions. Retrieved from ieeexplre.ieee.org.

Briggs, N. (2015). *Summative online assessments outside the examination period* (Internal working paper). Manchester, UK: University of Manchester.

Boud, J., & Molloy, E. (2013). Rethinking models of feedback for learning: the challenge of design. *Assessment & Evaluation in Higher Education 38*, 698–712.

Bull, J., & McKenna, C. (2004). *Blueprint for computer-assisted assessment*. London: Routledge Farmer.

Holmes, N. (2015). Student perceptions of their learning and engagement in response to the use of a continuous e-assessment in an undergraduate module. *Assessment & Evaluation in Higher Education, 40*, 1–14.

McCann, A. (2010). Factors affecting the adoption of an e-assessment system. *Assessment & Evaluation in Higher Education 35*, 799–818.

McGee Wood, M., Sargeant, J., & Jones, C. (2005). What students really say. *Proceedings of the 9th CAA Conference.* Loughborough, UK: Loughborough University. Retrieved from http://caaconference.co.uk/pastConferences/2005.

Price, M., Handley, K., Millar, J., & O'Donovan, B. (2010). Feedback: All that effort, but what is the effect? *Assessment & Evaluation in Higher Education, 35*, 277–289.

Sharif, S., Gifford, L., Morris, G. A., & Barber, J. (2003). Can we predict student success (and reduce student failure)? *Pharmacy Education, 3*, 77-86.

Sharif, S., Gifford, L., Morris, G.A., & Barber, J. (2007a). Diagnostic testing of first year pharmacy students: A tool for targeted student support. *Pharmacy Education, 7*, 215-221.

Sharif, S., Gifford, L., Morris, G.A., & Barber, J. (2007b). An investigation of the self-evaluation skills of first year pharmacy students. *Pharmacy Education, 7*, 295-302.

Warburton, B. (2009) Quick win or slow burn: Modelling UK HE CAA uptake. *Assessment & Evaluation in Higher Education 34*, 257–272.
Willis, G. B., Bailey, C P., Davis, H. C., Gilbert, L., Howard, Y., Jeyes, S., Millard, D. E., Price, J., Sclater, N., Sherratt, R., Tulloch, I. , & Young, R. (2009). An e-learning framework for assessment (FREMA). *Assessment & Evaluation in Higher Education, 34*, 273–292.

Author Details

Jill Barber
Jill.barber@manchester.ac.uk
Steven Ellis
Steve.ellis@manchester.ac.uk

Back to Contents page

IS MATHEMATICS STILL RELEVANT AS AN ADMISSION CRITERION FOR ENTRY INTO AN INFORMATION AND COMMUNICATION TECHNOLOGY COURSE AT A SOUTH AFRICAN UNIVERSITY?

Glenda Barlow-Jones and Duan van der Westhuizen
University of Johannesburg
Auckland Park, South Africa.

Carla Coetzee
Tshwane University of Technology
Pretoria, South Africa

Abstract

It is well documented in the literature that computer programming modules in higher education institutions are characterised by low success rates. Several reasons could be attributed to this situation, from the difficulty of the subject itself to the lack of problem solving abilities of the students. This paper reports on a study conducted at a South African university to determine the extent to which students' Grade 12 mathematics results can predict the success of first-year students enrolled for a programming module in an ICT course.

Introduction

It is well documented in literature (see for example Garner, 2007; Butler & Morgan, 2007; Robins, Rountree, & Rountree, 2003; Corney, Teague, & Thomas, 2010; Ali & Shubra, 2010) that computer-programming modules at Higher Education Institutions (HEIs) are characterised by low success rates. Teaching novice programmers to programme is and always will be a challenge, and it has been stated that failure rates for first level programming courses can be as high as fifty percent (Caspersen, 2007).

The factors that influence students' success or failure in computer programming have been researched for several decades now (Wileman, Konvalina, & Stephens, 1981; Goold & Rimmer, 2000; Wilson & Shrock, 2001). It became apparent that a lack of problem-solving skills and poorly developed mathematical knowledge and skills of students who enrolled for programming courses, was a significant contributing factor in predicting success or failure in these courses. Mathematics focuses on an abstract, deductive discipline that is required in the scientific, technological and engineering world (Venkat, 2007). Bohlmann and Pretorius (2008, p. 43) claimed that "the conceptual complexity and problem-solving nature of Mathematics make extensive demands on the reasoning, interpretive and strategic skills of learners," which are needed for computer programming.

According to Feza-Piyose (2012) the majority of South African students demonstrate a poor performance in mathematics. She attributes this to the poor quality of teaching in schools as well as the lack of content knowledge of the teachers. The Centre for Development and Enterprise (CDE) recently reported that not enough teachers are being produced in South Africa, especially in the important subjects of mathematics and science. The Department of Basic Education (DBE) confirmed that South Africa had a shortage of 4,890 mathematics teachers and 4,551 science teachers nationally in 2008 (Jacobs, 2013). The teaching system is producing about a third of South Africa's requirement of about 25 000 new teachers a year ("SA needs 15,000 more teachers a year," 2011), and only a few students graduate in mathematics and science.

The challenge for the Department of Basic Education emanates from teachers' low salaries and poor working conditions which are identified as strategic areas in need of improvement in order to recruit new and retain experienced teachers in the profession (Nilsson, 2003). Currently the Department of Basic Education has a bursary scheme in place, offering a four year bursary to students studying a Bachelor's Degree in Education, specifically targeting mathematics and other scarce skills educators in order to attract students (Jacobs, 2013).

In a report published in October 2013 and commissioned by the Centre for Development and Enterprise, it is stated that South Africa "has the worst education system of all middle-income countries" and learners "perform worse than in many low-income African countries" (Spaull, 2013, p. 3). The quality of South African education is demonstrated by statistics indicating that out of 100 learners, who start school, 50 will reach Grade 12, 40 will pass, and only 12 will qualify to study at a university (Spaull, 2013).

The summarised results of the National Senior Certificate (NSC) examinations for mathematics (from 2011 to 2014) are shown in Table 1, which clearly supports the report's findings.

Table 1

Overall Achievement in Mathematics, Diagnostic Report: National Senior Certificate Examination 2014.

Year	**0 to 39.9%**	**40 to 100%**
2011	69.80%	30.20%
2012	64.30%	35.60%
2013	59.50%	40.40%
2014	65%	35%
Average over 4 years	64.65%	35.30%

Note: Adapted from *National Senior Certificate Examination 2014, Diagnostic Report*. Department of Basic Education, (Pretoria, South Africa, p 110).

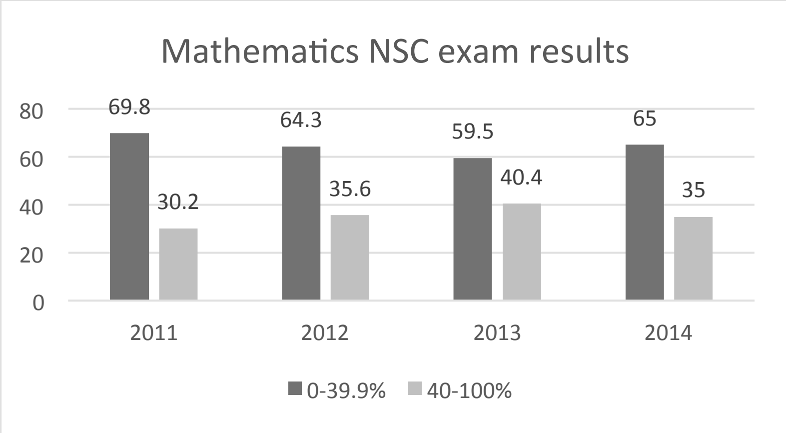


Figure 1. Overall achievement in mathematics for the years 2011-2014**.** Note: From *National Senior Certificate Examination 2014, Diagnostic Report*. Department of Basic Education, (South Africa, p 110).

Studies have shown a positive relationship between performance in mathematics and success in computer programming courses (Byrne & Lyons, 2001; Wilson & Shrock, 2001; Gomes & Mendes, 2008; Bergin & Reilly, 2005). However, Figure 1 confirms that in the last four years, in South Africa where this study was conducted, 65% of students are achieving between 0% and 39.9% for mathematics in their Grade 12 year. When Hourigan and O'Donoghue (2007) studied students enrolled for programming courses at HEIs, they identified the following areas of concern regarding their mathematical skills:

- Lack of mathematical knowledge
- Underdeveloped numeracy skills that are necessary to do basic calculations needed in their daily lives
- Low competency levels in Algebra
- An inability to apply mathematics in new contexts, different from the ones they encountered in previous exercises
- Inadequate mathematical reasoning abilities, i.e., problem solving skills

Selection criteria for an Information Technology (IT) diploma or degree is dependent on the results of the National Senior Certificate Examination (NSC), and particularly for mathematics. There is a common belief that a student who does well in high school mathematics will also do well in Computer Science (Goold & Rimmer, 2000; Spark, 2005). South African HEIs are however, questioning the validity of Grade 12 marks particularly for students who come from disadvantaged schools (Jenkings, 2004; Marnewick, 2012).

The Study

In order to determine whether the results of students who wrote the NSC mathematics is a good indicator of their academic performance in a programming module, their NSC mathematics results were compared to their final results in the first year programming modules. The sample for the study was a group of 82 randomly selected first year students at the Tshwane University of Technology (TUT), Pretoria, South Africa who were enrolled for the National Diploma: Information Technology (Course Code NDIT12).

In order to qualify for entry to the ND: IT, students must have achieved the NSC with the following scores: Mathematics level 4 (50% – 59%), English level 3 (40% - 49%) and an Admission Point Score (APS) of 18 (or more) at TUT. A student's APS into universities in South Africa is calculated as shown in Table 2

Table 2

National Senior Certificate Achievement Levels

%	100-80	79-70	69-60	59-50	49-40	39-30	29-20	19-10	9-0
NSC Level	7	6	5	4	3	2	1	1	1
Symbol	A	B	C	D	E	F	G	H	I

Note: Adapted from Schoer, Ntuli, Rankin, Sebastiao, & Hunt (2010). A blurred signal? The usefulness of National Senior Certificate (NSC) mathematics marks as predictors of academic performance at university level. *Perspectives in Education, 28*(2), 9-18.

The programming modules in the first year at TUT, *Development Software 1A* (DSO171AT) and *Development Software 1B* (DSO171BT) cover basic programming principles that are practically applied in VB.NET and expand the students' knowledge on programming principles and VB.NET. These two modules are prerequisites for all second year programming modules. The students' Grade 12 mathematics results were compared with their performance in the two programming modules using correlational statistical techniques.

Findings

A Pearson product-moment correlation coefficient was computed to assess the relationship between the students' performance in mathematics in Grade 12 and performance in Development Software 1 A.

Table 3

Correlation Between Students Grade 12 Mathematics Results and Performance in Development Software 1 A

		Development Software 1A	Grade 12 Mathematics
Development Software 1A	Pearson Correlation	1	.345**
	Sig. (2-tailed)		.002
	N	82	82
Grade 12 Mathematics	Pearson Correlation	.345**	1
	Sig. (2-tailed)	.002	
	N	82	82
**. Correlation is significant at the 0.01 level (2-tailed)			

As shown in Table 3, there was a weak positive correlation between the two variables, r = .345, n = 82, p = .002. It can therefore be concluded that there is a weak correlation between a student's NSC result for mathematics and final mark obtained for Development Software 1 A.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the students' performance in mathematics in Grade 12 and performance in Development Software 1 B.

Table 4

Correlation between Students Grade 12 Mathematics Results and Performance in Development Software 1 B

		Grade 12 Mathematics	Development Software 1B
Grade 12 Mathematics	Pearson Correlation	1	.261*
	Sig. (2-tailed)		.018
	N	82	82
Development Software 1B	Pearson Correlation	.261*	1
	Sig. (2-tailed)	.018	
	N	82	82
*. Correlation is significant at the 0.05 level (2-tailed)			

As shown in Table 4, there was a weak positive correlation between the two variables, r = .261, n = 82, p = .018. It can be concluded that there is a weak correlation between a student's NSC result for mathematics and final mark obtained for Development Software 1 B.

Conclusion

The findings indicate that in this study a South African student's NSC mathematics marks had a weak correlation with performance in the programming courses at the first year university level. This is consistent with the findings of Byrne and Lyons, (2001), Wilson and Shrock (2001), Gomes and Mendes (2008), and Bergin and Reilly (2005) who claim that performance in mathematics can predict programming performance. The TUT in conjunction with the University of Johannesburg are currently doing further research in identifying predictors for success in computer programming modules in order to gain insight into the programming needs of the students. The envisaged research findings, their implications and the conclusions will provide an opportunity to identify a better selection process for programming students and develop supporting learning activities that will assist students in becoming successful in their programming module.

References

Ali, A., & Shubra, C. (2010). Efforts to reverse the trend of enrolment decline in computer science programs. *The Journal of Issues in Informing Science and Information Technology*, *7*, 209-225.

Bergin, S., & Reilly, R. (2005, February). *Programming: Factors that influence success.* Paper presented at SIGCSE '05, St. Louis, Missouri, United States.

Bohlmann, C., & Pretorius, E. (2008). Relationships between mathematics and literacy: Exploring some underlying factors. *Pythagoras, 67*, 42-55.

Butler, M., & Morgan, M. (2007). Learning challenges faced by novice programming students studying high level and low feedback concepts. In *Proceedings of the 24th ASCILITE Conference* (pp. 2-5).

Byrne, P., & Lyons, G. (2001). The effect of student attributes on success in programming. *ITiCSE 2001*: *Proceedings of the 6th annual conference on innovation and technology in computer science education* (pp. 49-52). New York, NY: ACM.

Corney, M., Teague, D., & Thomas, R. N. (2010, January). Engaging students in programming. In *Proceedings of the Twelfth Australasian Conference on Computing Education-Volume 103* (pp. 63-72). Australian Computer Society, Inc.

Caspersen, M. E. (2007). *Educating novices in the skills of programming* (Doctoral dissertation, Aarhus Universitet Aarhus University, Science and TechnologyScience and Technology, Center for Scienceuddannelse (Centre for Science Education).

Department of Basic Education (2014). *National Senior Certificate Examination 2014, Diagnostic Report.* Department of Basic Education, Pretoria, South Africa.

Feza-Piyose, N. (2012). Language: A capital for conceptualizing mathematics knowledge. *International Electronic Journal of Mathematics Education, 7*(2), 62-79.

Garner, S. (2007). A program design tool to help novices learn programming.*ICT: Providing choices for learners and learning. Proceedings ASCILITE Singapore*.

Gomes, A., & Mendes, A. (2008). A study on student's characteristics and programming learning. In J. Luca & E. Weippl (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2008* (pp. 2895-2904). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/28776

Goold, A., & Rimmer, R. (2000). Factors Affecting performance in first-year computing. *SIGSE Bulletin, 32*(2), 39-43.

Hourigan, M., & O'Donoghue, J. (2007). Mathematical under-preparedness: the influence of the pre-tertiary experience on students' ability to make successful transition to tertiary level mathematics courses in Ireland. *International Journal of Mathematical Education in Science and Technology, 38*(4), 461-476.

Jacobs, M. (2013, June 18). New fix mulled for teacher shortage. *IT Web Training and Learning.* http://www.itweb.co.za/?id=64976:New-fix-mulled-for-teacher-shortage

Jenkings, J. D. (2004). *The predictive validity of the General Scholastic Aptitude Test (GSAT) for first year students in information technology.* (Unpublished master's mini-dissertation). University of Zululand, South Africa.

Marnewick, C. (2012). The mystery of student selection: Are there any selection criteria? *Educational Studies*, *38*(2), 123-137.

Nilsson, P. (2003). *Education for all: Teacher demand and supply in South Asia.* Education International Working Paper No 13. November 2003.

Robins, A., Rountree, J., & Rountree, N. (2003). Learning and teaching programming: A review and discussion. *Computer Science Education Journal*, 2003, *13*(2), 137-172.

SA needs 15,000 more teachers a year. (2011, September 21). *IOL News.* Retrieved from http://www.iol.co.za/news/south-africa/sa-needs-15-000-more-teachers-a-year-1.1142295#.VWIeLechxz0

Schoer, V., Ntuli, M., Rankin, N., Sebastiao, C., & Hunt, K. (2010). A blurred signal? The usefulness of National Senior Certificate (NSC) mathematics marks as predictors of academic performance at university level. *Perspectives in Education, 28*(2), 9-18.

Spark, L. (2005). Matric maths as a predictor of success in information systems: A study of information systems students at the University of the Witwatersrand. In *Proceedings of the 35th Conference of SACLA* (pp. 268-271) Kasane, Botswana.

Spaull, N. (2013). *South Africa's education crisis: The quality of education in South Africa 1994-2011*. Johannesburg: Centre for Development and Enterprise.

Venkat, H. (2007). Mathematical literacy - Mathematics and/or literacy: What is being sought? *Pythagoras, 66*, 76-84.

Wileman, S., Konvalina, J., & Stephens, L. J. (1981). Factors influencing success in beginning computer science courses. *The Journal of Educational Research, 74*(4), 223 – 226.

Wilson, B. C., & Shrock, S. (2001). Contributing to success in an introductory computer science course: A study of twelve factors. *SIGCSE Bulletin, 33*(1), 184-188.

Author Details

Glenda Barlow-Jones
glendab@uj.ac.za

Duan van der Westhuizen
duanvdw@uj.ac.za

Carla Coetzee
CoetzeeC@tut.ac.za

Back to Contents page

EXPLORING STUDENT EXPERIENCES OF ASSESSMENT IN HIGHER EDUCATION IN SCOTLAND AND BRAZIL: EMBARGO OR EMPOWERMENT?

Maria Eugenia Witzler D'Esposito
Faculdade Cultura Inglesa, Brazil

Iain McPhee
University of the West of Scotland
Scotland

Abstract

Education policy in Scotland and Brazil has increased the number of students in higher education institutions (HEIs) presenting challenges in learning and teaching in online, conventional and hybrid contexts. Academic writing remains a key factor in assessment of academic achievement. Using in-depth semi-structured interviews, 14 participants (Scotland n=7, Brazil n=7) who completed assessable written work were interviewed. Using Paulo Freire's concept of empowerment (1971), this paper explores students' perceptions of assessment in the two countries. Results presented thematically indicate that perceptions of the purpose of both the assessment and academic qualification are at odds with institutional habitus (Bourdieu, 1984).

Introduction

Changes in higher education (HE) have occurred globally and an increasingly number of universities operates using business models that require an increased number of students. Scotland and Brazil have recently begun processes of democratising education and widening access, key drivers of employment and economic success (Costa, 2013; Riddell, Raffe, Croxford, Weedon, & Minty, 2013), which impact on rates of academic failure (Osborne, 2003). This paper considers quality issues in HE by exploring students' understandings of the function of assessment and their experiences of accessing and receiving written feedback using the virtual learning environment (VLE) Moodle.

The Theoretical Constructs

Based on Freire's concept of empowerment (1971), we explore the consequences of institutional practices that underpin academic capitalism (Slaughter & Rhodes, 2004) of introducing *markets* in HE to provide a theoretical framework to explain the impact of shifting organisational patterns and modes of production within universities on the student experience of academic writing and assessment.

Academic Capitalism

Readings' thesis on the university (1996) described changes he believed to be damaging HE and impacting on academic success. The adoption of business principles in HEI known as *academic capitalism* is typified by student loans and tuition fees that transform students into consumers, universities into service-providers, and degree programmes into investment projects (Rhodes & Slaughter, 2004). It also refers to several key factors that impact on academic success, particularly widening access and increased student numbers. Hence, universities increasingly provide opportunities to enhance *employability* rather than offer transformative educational experiences (Chertkovskaya, Watt, Tramer & Spoelstra, 2013).

The focus on qualifications as commodities has two related consequences: students perceive the degree as a product of learning; and, in the context of widening access, institutional approaches to learning and teaching locate academic success or failure with the student, downplaying wider structural factors such as inequality. The increased number of students created by widening access creates workload in producing meaningful formative feedback provided (Cassidy, 2007). However virtual learning environments (VLE) can enhance flexibility and pedagogical practice. They can also increase tutor workload (McPhee, 2009).

Cultural Capital and Institutional Habitus
For Bourdieu (1984) cultural capital exists in three forms: (a) embodied, (b) objectified, and (c) institutionalised. Mode of speech and accent are examples of embodied cultural capital, while owning a personal computer is an example of cultural capital in its objectified state. Cultural capital in institutional form refers to qualifications that symbolise cultural competence and authority. Habitus, Bourdieu's most influential yet ambiguous concept, refers to the physical embodiment of cultural capital in individuals and to deeply embedded structural practices, used by Bourdieu to refer to the norms and practices of particular social classes or groups (Bourdieu & Passeron, 1977). The habitus refers to a set of dispositions created and shaped by the interaction between objective structures and personal histories, including experiences and understanding of *reality*. In this sense *institutional habitus* refers to the practices of assessment, which remain firmly rooted in serving the needs of affluent students who have few barriers in achieving academic success.

Empowerment
Places of leaning are instruments of social control (Illich, 1971) that lead to alienation (Freire, 2005), but also potential places of empowerment and resistance. Referring to traditional ways of teaching as *banking* models, Freire (2005, p.72) notes that institutions consider students as vessels to be filled by the teacher or the institution, and writes that "Education must begin with the solution of the teacher-student contradiction, by reconciling the poles of the contradiction so that both are simultaneously teachers *and* students." Freire (2014) recognised that the learning places were potentially spaces of domination and liberation, empowerment and restriction.

Embargo
The term embargo means typically *a ban on trade* when used as a noun, and, when used as a verb *the practice of government to seize or impose a ban on trade*. We introduce the term to describe barriers, both real and imaginary, levied on individual students via structural factors and institutional practices

related to teaching, learning and assessment. To date there has been little research investigating the students' experience of learning and assessment in the context of *open* access to HE. We note that "Washing one's hands of the conflict between the powerful and the powerless means to side with the powerful, not to be neutral" (Freire, 1985, p.122).

Methods

The participants were recruited using purposive sampling identifying students who had completed all assessments required to complete each programme. All participants had received formative feedback via the VLE. Using this inclusion criterion, we recruited 7 students from a cohort of 53 in Scotland and 7 from a cohort of 18 in Brazil, to explore students' experiences of the nature and function of assessment.

The context and participants

Since 1999, The University of the West of Scotland has offered online flexible postgraduate programmes in Alcohol and Drugs Studies, while The Faculdade Cultura Inglesa, São Paulo, Brazil, has since 2014, provided flexible courses in teaching English programmes. Both programmes are supported on and off-campus, in a *blended learning* or an *integrated learning* approach, using continuous assessment. The Scottish programme uses a 1,500 word mid-term essay and a 3,500 end of module essay, while the Brazilian uses a mid-term test and a 1,500-word end of module essay. Assessments are accessed through the VLE and grading and the Scottish programme feedback is delivered by Turnitin software (http://www.turnitin.com/en_us/features/grademark).

Table 1

Postgraduate Students in Scotland

Name	**Age**	**Sex**	**Study mode**	**Hours (week) Employed**	**Highest qualification**	**Children**
Mr JJM	41	M	F/T	16	2:1 hons Chemical Engineering	0
Ms J2	39	F	F/T	04	2:1 hons Social Science	4
Ms D	33	F	P/T	00 disabled	2:1 hons Social Science	3
Ms P	50	F	F/T	40	2:1 Nursing	2
Ms M	32	F	P/T	10	2:2 Social Medicine	1
Mr F	23	M	F/T	10	BA Commercial Music	0
Ms J1	24	F	F/T	10	2:1 BA Graphic Design	0

Table 1 indicates that the participants' age ranged from 23-50; five were full time students, and two used a blended mix of both off and on campus learning. Four had dependent children. Six had paid work to supplement their incomes to allow them to study. One did not work, being registered disabled as profoundly deaf.

Table 2

Graduate Students in Brazil

Name	Age	Sex	Study mode	Hours (week) Employed	Highest qualification	Children
Ms F	19	F	P/T	44	High School	0
Ms C	33	F	F/T	40	Specialization – Law	0
Ms G	27	F	F/T	35	BA – International Relations	0
Ms M	29	F	F/T	42	Technical course – Computer networking	0
Mr A	28	M	F/T	40	Specialization – not mentioned	0
Mr M	48	M	F/T	44	BA – Library	0
Ms P	29	F	F/T	0 – Disabled	BA – Marketing	0

Table 2 indicates that the participants' age ranged from 19-48, all but one was employed full time, with one registered disabled student did not work. Three of them are part of a student-financing fund to allow them to study. None had dependent children.

Results

The interview schedule allowed the researchers to reflexively explore factors that aided academic success or acted as barriers to programme completion.

Results from Scotland

Participants were asked to recall experiences of accessing learning materials and the assessment from the VLE. Ms J2 indicates that assessment is a test of knowledge, referring to the *core material*, that is, the minimum reading made available in the VLE required to meet the learning outcomes for the module:

> It's to see if you've learned what you are supposed to learn over your trimester at university … To see what your knowledge is, to see if you've taken in the core material or went above the core material.

Ms M agrees that the VLE is helpful however the amount of reading material is overwhelming:

> … I think it is really helpful, these selected journals, but obviously you are expected to [read] beyond. It can be overwhelming; you think: do I have to read all of this (Laughs)?

Ms J1 reveals that learning is a source of great stress:

> ... I suppose it's almost as if someone's sort of checking up on you … I get a little bit nervous and a little bit scared.

For Mr JJM assessment of learning is a test of critical ability, insisting that his beliefs about specialist subject knowledge are irrelevant:

> Well … it doesn't matter what I believe or not believe as long as I can write balanced … for a critical essay it doesn't matter what my belief is.

Mr JJM an engineering graduate, with a strong science background, is unsure of his ability in completing essays with the required level of critical analysis. His degree in engineering taught him absolute laws, and relies on scientific training to consider the assessment as an equation. He explains his formula for completing the written assessment:

> It's almost like splitting into equal paragraphs so roughly for a 3000 word essay my aim is not to write less than 200 words for a paragraph and not to go above 550 ... (Mr JJM)

Accessing the Assessment: The VLE

Participants were asked about the use of the VLE in accessing the assessment. Mr JJM suggests that he wonders how students coped without technology:

> … its all-digital … it amazes me how people [completed] essays 20 years ago when there was less electronic availability.

Support

Three sources of support were revealed in the data, peer support, staff support, and institutional support. Students organised peer support networks beyond the VLE, most often using social media, to organise informal support meetings:

> … there's about two or three of us, that'll sit and open up discussion forums and help each other, and get out our essays and say 'oh you've missed whatever.' We're quite open; we're adults so we help each other without actually copying. (Mr JJM)

Ms M relies on social media to connect with other students, however was unwilling to appear 'needy' asking for support. She explains:

> … they have their own life and I have my own. … I don't want to be needy. (Ms M)

Participants seek help from peers, and while helpful, some tension is revealed in the motives for seeking help, and sharing work. Sources of help are also sources of competition:

> … It's not that you don't want to tell them it's just that you're not sure whether they would want to tell you so you're [kind of] conscious of, and no we don't share, no we don't look at each other's writing at all. (Ms J1)

Participants were asked about their perceptions of the usefulness of feedback given by staff members to them at their midterm assessment:

> … feedback was really helpful … you gave me pointers on what I was doing wrong. But with another lecturer, I felt like leaving the course … It [formative feedback] seemed like sarcasm in a sense. There was nothing supportive at all… (Ms M)

University habitus locates the source of academic failure firmly with the student, and this is where learning support interventions are directed.

However, accessing formal institutional 'effective learning' support revealed negative experiences:

> Effective learning is not absolutely good … I mean couldn't fault them I think they are poorly staffed … (Ms P)
>
> Well, the effective learning is available … but unfortunately I just had a bad experience. I don't know what other support there is other than that. (Ms J1)

Ms D, a student with a hearing disability, is fulsome in her praise for the support afforded to her in completing assessments:

> Having a disability I have access to a proof reader. I can ask for extensions but I tend not to ask for that. The lecturers do offer a lot of help … (Ms D)

Barriers to Academic Success

Students faced several barriers in completing the essay: many had families, including young children, as most students had to work; they often had little time to study. Ms M a young mother of one child explains how she copes with academic life:

> My daughter, I used to sort her out and the do a little bit of reading when it was her nap time … recently I have not been able to do that. (Ms M)

As many students worked to pay for tuition, it was acknowledged that this impacted on the academic experience at university:

> … I've got to work to survive … I think it's just a huge issue. (Mr JJM)

Engaging with the assessment meant that tough decisions were made: continue working and risk failing the assessment; seek an extension; or, stop working, reducing income, to complete the assessment. Ms J1 explains her decision:

> ... I've kind of cut back on [work] at the moment just while I've got my essays and things on, so nothing at the moment right now (Ms J1)

For many, they were often the first in the family to attend university; which impacted on perceived ability to complete assessments:

> … coming from a working class background I was the first person from the family to come to university… I've put in quite a lot of years of education and still not getting it. No doubt I'll get it eventually. (Mr JJM)

Employability

Participants were asked if they believed assessments were helpful in making them more employable. Ms D states:

> Yes, I actually do think it will help me get a job. As I want to get into research and it's teaching me how to ask the appropriate questions. I think this will help me prepare for that. (Ms D)

However, Ms M acknowledges that she will be seeking employment on graduation, and she worries about being tested on practice, even if she becomes comfortable with theory:

> … it [assessment] makes you realise how much you don’t know … I would like a job to put it into practice; but then I think oh my God! What if I get tested? (Ms M)

The results presented thematically reveal that participants consider assessment necessary to document learning and understanding, and useful in gaining employment. However, several barriers to academic success were revealed. That all but one of the participants worked over 10 hours per week (one worked 40 hours) had an impact on ability to engage academically. While institution support was offered, participants created informal support networks that were also revealed to be sources of competition.

Results from Brazil

Ms G suggests that the term assessment is broad and difficult to define. After some reflection she describes written assessment as a necessary instrument to evaluate learning:

> Actually assessment is a very broad word…lots of varied kinds of assessment … I think it´s important to have something, something physical like an essay, a test or a presentation to evaluate …(Ms G)

The Purpose of Assessment

Participants reveal that the assessment serves several functions: for some it is an important process to check and certify that learning and understanding has taken place, and to test subject specific knowledge:

> [assessment] means to evaluate the knowledge a person has in relation to a certain topic or subject. (Ms P)

For others, it is a process that helps the teacher to diagnose progress, academic difficulties and knowledge construction, as well as provide guidance to rethink the teaching practice. Ms G explains:

> [the assessment] is a way of diagnosing, a way of getting the real diagnosis of what the students have been learning and what they lack, their difficulties, their problems … (Ms G)

Academic Progress

In explaining the writing process participants saw it as productive and relevant challenge wanting to use it to gauge their academic progress.

> Many challenges … there were lots of possibilities and people could address the topic from different perspectives … it´s something great, but it´s kind of overwhelming when you think about it. … But I think it´s intentional and it´s **good** (hesitation) but it makes us feel a bit worried and anxious. But I like challenges so (hesitation) it´s not **bad** for me to feel that way. (Ms G)

> … it was a sense of accomplishment. I managed to do it. (Ms C)

Participants noticed that the process made them more autonomous, helping them to develop relevant subject specialist skills:

> If the aim of evaluation is to check your technical competence I agree that it helps us to notice our technical evolution. (Mr M)

Some participants expressed concerns and noted several barriers to completion, in particular, lack of time:

> I got scared because I think that everything is very difficult … oh this is hard, it's going to require lots of work, I'll need to spend a lot of time working on it; I don't have time. (Ms F)

Using the VLE

Participants had access to numerous sources of information and materials to aid the academic writing process:

> … we had the material we used during the course, and texts, and some extra materials like the handbook, we have the library (hesitation) I didn´t use it but we had it. (Ms G)

The VLE Moodle was considered useful in developing independent learning:

> … (Moodle) gives us autonomy. I just think Moodle gives us even more because it makes us committed … it's easier for us, if we have any doubts, if we need to talk, if we need to ask something. (Ms F)

On the other hand, Ms C expressed resistance to use of the VLE, preferring to seek the tutor:

> I wanted you to sit with me to talk about it … I don't want to look at it on the computer … I need to talk, to sit down. To me that makes much more sense. Maybe I would memorize my feedback better or understand it better. (Ms C)

Seeking Formal Help

The main support received was from the teacher who, according to participants, was available, promptly replied providing feedback on the content and text organization, without influencing but guiding.

> There were the guidelines … you were following us. You gave us feedback in the middle of the process. So, I felt more relaxed. (Mr M)

Participants also used less formal sources of help, and shared ideas via email in addition to seeking and receiving formal help and support from their tutor:

> The tutor … I talked to you and I could get your feedback…I showed you the skeleton and you said ok …oh, we had the material we used during the course, and texts, and some extra materials like the handbook, we have the library (hesitation) I didn´t use it but we had it … I lent my piece of writing to some students … (Ms G)

Participants considered feedback meaningful, relevant; allowing them space to reconsider aspects, look for alternatives, showing how and what to improve in terms of content and organisation:

> That was great … I really liked the way you corrected it because we could see exactly where we should pay attention in terms of mistakes, or getting confused …(Ms G)

> It made sense in relation to what that I had to do better. I think it also gave some direction … the feedback also brings a certain security to the student to know what he has to improve ... (Mr A)

Impact of institutional and disciplinary *ownership* of the rules, conventions and practices of academic writing were sources of much stress. However, the tutor could minimize these:

> The way I got the feedback showed that you cared (hesitation) you care about the student … it's not just about what is wrong or right (hesitation) but it's to indicate, make us think, what we could have done, what was nice … It makes us feel important… And it was pretty clear, very clear. (Ms F)

Barriers to Academic Success

All of the participants work to pay for tuition, and describe how this impacts on ability to study:

> … time management … I work long hours … we had to study for the other subjects; do other papers … I didn't have much time. (Ms G)

Employability

Participants were asked if the assessment processes were helpful in making them more employable. This proved to be a difficult question to answer. Mr A, for example, notes that his academic success translated into employment gain, he explains:

> I think there has been a gain at work … and academically. I think there is a connection between them [the assessment and employability] and I guess I couldn't see it before. I thought the academic part was one thing and the profession another … I also had it recognized at work. I even had opportunities to have other duties. So, it was certainly something very positive for me and with good results … (Mr A)

The results presented thematically reveal participants consider assessment an integral part of the academic experience and describe several barriers to academic success. All but one of the participants worked around 40 hours per week, which impacted on the ability to engage with the learning material in the VLE. Many comment on time management and lack of time to complete assessments. Participants described several ways to resist barriers to completion, seeking support from peers the teacher and the institution

Discussion and Conclusions

One of the fundamental principles underpinning a global HE education system is the meritocratic idea that, irrespective of social background, all citizens have equal opportunity to develop their academic potential. However, evidence demonstrates that the majority of people who successfully complete university are from middle class backgrounds (Riddell et al., 2013). Widening access, a feature of global academic capitalism, presents challenges to staff, institutions, and students. Despite clear differences in course content in Brazil and Scotland, results reveal similarities in student perceptions of the assessment process and its function. Participants reveal several barriers to educational success that include having to work long hours to support learning, family commitments, and in perceived academic ability.

Bourdieu's theory of cultural reproduction is useful in explaining why academic success is not universal and structural inequality impacts on educational inequality. According to Bourdieu, education in industrialised societies legitimates and perpetuates class inequalities. Success in education is facilitated by cultural or academic capital.

Freire posits that education should allow the powerless to regain their humanity, and in turn overcome their oppression. Nevertheless, he acknowledges that for this to occur, the oppressed individual must play a role in their emancipation. Freire (2005, p. 54) notes that:

> No pedagogy which is truly liberating can remain distant from the oppressed by treating them as unfortunates and by presenting for their emulation models from among the oppressors. The oppressed must be their own example in the struggle for their redemption.

We consider the connections between Bourdieu and Freire useful in describing transformative pedagogies in light of resistance by institutions to address the tensions between institutional habitus in relation to the student academic experience of assessments. Widening access has increased student numbers, however institutional assessment practices remain fixed and unyielding in both institutions. We re-present and reintroduce the term *embargo* to describe barriers, both real and imagined levied on individual students via structural factors and institutional practices relating to teaching, learning and assessment. Participants resist several embargos that impact on academic success, accessing help from several sources, including peer, staff, and institutional support.

Limitation and Future Research

The study provides small samples from Scotland and Brazil, and results may be complicated by the researchers also teaching the students recruited into the study. Results indicate the need for further research to understand the impact of shifting organisational patterns and modes of production within HEIs on the student experience of academic writing and assessment.

References

Bourdieu, P. (1984). *Distinction: A social critique of the judgment of taste*. Cambridge MA: Harvard University Press.

Bourdieu, P., & Passeron, J. C. (1977). *Reproduction in education, society and culture.* London and Beverly Hills: Sage Publications.

Cassidy, M. (2007). Architecture and the sociology of university life. *Higher Education Quarterly*, *18*, 352–365.

Chertkovskaya, E., Watt, P., Tramer, S., & Spoelstra, S. (2013). Giving notice to employability. *Ephemera: theory & politics in organization*, *13*(4), 701-716.

Costa, D. M. (2013). Public funding and the beginning of a new era in higher education in Brazil. *Comparative & International Higher Education*, *5*, 80-85.

Freire, P. (1985). *The politics of education: Culture, power, and liberation* (D. Macedo, Trans.). South Hadley, MA: Bergin & Garvey.

Freire, P. (2005). *Pedagogy of the oppressed, 30th anniversary edition*. New York: Continuum Education.

Freire, P. (2014). *Pedagogia da autonomia: Saberes necessários à prática educativa* (49ª ed.). Rio de Janeiro: Paz e Terra.

Illich I. (1971). *Deschooling society*. New York: Harper & Row.

McPhee, I. (2009). Does supporting equated learning for online and on-campus postgraduate students by using a VLE increase tutor workload? *The University of the Fraser Valley Research Review*, *2*(3), 97-110.

Osborne, M. (2003). Increasing or widening participation in higher education? - A European overview. *European Journal of Education*, *38*(1), 5-24.

Rhoades, G., & Slaughter, S. (2004). *Academic capitalism and the new economy: Markets, state, and higher education.* Baltimore: JHU Press.

Readings, W. (1996). *The university in ruins*. Cambridge: Harvard University Press.

Riddell, S., Raffe, D., Croxford, L., Weedon, E., & Minty, S. (2013). *Widening access to higher education: Scotland in UK comparative context.* Retrieved from http://www.esrcsocietytoday.ac.uk/_images/Briefing_TT2_widening%20access_tcm8-28589.pdf

Author Detail

Iain McPhee
iain.mcphee@uws.ac.uk

Maria Eugenia Witzler D'Esposito
eugeniadesposito@yahoo.com.br

Back to Contents page

MODEL OF THE "MEDIATING TEACHER" IN DISTANCE LEARNING ENVIRONMENTS: CLASSES THAT COMBINE ASYNCHRONOUS DISTANCE LEARNING VIA VIDEOTAPED LECTURES

Aryeh Ben-Chayim & Baruch Offir
Bar-Ilan University, Israel

Abstract

This study investigated a distance-learning model that includes a *mediating teacher* in the classroom, in addition to the teacher teaching from a distance. The study compares the characteristics of the mediating interaction between teachers and students in high school classes that include asynchronous distance learning, in which a mediating teacher is present in the classroom in addition to the teacher who is teaching from a distance via videotaped lectures. Teachers who had training for mediated teaching in the classroom in an asynchronous distance- learning environment were better mediators than teachers who did not receive training for mediated teaching.

Theoretical Background

The Information Technology (IT) Learning Revolution in general, and distance learning in particular, have a significant influence on teaching methods (Horizon Report, 2008; Milne, 2007; Moore & Kearsley, 2005). An approach of *blended learning* (Konja & Ben-Zvi, 2009) or a *hybrid approach* (El Mansour & Mupinga, 2007), which combine distance learning with face-to-face learning by a lecturer, are becoming more prevalent in the academia.

A combination of IT with education can assist in shaping teaching processes and methods, where the teacher serves as a mediator and promotes learning, and is not necessarily the sole source of knowledge (Fullan, 2000; Harasim, 1993; Hayes, 2007; Muri-Herzing, 2004; Offir, 2010; Salomon, 2000). Theories on distance teaching and learning (Holmberg, 2007; Moore, 2007; 2013; Moore & Kearsley, 1996) as well as research findings (Blau & Barak, 2009; Kock, 2007; Nachmias, Mioduser, & Shemla, 2000; Offir, 2006; 2010; Offir & Lev, 1999; 2000; Offir, Bezalel-Rosenblat, & Barth, 2007; Offir, Lev, & Bezalel, 2008; Offir, Lev, Lev, Barth, & Shteinbok, 2004; Rovai, 2002; Weimer, 2013) indicate that classical distance learning environments restrict important pedagogical factors such as student-teacher and student-student interactions.

Following these findings, the goal of the present study is to propose a change in the distance learning method and in the teachers' roles and to test a model of a *Mediating Teacher* for distance teaching and learning environments. The model proposes a combination between a teacher who is an expert in the content who gives the lesson in parallel to several classes either synchronously or asynchronously through videotaped lectures, and a mediating teacher who is present in each classroom. This enables the *mediating teacher* to find time for issues which are beyond the teaching contents, such as mediating a sense of efficacy, mediating discipline and increasing the motivation to learn, mediating expansion and development of learning and thinking skills and mediating regulation of behavior (Klein & Sobleman, 2010), which were found to be essential in the distance learning environment. This model is based on Feuerstein, Rand and Hoffman's (1979) Mediated Learning Experience (MLE) theory.

The study compares the characteristics of the interaction between teachers and students in high-school classes that include asynchronous distance learning, in which a mediating teacher is included in the classroom (all teachers underwent training by the research team). The mediation components investigated in the study included: intentionality and reciprocity (two-way communication between the student and the teacher), meaning (the manner in which the student understands why he/she is learning, in order to increase motivation), transcendence (moving the learning from its connection to the here and now to material learned, material to be learned and meta-cognitive thinking), a feeling of confidence (affording encouragement and reinforcements to the students, while explaining the reason for success) and regulation of behavior (impartation of skills to the student for planning and controlling his/her learning). The study was based mainly on Klein's method for analysis of mediating interactions between teachers and students, the OMI (Observing Mediational Interactions) (Klein, 1988; Klein, Raziel, Brish, & Birenbaum,1987; Klein, Weider, & Greenspan, 1987).

The *Mediating Teacher* model proposes a learning and teaching process based on two channels: a content channel carried out from a distance and a mediation channel, which is performed in the classroom, where the *mediating teacher* who is found in the classroom bridges between them.

Methods

The research involved both quantitative and qualitative analyses of data. The independent research variable was training teachers in mediation. The dependent variables were the students' assessment of the mediated teaching, the frequency of the occurrence of the mediation components and the communication chains in the mediated teacher-student interaction. The mediator variable was the teacher's sense of efficacy.

Participants

The participants included 12 teachers and 116 students who were divided into an intervention group comprised of classes of six teachers who received training for mediated teaching and used videotaped lectures in their lessons and a comparison group of the classes of six teachers who did not receive such training and used videotaped lectures in their lessons.

Research Tools

The research tools included a questionnaire for evaluating mediated teaching – the Mediating Interaction Evaluation Questionnaire (MIEQ), which was developed by the researcher, an observation tool for analysis of mediating interactions, OMI (Klein, Weider & Greenspan, 1987) and a Teacher's Sense of Self-efficacy Questionnaire (Rich, Lev, & Fischer, 1996).

Procedure

An intervention based on Klein's (2004) Mediational Intervention for Sensitizing Caregivers (MISC) model was performed during the study. The teachers received instruction for mediated teaching that dealt in two dimensions of the model – the teaching dimension and the communication dimension. The study was carried out in three stages:

- Pre stage: All teachers in both groups (intervention and comparison) were videotaped at the beginning of the year in a lesson in which they included a videotaped lecture. The teachers chose a videotaped lecture that refers to the material learned in the class from a database of recorded lessons. The MIEQ for evaluating mediated teaching was administered to the students at the end of the lesson.
- Intervention stage: The teachers in the intervention group received instruction for mediated teaching during the school year, with inclusion of a videotaped lecture in the lesson, whereas the comparison group received no instruction.
- Post stage: All teachers in both groups (intervention and comparison) were videotaped at the end of the year in a lesson in which they included a videotaped lecture. The students were administered a questionnaire for evaluating mediated teaching at the end of the lesson.

Results and Discussion

It was found that teachers who received training for mediated teaching in an asynchronous distance-learning environment that includes videotaped lectures in their lessons are better mediators than teachers who do not receive such training.

This finding is expressed in three dimensions: The teaching dimension, the communication dimension and the mediation dimension.

In the teaching dimension, the teachers who received training make greater use of the mediation components during their teaching in the classroom. The results of a linear log test for the frequency of the mediation components are presented in Table 1. A significant difference was found in all five mediation components: focusing (intentionality and reciprocity); meaning; transcendence; feeling of confidence and regulation of behavior.

Table 1

*Standardized (Z) Values for Main Effects and the Effect of the Interaction Between the Two Research Groups and the Three Research Stag*es

Type of Effect	Estimate	Standard Error	*Z*
Focusing (intentionality and reciprocity			
Group X Research Stage	.20	.07	2.74**
Group	-.27	.07	- 3.72***
Stage	.11	.07	1.49
Meaning			
Group X Research Stage	.11	.05	2.33*
Group	-.07	.05	-1.51
Stage	.04	.05	.74
Transcendence			
Group X Research Stage	.27	.06	4.58***
Group	-.26	.06	- 4.46***
Stage	-.13	.06	-2.18*
Feeling of Confidence			
Group X Research Stage	.36	.14	2.61**
Group	-.53	.14	- 3.88***
Stage	.17	.14	1.22*
Regulation of Behavior			
Group X Research Stage	.36	.14	2.59**
Group	-.33	.14	-2.34*
Stage	.20	.14	.12

**p*<.05, ***p*<.01, ****p*<.001

The teachers who received training expanded the topic learned in the videotaped lesson and connected it to material that was learned in the past and to material that is relevant to the students' everyday life. These teachers also asked the students to reach conclusions and perform comparisons from the material learned in the videotaped lecture (transcendence). The teachers encouraged their students more and supported them when necessary (mediation for a feeling of confidence).

The teachers in the intervention group were found to maintain longer communication and discourse with the students. The results of a linear log test for the communication chains are presented in Table 2. The use of videotaped lectures had a positive significant effect on the length of the communication chains between the teachers and the students.

Table 2

Standardized (Z) Values for Main Effects and for the Effect of the Interaction Between the Two Research Groups and the Three Research Stages

Type of Effect	Estimate	Standard Error	*Z*
Number of Communication Chains			
Group X Research Stage	-.10	.10	-1.0
Group	-.05	.10	1.17
Stage	.11	.07	1.49
Length of the Communication Chains			
Group X Research Stage	.24	.07	3.50***
Group	.11	.07	1.60
Stage	-.35	.07	-5.14***
Length of Videotaped Lecture			
Group X Research Stage	-.11	.07	-1.50
Group	.10	.07	.15
Stage	.05	.07	.66
Number of Times the Video was Halted			
Group X Research Stage	-.05	.12	-.37
Group	-.12	.12	-1.00
Stage	-.15	.12	-1.20

****p<.001*

The students of the teachers in the intervention group evaluated the mediating teaching level as higher. A significant difference was found in four of the five mediation components: intentionality and reciprocity, meaning, feeling of confidence and regulation of behavior. Pearson correlations between the students' evaluation of the mediated teaching and the frequency of the appearance of the mediation components are presented in Table 3. It should be noted that in the context of this finding, the mediation components of mediation for meaning (motivation) and for regulation of behavior were found to be essential for students in distance learning environments (Heum & Joon, 2013; Hodges, 2005; Schunk & Zimmerman, 2007).

Thus, teachers who received training for mediated teaching in an asynchronous distance learning environment and used videotaped lectures of a teacher teaching from a distance, were more attentive to the students, referred to their questions and focused them during the videotaped lecture (mediation for focusing – intentionality and reciprocity). The teachers held more discussions and enabled the students to participate in them by asking questions and giving an explanation from the videotaped lecture (mediation for meaning).

Table 3

Pearson Correlations and Frequency of the Mediation Components among Students whose Teachers Received Training in Mediated Teaching (N=57)

Students' evaluation of mediated teaching	**Frequency of the appearance of the mediation components**				
	Intentionality and reciprocity	Meaning	Transcendence	Feeling of confidence	Regulation of behavior
Intentionality and reciprocity	**.36****	.42**	-.25*	.10	.39**
Meaning	.23*	**.26***	-.11	.-04	.28*
Transcendence	.22	.29*	**-.19**	.02	.30*
Feeling of confidence	.45**	.48**	-.26*	**-.06**	.35**
Regulation of behavior	.26*	.29*	-.14	.06	**.32****

*p<.05, **p<.01

The teachers used work sheets and asked the students to think before they answer questions and plan and look at their answers critically with reference to the topic learned in the videotaped lesson (mediation for regulation of behavior).

Conclusions

The findings are in agreement with the claim that the teacher can serve as a mediator and a promoter of learning in IT environments, and not necessarily as the sole source of knowledge (Harasim, 1993; Muri-Herzig, 2004; Offir, 2010). The teacher can thus help bridge the physical and pedagogical gap (Moore, 2007; 2013; Moore & Kearsley, 1996; 2005; Offir, 2010), which is created due to the distance between the teacher teaching from a distance and/or his/her videotaped lectures and the students. This may help overcome the pedagogical limitations of these environments (Blau & Barak, 2009; Kock, 2007; Nahmias et al., 2000; Offir, 2006; 2010; Offir & Lev, 1999; 2000; Offir, Bezalel-Rosenblat, & Barth, 2007; Offir, Lev, & Bezalel, 2008; Offir, Lev, Lev, et al., 2004; Rovai, 2002; Weimer, 2013).

Assuming that the students also acquire the content learned in the lesson through videotaped lectures, the findings indicate that teachers who are trained for mediated teaching can plan the framework of their teaching in the classroom such that they can be free for more individual and personal teaching. They can encourage the students to feel confident, mediate for meaning and strengthen the motivation to learn, to regulate behavior, plan and control the learning process and expand the thinking skills that were found to be important and essential for students in distance learning environments (Aileo, Cascio, Ficarra, Messina, & Severino 2011; Cho & Kim, 2013; Garrison, Anderson, & Archer, 2001; Hodges, 2005; Wang & Wu, 2008; Zhang, Duan, & Wu, 2001).

The findings from the subjective perspective of the students and from the objective perspective of observations of video-filmed mediation interactions between the teachers and the students support the basis of the Mediating Teacher model which is proposed in the present study for distance learning environments. The findings show that all three factors: the teacher who teaches from a distance, the mediating teacher in the classroom, and the students in the classroom contribute to learning.

The teaching and learning process includes the transmission of numerous components: information, skills, abilities, and values. Future studies should test the role and contribution of each of the above three factors (the teacher who teaches from a distance, the mediating teacher in the classroom and the students in the classroom) in this process.

References

Aileo, F., Cascio, M., Ficarra, L., Messina, R., & Severino, S. (2011). Distance education: The role of self-efficacy and locos of control in lifelong learning. *Procedia-Social and Behavioral Sciences*, *28*, 705–717.

Blau, I., & Barak, A. (2009). Synchronous online discussion: Participation in a group audio conferencing and textual chat as affected by communicator's personality characteristics and discussion topics. In *Proceedings of the International Conference on Computer Supported Education – CSEDU'09* (pp. 19–24), Lisbon, Portugal.

Cho, H., & Kim, J. (2013). Students' self-regulation for interaction with others in online learning environments. *Internet and Higher Education, 17*, 69–75.

El Mansour, B., & Mupinga, D. M. (2007). Students’ positive and negative experiences in hybrid and online classes. *College Student Journal, 41*, 242–248.

Feuerstein, R., Rand, Y., & Hoffman, M. B. (1979). *The dynamic assessment of retarded performers: The learning potential assessment device, theory, instruments, and techniques*. Baltimore: University Park Press.

Fullan, M. (2000). The return of large-scale reform. *Journal of Educational Change, 1*, 5–28.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education, 15*(1), 7–23.

Harasim, L. (1993). Collaboration in cyberspace: Using computer conferences as a group learning environment. *Interactive Learning Environments, 3*(2), 119–130.

Hayes, D. N. A. (2007). ICT and learning: Lessons from Australian classrooms. *Computers and Education, 49*, 385–395.

Heum, C., & Joon, K. (2013). Students' self-regulation for interaction with others in online learning environment. *Internet and Higher Education, 17*, 69-75.

Hodges, C. (2005). Self-regulation in web-based courses: A review and the need for research. *The Quarterly Review of Distance Education, 6*(4), 375–383.

Holmberg, B. (2007). A theory of teaching-learning conversations. In M. G. Moore (Ed.), *Handbook of distance education* (2nd ed.) (pp. 69–75). Mahwah, NJ: Lawrence Erlbaum.

Horizon Report (2008). *EDUCAUSE learning initiative*. Retrieved from http://www.nme.org/pdf/2008-Horizon-Report.pdf

Klein, P. S. (1988). Stability and change in interaction of Israeli mothers and infants. *Infants Behavior and Development, 11*, 55–70.

Klein, P. S. (2004). Patterns of interaction with the child and its influence on neurological processes, emotion, language and thinking. Lecture at the Baker Conference, Tel-Aviv (Hebrew).

Klein, P. S., & Sobelman, V. (2010). *Together and alone: Inclusion of children with special needs in regular educational frameworks for early childhood*. Even-Yehuda: Reches (Hebrew).

Klein, P. S., Raziel, P., Brish, M., & Birenbaum, E. (1987). Cognitive performance of 3 year olds born at very low birth weight. *Journal of Psychosomatic Obstetrics and Gynecology, 7*, 117–129.

Klein, P. S., Weider, S., & Greenspan, S. I. (1987). A theoretical overview and empirical study of mediated learning experience: Prediction of pre-school performance from mother-infant interaction patterns. *Infant Mental Health Journal, 8*(2), 110–129.

Kock, N. (2007). Media naturalness and compensatory encoding: The burden of electronic media obstacles is on senders. *Decision Support Systems, 44*, 175–187.

Konja, M., & Ben-Zvi, D. (2009). The added value of Wiki to collaborative learning as viewed by the learners. In Y. Eshet-Alkalai, A. Caspi, S. Eden, N. Geri & Y. Yair (Eds.), *The learning man in the technological era* (pp. 145–151). Raanana: The Open University (Hebrew).

Milne, A. J. (2007). Entering the interaction age: Implementing a future vision for campus learning spaces…today. *EDUCAUSE Review, 42*, 13–31.

Moore, M. G. (2007). *Handbook of distance education* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum.

Moore, M. G. (2013). *Handbook of distance education* (3nd ed.). New York: Routledge.

Moore, M. G., & Kearsley, G. (1996). *Distance education: A systems view*. New York: Wadsworth.

Moore, M. G., & Kearsley, G. (2005*). Distance education*: *A system view* (2nd ed.). Belmont, CA: Wadsworth.

Muir-Herzig, R. G. (2004). *Technology and its impact in the classroom*. *Computers and Education, 42*, 111–131.

Nahmias, R., Mioduser, D., & Shemla, A. (2000). Internet usage by students in an Israeli High school. *Journal of Educational Computing Research, 22*(1), 55–73.

Offir, B. (2006). Influence of a distance learning environment on university students' attribution of success and failure. *Computer in Education Journal, 16*, 82–94.

Offir, B. (2010). *The process of change in education. Moving from descriptive to prescriptive research*. New York: Nova Science.

Offir, B., & Lev, J. (1999). Teacher-learner interaction in the process of operating D.L. (Distance Learning) System. *Educational Media International, 36*(2), 132–138.

Offir, B., & Lev, J. (2000). Constructing an aid for evaluating teacher-learner interaction in Distance Learning. *Educational Media International, 37*(2), 91–98.
Offir, B., Bezalel-Rosenblat, R., & Barth, I. (2007). Introverts, extroverts and achievement in a distance learning environment. *American Journal of Distance Education, 21*(1), 3–19.
Offir, B., Lev,Y., & Bezalel, R. (2008). Surface and deep learning processes in distance education: Synchronous verses asynchronous systems. *Computer and Education, 51*, 1172–1183.
Offir, B., Lev, Y., Lev,Y., Barth, I., & Shteinbok, A. (2004). An integrated analysis of verbal and nonverbal interaction in conventional and distance learning environment. *Journal of Educational Computing Research, 13*(2), 101–118.
Rich, Y., Lev, S., & Fischer, S. (1996). Extending the concept and assessment of teacher efficacy. *Educational and Psychological Measurement, 56*, 1015–1025.
Rovai, A. P. (2002). Building sense of community at a distance. *International Review of Research in Open and Distance Learning, 3*(1), 1–16.
Salomon, G. (2000). *Technology and education in the information age*. Tel-Aviv: Zemora-Bitan (Hebrew).
Schunk, D. H., & Zimmerman, B. J. (Eds.). (2007). *Motivation and self-regulated learning: Theory, research, and applications*. Mahwah, NJ: Erlbaum.
Wang, S. L., & Wu, P. Y. (2008). The role of feedback and self-efficacy on web-based learning: The social cognitive perspective. *Computers & Education, 51*, 1689–1598.
Weimer, M. (2013). *Student persistence in online courses: Understanding the key factors* (Web log comment). Retrieved April 2, 2013.
Zhang, J., Li, F., Duan, C., & Wu, G. (2001). Research on self-efficacy of distance learning and its influence to learners' attainments. In C. H. Lee (Ed.), *Proceedings of the International Conference on Computers in Education (ICCE)/ SchoolNet 2001* (pp. 1510–1517). Incheon, South Korea: Incheon National University of Education.

Author Details

Aryeh Ben-Chayim
aryebh@walla.com

Baruch Offir
offir-e@inter.net.il

Back to Contents page

BUILDING TEACHER CONFIDENCE IN ADDRESSING INDIGENOUS ISSUES IN THE CLASSROOM

Rose-Marie Thrupp and John Hunt
University of the Sunshine Coast,
Stacey Cowell and Ben Crowley
Urangan State School, and
Leanne Whittaker, Sunbury State School
Australia.

Abstract

During the 2014 ICICTE Conference John Hunt (2014) described the pedagogical and technological requirements for the Wondervision Project, reporting on the project's first phase, resource development. This paper focuses on its second, data collection. It addresses three questions.

1. How have the resources contributed to teachers embedding Indigenous perspectives in the learning they design?
2. To what extent do the different resources in digital learning environments engender changing attitudes to learning?
3. How have these resources contributed to reconciliation with our Indigenous peoples?

This paper adopts a case study approach to two of the participating schools. The study identified a number of positive attributes created by accessing the range of resources, including the structure and content of the resources and the provision of resources for independent use by children.

Wondervision: The Project Enacted

Wondervision is a project of the University of Sunshine Coast, Queensland, Australia. Its purpose is to connect elementary school students with the Western Desert art collection curated by the university's Art Gallery. A significant direction of the project is the use of Information Communication Technologies (ICT) to engage students.

By late 2014, the research team had started to receive feedback from the schools participating in the Project. This feedback comprised artworks and video clips from elementary students. Two of the schools became the case study sites reported on in this paper. The researchers explored the usability of the resources available, how they were used and examined artefacts produced by the students. Of particular interest were the perceptions of teachers around how the resources had impacted on teaching about Indigenous issues and how ICT contributed to both usability and student learning.

Background and Theoretical Underpinning

The sharing of these cultural resources with schools had four purposes. These included: (a) building partnerships between the university and schools, (b) creating advantage for schools in accessing cultural resources otherwise not accessible, (c) the cultural learning for children, and (d) enacting the university's Reconciliation Action Plan.

The program developed included the virtual gallery and a range of resources (digital and print) to support teaching in schools related to the virtual gallery, specifically, knowledge of Western Desert art and the cultural learning inherent in it. Multiple resources to facilitate connection between schools and the university were developed (Hunt & Thrupp, 2013a): e-books of digital task cards, printed task cards and consequently, a website hosted by the university Art Gallery. Task cards were developed for Prep to Year 4 and Year 5-7 students with a focus on promoting small group collaborative work investigating and reflecting upon the arts using Western Desert art.

Earlier research had established that Information Communication Technologies (ICT) - mediated learning provided considerable pedagogical advantage for students (Hunt, 2014). These advantages are detailed below. Students were seen to be:

- Accessing information, people and places (the remote gallery and curator)
- Making thinking visible (engaging with a virtual gallery and high resolution images of artworks)
- Co-researchers in the project (investigating the artworks and engaging with remote curator/s)
- Collaborating with each other and the remote expert (students as co-researchers and co-curators)
- Passionate about learning (evidenced by their personal artworks and their myriad of questions seeking further knowledge)

To engage learners in meaningful learning experiences, the authors turned to the work of Keogh and Naylor (1997). Their guiding principles for the development of resources as reflected in this study are:

- Contexts that establish a sense of purpose, relevance and connection in the learner's mind with the new learning of the unit.
- Learners need to be actively involved in activities: "hands-on and minds-on" (the intellectual component).
- Activities should be conceptually accessible to the learners, set in appropriate language, challenging but within reach.
- Activities should have a sense of "wow, let me have more of this" about them (the live presentations).

A developing understanding of what learning should look like for Indigenous students has also influenced the authors' work. It is not so different to what schooling looks like for other learners, except that a greater emphasis needs to be placed on Indigenous (or cultural) knowledge. Table 1 describes the authors' views, presented as a part of a review of schooling in a remote area of Queensland.

Table 1

A View of Indigenous PCK (IPCK)

Indigenous Knowledge (Australian Aboriginal peoples)
Culture: • Both traditional and contemporary views are respected. • Ways of knowing and valuing are paramount considerations. • Historical contexts are understood and respected. • Remote or provincial contexts are recognised and acted on. • Views of childhood and its place in different Aboriginal groups. • Place/role of the child is valued. • Value of school learning and participation in a wider community is at the core of learning.
Pedagogical Knowledge
Approaches to learning based in the physical and cultural context of the community: • A community-by-community approach. • Pedagogy is prefixed and influenced by the language group/s and recognition that children are 'English as additional language' speakers. • Cultural diversity, alignment of values and 'ways of acting' between groups are a feature. • The child's identity as a learner is understood and acted on – strength-based focus. • The child is an emotional, social, physical and intellectual being. • A holistic view of each child is the basis for designing learning to occur from "where the learner is." • There is an alignment of community and school values of what school learning is.
Content Knowledge
Australian curriculum embeds both declarative and procedural knowledge: • Learning is situated in the context of the culture/community. • Contextualised literacy and numeracy learning is evident. • Particular attention is given to General Capabilities. • Curriculum is designed on a non-graded basis for continuity for the learner. • Curriculum fits the learner not learner to fit the curriculum.

Note: Adapted from Thrupp, Hunt and Barrie, 2012. *Re-envisioning learning at Doomadgee State School.* p. 15. Reprinted with permission.

The pedagogical considerations within the design of these resources included problem-based learning with a driving question, independent learning approaches with individuals and/or groups moving at their own pace, deep learning, literacy learning, self-direction and self-regulation, and multiple pathways to learning the same content, all within the same or themed context.

This project was designed to give teachers the ‘whole’ package and provide them with a resource and model to include Indigenous Perspectives in their classes; through art, students would investigate cultural ways of Indigenous people including beliefs and relationships.

The learning experiences are designed for children to engage with the thinking and life of the artist to understand their culture through art. Indeed, the students would become artists in this project. Some learning experiences are designed for children to use the techniques of these artists to reflect on their own culture. Other experiences are designed for students to use the techniques of the Western Desert artists to reflect on the culture and environment of Western Desert artists, enabling a comparison between artists to be made. The learning experiences provide a rich mix of locating and reading information, creating works of art, and analysing art works toward conceptualising wider learning than art. The learning focuses on art, history and geography, reading, writing and mathematics through engaging with art.

The Technologies

A range of digital technologies have been used to connect with the university’s art collection:

- Real time video streaming with a virtual curator (using FaceTime and mView Broadcaster)
- Interactive electronic books (hyperlinks and embedded video/audio)
- Interactive PDFs (hyperlinks embedded)
- Hard copy post cards and activities
- Small video clips with a cultural perspective and to broaden the scope of the arts curriculum: stories and storytelling, dance, art classes and bush tucker

This technical and pedagogical development phase of Wondervision has concluded. At this point, the resources have been reviewed and researched and are reported here as a case study.

Note: mView is a commercial streaming app for use on a range of mobile platforms. Its advantage is that a broadcast can be recorded. Its disadvantage is that audio is not duplexed; instead students can text messages to the remote expert via a text window in the app. This in itself is an advantage as students focus on the dialogue from the expert and must think carefully about questions they post to the text window.

The Methodology

A case study (and qualitative) approach has been adopted for this review with teachers' interviews and analysis of student artefacts being the prime sources of data. Our interest was in answering the broad question: *what is going on when these resources are being used?* This is developed further as a set of more specific research questions:

RQ1. How have the resources contributed to teachers embedding Indigenous perspectives in the learning they design?

RQ2. To what extent do the different resources in digital learning environments engender changing attitudes to learning?

RQ3. How have these resources contributed to reconciliation with our Indigenous peoples?

Stories Gathered: Data School 1

Teachers at school one planned an eight-week arts-based integrated unit of work for their Year 5 students. Sixteen percent of the school's student population and the school principal declared an Indigenous heritage (72 students of 449 students). The Indigenous liaison works within the school and coordinates an Indigenous playgroup. Planning was undertaken in full consultation with representatives of the local Indigenous people, the Butchulla, who are actively involved in the life of the school.

Elements of this plan included:

- Identifying the relevance of Indigenous studies: what do students already know?
- Exploring aspects of Indigenous culture with local Butchulla people: respecting the original local people.
- Interpreting local Butchulla art works:
  - Exploring symbols of the Western Desert and comparing to the symbols of the local Butchulla and creating their own symbols.
  - Making comparisons between local art and that of the Western Desert: X-ray and marine art versus a bird's eye view.
- Participating in National Aboriginal and Islander Day Observance Committee (NAIDOC) week celebrations, making cultural understanding relevant and participatory.
- Making links to geography (maps) and history (events of the past).
- Developing students as active citizens.
- Creating artworks for the classroom and school environment that integrate the techniques of Western Desert artists and Butchulla people. See Image 1.

Image 1: Art by the students of Urangan State School.

Using The Resources: School 1

The teacher used the digital books available from the project to plan class activities. Students did use the eBooks available but this was hampered by the lack of iPads in the school. However, the hard copy cards provided many opportunities for students to engage in research using traditional desktop computers and the Internet. The cards were used as a part of Literacy rotations in the class (integration), where students worked collaboratively in small groups to interpret and complete tasks.

Two local Butchulla people, a class teacher-aide and a classroom teacher, assisted with program delivery and worked with small groups to develop large artworks for the school foyer. See Table 2 for comments and pedagogical advantages.

Table 2

Teacher Comments School 1

Comments	Pedagogical advantage
The cards worked well for independent work in small groups, although they could be easily used for individual activity/in student language and hence, children-friendly text.	The pedagogy of collaboration was evidenced.
Having a Butchulla teacher-aide and fellow teacher helped me and gave a sense of pride to the aide.	Building teacher personal knowledge and cultural respect.
The resources helped to tackle a topic I had been avoiding as I did not have resources readily available: I was worried I would do something wrong.	Providing the 'whole deal', the one-stop shop for the teacher.
These resources gave me a good background knowledge.	Personal growth (content knowledge).
The virtual tour of the gallery was awesome.	Communication and collaborating over a distance.

Table 2 *Teacher Comments School 1 (Continued)*

Comments	Pedagogical advantage
The kids could see a purpose and wanted to do well.	Making the curriculum relevant and purposeful.
The kids were so switched on.	Engaged learners.
The Indigenous kids became "the experts"; "gave them an area, where they were the experts."	Learning is situated in the context of the culture/community.
It was great to have an Elder come and speak to the class. I learned so much from her.	Connecting with community and culture.
The initial PD and ongoing support for the program sold me on this work.	Supportive environment.
The A4 cards were much more useful than the A5 cards.	This comment is about design, a lesson learned by the authors.
There wasn't too much techie stuff to get lost with.	Catering for diversity and keeping it simple.
The idea of bird's eye view was so useful in mathematics.	Integration and connectedness of curriculum.
These materials are real. The kids were working with real things about real people.	Connectedness of the curriculum, authentic.
The kids have started to understand that we are all the same.	Getting heads around stereotyping issues.

Teachers in this study used ICT in three ways: (a) for virtual tour of the Art Gallery using FaceTime providing access to full sized works in an Art Gallery context, (b) for e-book used on electronic whiteboard, and (c) for extended resources via URLs checked and provided

Stories Gathered: Data School 2

The Year 5 and 6 teacher at school two planned a six month Visual Arts Unit of work. This unit "fell into place" when the teacher attended the professional development for the Wondervision resources. As students had completed a unit on colours in term 1, this resource provided an obvious direction for further work. Sixteen percent of the school's student population declare an Indigenous heritage (35 students of 209 students). Planning was undertaken with due consideration for the Butchulla people, the local Indigenous people, who are engrained in the life of the school.

Elements of this plan included:

- Exploring colours and combinations with an emphasis on warm, earthy colours using templates of Indigenous icons
- Investigating aspects of story in Indigenous art with children writing stories with icons
- Creating personal interpretations based on the techniques used by Western Desert artists to represent local environments

- Using an investigation-creation cycle as a basis of learning

Using The Resources: School 2
Feedback from one teacher at School 2 is in Table 3.

Table 3

Teacher comments School 2

Comments	Pedagogical advantage
The learning experiences provided for whole class activities for foundation work, which was then applied individually.	The pedagogy of collaboration was evidenced.
Materials gave me a structure with which to work that did not westernise important Aboriginal business (different reasons for art, stories are different, icons are different).	Learning is situated in the context of the culture/community.
The resources were sufficient for a whole semester of study.	Providing the 'whole deal', the one-stop shop for the teacher.
Some students really got the idea that there is meaning in the stories.	Ways of knowing and valuing are paramount considerations.
The kids loved the art works and learning experiences.	Engaged learners.
It was great to have a resource that enabled me to connect with a major value of the school (local Butchulla culture)	Connecting with community and culture.
The package of resources built foundation knowledge (of teacher)	A community-by-community approach.
The A4 cards were much more useful than the A5 cards.	This comment is about design, a lesson learned by the authors.

Descriptive Analysis

The Wondervision resource was the stimulus for investigation of the local Indigenous culture, using the art of the Western Desert in Australia. Furthermore, in both cases, these learning opportunities would not have been available to students without the package. Both cases involved classes and teachers in schools where the local Indigenous group, the Butchulla people, are heavily involved in the school, and building cultural knowledge integral to the school curriculum; thereby their involvement in this research was evident. The teachers in these schools are seeking ways by which to build their knowledge of Indigenous perspectives and contribute to the vision of the school in this regard. The case studies differed in that in the first case art was used as the integrative device for an integrated unit of work whereas case two was an art unit focused only on art.

Similarities between the cases included:

- Learning with authentic resources was supported by a comprehensive package.
- Resources:
    - o Provided content knowledge for the teacher and thereby the confidence to engage in Aboriginal perspectives in way that was ethically sound.
    - o Provided a unit structure with pedagogical advantage (e.g., collaborative approaches, active learning, problem-based learning).
    - o Became a tool for both teachers and students.
    - o Were well received by students and appropriate to their levels
- E-learning aspects were limited by the lack of available ICT in schools; both teachers identified use of printed materials in association with digital materials in some instances, in preference to digital materials.

In both cases a disadvantage was the lack of ICT access (i.e., enough iPads, and connections for FaceTime for the whole class in primary schools).

Conclusions

Clearly, the assumption is that these resources provide teachers with a structure, which they require to work in the area of Indigenous perspectives. Following are the findings related to each of the research questions.

1. How have the resources contributed to teachers embedding Indigenous perspectives in the learning they design?

   The use of the Wondervision resources (Hunt & Thrupp, 2013a; Hunt & Thrupp, 2013b) provided the means by which teachers confidently and competently worked meaningfully with students with knowledge of Indigenous perspectives. Learning with Indigenous perspectives is a challenge for some Australian teachers as it as been embedded in the Australian curriculum (www.australiancurriculum.edu.au/). Teachers struggle with the knowledge required to provide content that culturally aligns with Indigenous perspectives. Consequently, teachers are looking for resources that provide depth and scope in learning for students by providing them with structure that enables effective learning design.

2. To what extent do the different resources in digital learning environments engender changing attitudes to learning?

   There are limitations to the influence of digital learning environments on attitudes to learning. These limitations remain firmly embedded in the access to ICT available in our schools. While the Wondervision resources (Hunt & Thrupp, 2013a; Hunt & Thrupp, 2013b) are designed to extend learning beyond the four walls of the classroom into contexts such as art galleries, information banks, and Internet sites that elaborate learning, the full extent of this capability is yet to be in evidence in some schools.

3. How have these resources contributed to reconciliation with our Indigenous peoples?

   Knowledge is the basis of reconciliation, and, certainly, the knowledge of these teachers and students has been widened and deepened for both the Western Desert people and the local Butchulla people. Understanding that there is not one Indigenous perspective but many and that there are many Indigenous peoples have resulted in major learning for teachers as a result of the project.

Acknowledgement of Country

The authors acknowledge the traditional custodians of the land on which they work and live and pays tribute to the strength and resilience of these people, past, present and future.

References

Hunt, J. (2014). Exploring culture in a digital world. In L. Morris & C. Tsolakidis (Eds.), *ICICTE 2014 Proceedings* (pp.312-322). Retrieved from http://www.icicte.org/Proceedings2014/HOME2014.htm

Hunt, J., & Thrupp, R. (2013a), *Western Desert art activities for years P-4.* University of the Sunshine Coast: Queensland, Australia.

Hunt, J., & Thrupp, R. (2013b), *Western Desert art activities for years 5-7.* University of the Sunshine Coast: Queensland, Australia.

Hunt, J., & Thrupp, R., & Barrie (2012), *Re-envisioning learning at Doomadgee State School.* Unpublished.

Keogh, B., & Naylor, S. (1997). *Starting points for science investigations*. Cheshire, UK: Millgate House Publishers.

Author Details

Rose-Marie Thrupp
rose_marie_thrupp@icloud.com

John Hunt
Huntj1@usc.edu.au

Stacey Cowell
scowe14@eq.edu.au

Ben Crowley
bcrow31@eq.edu.au

Leanne Whittaker
Lwhit13@eq.edu.au

Back to Contents page

ENCOURAGING STUDENT ENGAGEMENT WITH COLLABORATIVE SERIOUS GAMES: THE COCO FRAMEWORK

Prins Butt, Southampton Solent University
Gary Wills, University of Southampton
United Kingdom

Abstract

Collaborative serious games may offer new methods for encouraging student engagement but are currently underexplored in the literature. Their construction remains difficult partly due to a lack of conceptualisation. In this paper, we present COCO—a conceptual framework for collaborative serious games. We explore the validity of its components using t-tests to analyse the data from surveying and interviewing 10 experts and surveying 23 students. We find the results validate the framework and conclude that our framework provides an appropriate theoretical foundation for further research and can aid understanding and communication about collaborative serious games.

Introduction

Student engagement is a topic of interest to educators as correlations between student engagement and learning continue to be observed (Halm 2015). There is an abundance of research to indicate that engagement has an impact on learning. That is, students that fail to engage and fail to achieve academic success can become demotivated, abandon their study and be deterred from future educational opportunities (Kirby & Sharpe, 2001). Poor student engagement has consequences for academic institutions as it results in poor retention rates, which can have a negative impact on finances, accreditation and reputation (Baruah, 2011). Academic institutions are therefore continually identifying and pursuing reforms that seek to improve student engagement and retention (Anderman, 1997). Educators, for their part, have been trying to address student engagement for some time and with varying degrees of success. Two approaches that have been explored in the literature in this regard are collaborative learning and serious games. The benefits of collaborative learning are widely documented and accepted and its fundamental ideas are supported by social learning theories as articulated by Bandura (1977) and Vygotsky (1978). The role of technology in supporting collaborative learning has received considerable focus with computer gaming technology attracting more recent attention. The use of computer games in education has been growing in popularity and is the notion behind serious games. Whilst a variety of serious games already exist, most are designed for a single player, a limited number provide multi-player support and even fewer incorporate collaborative learning in their construction. The synergy between collaborative learning and serious games remains underexplored and whilst collaborative serious games may offer new methods of encouraging student engagement, their construction remains challenging not least due to a lack of conceptualisation in the literature.

In this paper we present a conceptual framework for collaborative serious games, which can be used to inform studies and methods that lead to their construction. We draw on knowledge and understanding from a number of disciplinary fields including learning theory, pedagogy and game design and identify five core dimensions that form the basis of the framework. The remainder of this paper provides a review of related work, the proposed framework and a discussion of the methodology and results of validating the framework. The paper concludes with a summary of the main contribution of this research and recommendations for future work.

Literature Review

Student engagement is a "broad construct" (Coates 2007, p. 122) and a variety of definitions and uses for this term exist in the literature (Appleton, Christenson, & Furlong, 2008). Despite considerable focus there is a lack of constancy in the application of any one definition. Some researchers have focused on behavioural components (Squires, Huitt, & Segars, 1981) such as attendance or the time spent on a task. Others have identified emotional (Skinner & Belmont 1993) and cognitive (Fredricks, Blumenfeld, & Paris, 2004) components indicating the importance of students engaging with their hearts and minds. For the purpose of this study, *student engagement* is understood as the energy exerted by students in educationally meaningful tasks and includes behavioural, emotional and cognitive components as well as a social dimension.

Collaborative Learning

Collaborative learning supports a social learning paradigm (Vygotsky, 1978) and describes situations "in which two or more people interact with each other and, in some circumstances, some types of interaction occur that have a positive effect" (Dillenbourg, Baker, Blaye, & O'Malley, 1996) on learning. It can be encouraged with group goals and individual accountability (Slavin 1988) and affected by group composition, group size and individual differences (Dillenbourg et al., 1996). It relies on social skills and positive interdependence (Laal, 2012), which can present challenges, but where meaningful collaboration takes place, can result in higher-order thinking (Ma, 2009) and significant contribution to student engagement and achievement.

Computer Supported Collaborative Learning

Computers offer new opportunities for communication and collaboration, and their role in computer supported collaborative learning continues to be explored. Research in this field has evolved with the technology from facilitating organisation and communication to providing intelligent tutoring systems and integrated collaborative working environments. More recently, the use of computer games has also received growing focus in this field.

Serious Games

Games are defined by rules, are interactive, involve goals, challenges, conflict and choice (Crawford 2003, p. 6). They have "variable and quantifiable outcomes" and require players to exert effort in order to influence the outcome (Juul, 2003). In their electronic form they are played by over 1.2 billion gamers (SpilGames, 2013) and make up a USD $75.5 billion global games market (NewZoo, 2014). Their popularity has attracted much academic interest leading to the field of serious games. These use instructional and game elements for non-entertainment purposes (Charsky, 2010) and are explored in academia as a means of motivating and engaging students. A number of frameworks for serious games already exist including the input-process-outcome model (Garris, Ahlers, & Driskell, 2002) and the four-dimensional framework (de Freitas & Oliver 2006). However, these are limited to single players and give little consideration to the social dimension of student engagement. More recent studies (Wendel, Gutjahr, Göbel, & Steinmetz, 2012; Vahdat, George, & Serna,. 2013) have investigated the idea of collaborative serious games but this area remains underexplored.

The COCO Framework

The proposed conceptual framework is shown in Figure 1 and consists of five dimensions and nineteen components.

Gameplay

The *Gameplay* dimension includes the features of the game that control how the game is played. This dimension consists of *Shared Goals*, *Gameplay Customisation*, *Feedback System*, *Team Progression* and *Team Ownership*. *Shared Goals* are specific, measurable, attainable, relevant and time-bound results that the group aim to achieve in the game. *Gameplay Customisation* is the functionality that is made available by the game that allows the players to directly modify the gameplay in accordance with their preferences. *Feedback System* is the functionality that is responsible for the type and the timeliness of feedback generated by the game and presented to the player before, during and after the gameplay. *Team Progression* is the functionality for managing progress made by the group towards achieving the shared goals. *Team Ownership* is the functionality for managing the degree of control and autonomy the players can exercise in tandem particularly in relation to the shared resources.

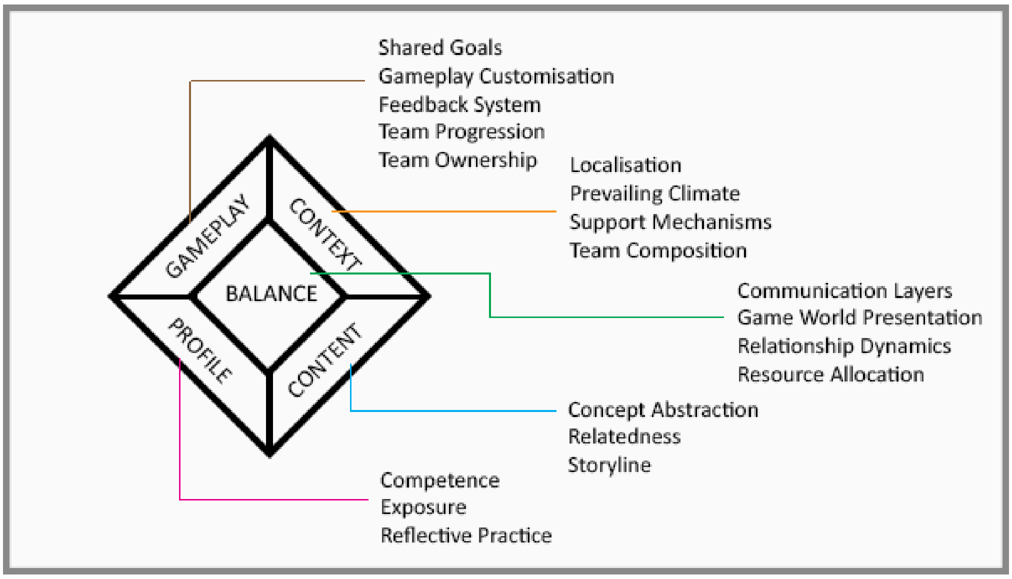


Figure 1. The COCO framework.

Context

The *Context* dimension relates to the entities and mechanisms that are external to the game and impact the game. This dimension consists of *Localisation*, *Prevailing Climate*, *Support Mechanisms* and *Team Composition*. *Localisation* is the degree to which the game is adapted for different locales including linguistic, cultural and legal and identity differences. *Prevailing Climate* is the emotional atmosphere in which the game is being played. *Support Mechanisms* are the type and extent of support available external to the game. *Team Composition* is the number of individuals that make up the team and their relative attributes, characteristics and traits.

Profile

The *Profile* dimension relates to a learner's prior learning and expectations. This dimension consists of *Competence*, *Exposure* and *Reflective Practice*. *Competence* is an individual player's state or quality of being adequately or well qualified to perform a task within a specific range of skill, knowledge or ability. *Exposure* is the breadth and depth of skills, knowledge and experience of a player. *Reflective Practice* is the degree of conscious analysis of practice and its significance exhibited outside of the gameplay.

Content

The *Content* dimension is the actual learning content provided in the game and consists of *Concept Abstraction*, *Relatedness* and *Storyline*. *Concept Abstraction* is the need and degree to which a concept or idea is abstracted in relation to its real-world concrete equivalent. *Relatedness* is the degree of affinity and connection between the learner and the subject matter. *Storyline* is the need and extent to which the storyline is interwoven into gameplay and has a purpose, is meaningful and supports progression.

Balance

The *Balance* dimension represents the components of the game that affect or are affected by the components in each of the other dimensions and controls the overall presentation of the game as well as the relationships in the game. This dimension consists of *Communication Layers*, *Game-World Presentation*, *Relationship Dynamics* and *Resource Allocation*. *Communication Layers* are the different means of exchanging information during gameplay and their relative information density. *Game-World Presentation* is the degree of realism, interaction and immersion offered by the gameplay. *Relationship Dynamics* is the balance between the relationships of all the players during gameplay. *Resource Allocation* is the distribution of available resources between the players.

Validation of the COCO Framework

Validation is the process by which the validity of results, concepts, theories and tests can be checked. In the case of the COCO framework, validation assesses the framework in terms of fitness-for-purpose to ensure that it is indeed derived from strong principles and evidence and supports its intended purpose.

Methodology

To validate our framework we used a mixed methods approach as this allows more insight to be gained than either a qualitative or quantitative method on its own (Stecklar, McLeroy, Goodman, Bird, & Mc-Cormick, 1992). Qualitative data was collected using individual interviews whilst quantitative data was collected using surveying.

Procedure

Two surveys were conducted. The first involving 10 experts, and the second involving 23 students. The 10 experts were selected for sampling based on the relevance and currency of their experience. Each expert completed a survey in which they indicated the level of importance of each component in our framework for a collaborative serious game using a Likert five-point scale ranging from 5 = extremely important to 1 = not at all important. The results of the survey were then interpreted using a one-sample t-test with the following hypothesis:

H_0: $\mu \geq 3.5$ Component is important for a collaborative serious game
H_A: $\mu < 3.5$ Component is not important for a collaborative serious game

Test Criteria: if p value ≤ 0.05 then reject null hypothesis H_0 in favour of alternative hypothesis H_A.

The same hypothesis was then tested in the second survey with each of the 23 students selected based on three criterion: the student is enrolled and actively studying a games development course, the student has completed a year of study at FHEA level 4, and the student has experience of group work.

A two-sample t-test was then performed on the two sample groups using the following hypothesis:

H_0: $\mu_{experts} = \mu_{students}$ Means of the two groups are the equal
H_A: $\mu_{experts} \neq \mu_{students}$ Means of the two groups are not equal

Test Criteria: if p-value ≤ 0.05 then reject null hypothesis H_0 in favour of the alternative hypothesis H_A else accept null hypothesis H_0.

The surveys were followed by individual interviews with experts during which they discussed their responses. The interviews were transcribed and verified before being analysed for further insights.

Results and Interpretation

Table 1 shows the results of performing a one-sample t-test with a significance level of 5% on the experts' survey data.

Table 1

Responses of Experts and One-Sample t-Test

Component	Expert A	B	C	D	E	F	G	H	I	J	One-Sample t-test p	Accept
Balance Dimension												
Communication Layers	4	4	4	4	5	2	4	4	4	5	0.9576	H_0
Game World Presentation	3	4	2	3	3	4	3	4	3	4	0.1866	H_0
Relationship Dynamics	4	3	1	4	5	4	3	5	2	5	0.5900	H_0
Resource Allocation	4	4	3	5	3	5	4	4	4	3	0.9387	H_0
Content Dimension												
Concept Abstraction	3	3	4	5	4	3	4	4	5	5	0.9576	H_0
Relatedness	4	5	2	5	5	4	3	5	5	5	0.9797	H_0
Storyline	2	4	1	4	4	4	5	4	3	5	0.5959	H_0
Context Dimension												
Localisation	5	4	3	4	5	2	3	3	3	4	0.6245	H_0
Prevailing Climate	3	3	2	2	5	3	4	4	3	5	0.3876	H_0
Support Mechanisms	4	4	4	4	5	4	4	3	4	5	0.9957	H_0
Team Composition	4	4	1	5	4	3	5	5	2	5	0.7427	H_0
Gameplay Dimension												
Feedback System	5	3	4	5	5	5	5	5	5	5	0.9998	H_0
Gameplay Customisation	5	3	2	2	5	4	3	4	3	4	0.5000	H_0
Team Ownership	4	3	1	4	4	3	4	5	3	4	0.5000	H_0
Shared Goals	5	5	3	4	3	5	4	5	5	5	0.9959	H_0
Team Progression	4	4	1	5	4	4	5	4	3	5	0.8409	H_0
Profile Dimension												
Competence	4	4	2	5	5	4	4	5	5	4	0.9803	H_0
Exposure	4	4	4	5	3	3	4	5	3	3	0.8701	H_0
Reflective Practice	5	3	1	5	4	4	5	5	4	5	0.9128	H_0

They indicate that the null hypothesis is accepted for each component in our framework indicating that each is important for a collaborative serious game. The p-values for the *Game-World Presentation* and *Prevailing Climate* components are < 0.5. Therefore we can infer that whilst not enough to reject the null hypothesis, these components exhibit statistically weak levels of importance to collaborative serious games. Conversely, with p-values greater than 0.99, the *Support Mechanisms*, *Feedback System* and *Shared Goals* components exhibit statistically strong levels of importance to collaborative serious games.

Table 2 shows the results of performing a one-sample t-test on the students' survey data. The results indicate that the alternative hypothesis is accepted for the *Prevailing Climate* and *Team Ownership* components, inferring that the students do not consider these two components to be important. With p-values < 0.5, the *Concept Abstraction*, *Storyline* and *Localisation* components also exhibit statistically weak levels of importance to collaborative serious games.

Table 2

Responses of Students and One-Sample t-Test

Component	Student A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	One-Sample t-test p	Accept
Balance Dimension																									
Communication Layers	4	3	5	4	3	2	3	4	4	5	5	4	4	5	3	4	4	2	4	5	4	5	3	0.9665	H_0
Game World Presentation	2	4	5	5	5	3	3	3	5	5	4	2	2	5	5	4	3	4	5	5	4	5	3	0.9697	H_0
Relationship Dynamics	1	4	5	4	4	2	5	3	5	5	5	4	4	3	4	5	3	5	4	4	5	4	4	0.9842	H_0
Resource Allocation	3	4	5	4	3	4	5	5	5	5	3	4	5	4	3	3	3	3	4	4	5	3	4	0.9928	H_0
Content Dimension																									
Concept Abstraction	3	4	5	5	3	3	2	4	5	3	2	3	2	3	5	4	2	2	3	5	4	3	2	0.2593	H_0
Relatedness	1	4	5	5	4	4	4	4	1	3	4	5	5	5	4	5	5	4	4	4	5	4	1	0.9326	H_0
Storyline	1	2	1	3	5	4	4	4	5	4	3	2	1	2	5	5	1	3	3	5	5	5	3	0.2677	H_0
Context Dimension																									
Localisation	3	3	5	5	5	3	3	5	4	4	2	2	4	3	3	3	5	4	2	3	3	2	2	0.3164	H_0
Prevailing Climate	2	4	4	3	5	2	2	4	5	3	4	3	1	4	3	3	2	3	3	4	2	3	2	0.0357	H_A
Support Mechanisms	3	3	5	4	4	4	3	5	5	2	5	4	5	2	3	5	4	5	2	4	3	2	2	0.7335	H_0
Team Composition	2	3	5	4	4	3	4	4	4	4	5	4	5	4	4	3	3	3	4	4	4	3	3	0.9293	H_0
Gameplay Dimension																									
Feedback System	4	3	5	3	3	4	4	5	3	5	4	4	4	4		4	4	5	5	5	5	4	4	0.9930	H_0
Gameplay Customisation	3	4	3	3	4	3	2	3	4	3	4	3	4	5	3	4	5	4	2	3	4	5	3	0.5485	H_0
Team Ownership	5	4	5	5	3	2	4	4	4	5	5	3	5	5	2	5	5	3	4	3	4	4	4	0.0097	H_A
Shared Goals	5	3	5	5	4	4	5	4	4	5	3	4	3	5	4	5	3	4	4	4	4	3	5	0.9998	H_0
Team Progression	4	3	1	4	4	3	2	4	3	4	2	3	3	4	4	2		2	2	4	3	2	3	0.9997	H_0
Profile Dimension																									
Competence	3	3	2	4	5	4	3	5	5	4	5	3	5	4	4	2	4	5	3	3	3	4	3	0.8776	H_0
Exposure	4	3	5	4	4	2	4	5	3	4	4	3	5	4	4	4	4	4	3	5	4	4	4	0.9935	H_0
Reflective Practice	5	4	5	2	4	5	3	4	4	4	4	4	4	4	4	4	5	5	3	4	5	3	3	0.9967	H_0

A two-sample t-test shows no statistically significant difference at the 5% significance level between the two groups for all but the *Game-World Presentation* (p=0.0463) and *Feedback System* (p=0.0354) components. Whilst both groups consider both of these components important, students consider the *Game-World Presentation* to be more important than is deemed by the experts. Similarly, the experts consider the *Feedback System* to be more important than is deemed by the students. During interviews, six experts expressed the view that realism in the *Game-World Presentation* could be compromised, which may explain the difference in view between experts and students. For example, one expert stated, "It's nice to have a degree of realism," but elaborated, "It can be a significant factor but not necessarily a deciding factor with regards to immersion. There are games that can be less realistic but offer deeper levels of immersion." Three experts cited cost as a factor with one expert stating, "I think it could be [realistic] but the cost is so high. It is not necessary." With regards to the *Feedback System*, all ten experts expressed it as being very important with one stating, "It is essential. It is essential. It is important that students are getting constant feedback and it definitely has something to do with the level of engagement. It definitely keeps them engaged and informed of how they are doing at any point." A recurring view expressed by the experts is the link between feedback and student engagement, which may explain why the experts rated the *Feedback System* so highly. In relation to the *Prevailing Climate*, two experts stated that it was not important, whilst a further three felt it was dependent on the players. For example, one expert expressed, "I think that this one depends on people. Personally I think I am good at ignoring the noise," whilst another offered, "It would have some effect on you so you would have to make sure the game is playing in the right climate. So it is important but I don't think it's necessarily essential." One expert felt that "distractions" in the prevailing climate could "stop the students from paying attention to the game or from benefitting from the game's objectives" and suggested, "We should have a controlled environment." One expert in relation to Game Customisation also expressed this idea of a *controlled environment*:

> At the end of day you want to achieve the learning objectives of a particular unit using games. I don't think students should be given the opportunity to customise the game. The game should be designed by the tutor or lecturer and the students should just play it.

The other experts felt that being able to customise the game could be useful and expressed accessibility as a recurring view. The experts provided similar insights regarding the remaining components with the results broadly validating the COCO framework.

Conclusion

We have explored the synergy between collaborative learning and serious games in the form of collaborative serious games. We have developed a conceptual framework to explain the core components of collaborative serious games and their relationships. We have evaluated our framework by analysing the results of student surveys and expert surveys and interviews and found that the results support our framework. We expect that our framework can aid understanding and communication related to collaborative serious games and can contribute to studies and methods that lead to their construction. As future work we plan to further validate our framework and use the framework to inform the design and development of a collaborative serious game.

Acknowledgements

This research is used for writing up a PhD thesis at the University of Southampton. I would like to thank Gary Wills for his PhD supervision and my colleagues Jomo Batola and Neville Palmer for their feedback during the drafting of this paper.

References

Anderman, E. M. (1997). Motivation and school reform. *Advances in Motivation and Achievement*, *10*, 303-337

Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008). Student engagement with school: critical conceptual and methodological issues of the construct. *Psychology in Schools*, *45*(5), 369-386

Bandura, A. (1977). *Social learning theory*. Upper Saddle River, NJ: Prentice-Hall.

Baruah, T. D. (2011). Improving student retention through technology in India. *The Asian Society of Open and Distance Education*, *9*(2), 15-25.

Charsky, D. (2010). From edutainment to serious games: A change in the use of game characteristics. *Games and Culture*, *5*(2), 177-198.

Coates, H. (2007). A model of online and general campus-based student engagement. *Assessment and Evaluation in Higher Education*, *32*(2), 121-141

Crawford, C. (2003). *Chris Crawford on game design*. San Francisco, CA: New Riders.

de Freitas, S., & Oliver, M. (2006). How can exploratory learning with games and simulations within the curriculum be most effectively evaluated? *Computers & Education*, *46*, 249-264.

Dillenbourg, P., Baker, M., Blaye, A. , & O'Malley, C. (1996). The evolution of research on collaborative learning. In E. Spada & P. Reiman (Eds.), *Learning in humans and machine: Towards an interdisciplinary learning science* (pp. 189-211). Oxford: Elsevier.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 4*(1), 59-109.

Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation and Gaming, 33*(4), 441-467.

Halm, D. S. (2015). The impact of engagement on student learning. *International Journal of Education and Social Science, 2*(2), 22-33.

Juul, J. (2003). The game, the player, the world: Looking for a heart of gameness. *Proceedings of Level Up: Digital Games Research Conference* (pp. 30-45).

Kirby, D., & Sharpe, D. (2001). Student attrition from Newfoundland and Labrador's Public College. *Alberta Journal of Educational Research*, *XLVII*(4), 353-368.

Laal, M. (2013). Positive interdependence in collaborative learning. *Procedia - Social and Behavioral Sciences*, *93*, 1433-1437.

Ma, A.W.W. (2009). Computer supported collaborative learning and higher order thinking skills: A case study of textile studies. *Interdisciplinary Journal of E-Learning and Learning Objects*, *5*, 145-167.

NewZoo.(2014). *Towards the global games market in 2017. A broad look at market growth by screen & region.* Retrieved from http://www.newzoo.com/insights/free-casual-games-sector-report-towards-global-games-market-2017/

Skinner, E., & Belmont, M. (1993) Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Research and Technology in Education*, *85*(4), 571-581.

Slavin, R. E. (1988). Cooperative learning and student achievement. *Educational Leadership*, *45*(2), 31-33.

SpilGames. (2013). *State of online gaming report*. Retrieved from http://www.spilgames.com/state-online-gaming-2013-2/

Squires, D. A., Huitt, W. G., & Segars, J. K. (1981). Improving classrooms and schools: What's important. *Educational Leadership*, *39*(3), 174-179.

Stecklar, A., McLeroy, K. R., Goodman, R. M., Bird, S. T., & Mc-Cormick, L. (1992). Toward integrating qualitative and quantitative methods: An Introduction. *Health Education Quarterly*, *19*(1), 1-8.
Vahdat, M., George, S., & Serna, A. (2013). Wizard of Oz in designing a collaborative learning serious game on table tops. *International Journal of Information and Education Technology*, *3*(3), 325-329.
Vygotsky, L. S. (1978). *Mind in society: Development of higher psychological processes*. Cambridge, MA: Harvard University Press.
Wendel, V., Gutjahr, M., Göbel, S., & Steinmetz, R. (2012). Designing collaborative multiplayer serious games for collaborative learning. *Proceedings of the CSEDU*, *2*, 199-210.

Author Details

Prins Butt
prins.butt@solent.ac.uk
Gary Wills
gbw@ecs.soton.ac.uk

Back to Contents page

ON THE NATIONAL EDUCATIONAL TECHNOLOGY STRATEGIC PLAN 2012-2017: THE IMPORTANCE OF ESSENTIAL CONDITIONS AND RIGOROUS PILOTING

Maria Ghosn-Chelala
Notre Dame University – Louaize
Lebanon

Abstract

The National Educational Technology Strategic Plan 2012-2017 of the Ministry of Education and Higher Education (MEHE) advocates access to and integration of technology in Lebanese public school classrooms to support curricular goals. The rationale for the plan is grounded in research based on a literature review. Considering the critical task of technology integration currently underway in Lebanon, this paper explores associated problems, namely ineffective piloting and procurement procedures. Recommendations are made to help ensure a data-driven ICT selection approach and essential conditions for achievement in the context of local public schools considering Lebanon's challenging education landscape.

Introduction

In the context of the digital age and curricula for building 21st century skills, technology is viewed as pivotal to providing current and supportive learning environments and competing in the global market. While the Lebanese National Curriculum does not yet address this, educational institutions around the world, and even some local private schools, have been integrating technology in their classrooms for years. To that end, the Ministry of Education and Higher Education (MEHE) published a National Educational Technology Plan in 2012. The plan proposes that all students must have suitable access to technology in class to support curricular goals by 2017. The foundation of the plan is mainly a literature review with limited local practical, empirical evidence on information and communication technology (ICT) integration to draw upon. Two national pilots are mentioned in the plan. However, they do not form a major basis for the recommendations, possibly due to their small size. To quote, in describing the plan the authors write:

> If followed, this document serves as a guide or what to do – and what not to do – to assure a greater likelihood that educational technology can support reforms in teaching and learning. This does not mean that mistakes will not occur nor false starts be taken…rather, it means that program designers and implementers can draw upon, and contribute to, a reservoir of usable knowledge about how to use technology to improve teaching and learning and design programs for the Lebanese educational system that build on best practice. (MEHE, 2012, pp.9-10).

This is an appropriate initiative in terms of strategic planning. Possible *false starts* or *mistakes* can be costly and hinder the learning/teaching process. In any such endeavour, technology selection and piloting is pivotal whereby efficient decision-making is critical within the local education landscape. To that end, the purpose of this paper is twofold:

1. Focusing on selection and piloting, explore problems related to desirable classroom integration of ICT.
2. In light of Lebanon's National Educational Technology Strategic Plan and in the context of desirable classroom ICT integration for Lebanese public schools, make recommendations to help ensure essential conditions and a technology selection approach with rigorous piloting.

Background

To ground this work, an overview of the National Educational Technology Plan 2012-2017 is presented in this section. Documented complexities of a general nature and those related specifically to Lebanese schools are then considered with a focus on ICT integration, essential conditions, and key activities such as piloting.

The National Educational Technology Plan

The MEHE published a National Educational Technology Plan for 2012-2017. The plan proposes that students must have sufficient access to technology in class to support curricular goals by 2017, with detailed implementation plans to be outlined incrementally starting with cycle 1. This is dependent on the curriculum review currently taking place with a new competency-based rather than knowledge-based curriculum to be developed by the Center for Educational Research and Development (CERD); it is estimated that this will be completed in 2017.

The rationale for the technology plan is grounded in literature based on a literature review commissioned by the MEHE prior to the development of the strategy (MEHE, 2012). Overall, six areas for guidance are presented in the strategic plan: procurement; placement and maintenance; support for curriculum, content, instruction, and assessment; ongoing professional development, formation, and support; implementation and support; and evaluation. Well-known challenges currently faced by public schools in Lebanon are also documented. In terms of ICT, these challenges include the absence of any national curriculum or standards for technology and uneven technology infrastructure. Further, related challenges are: excessive focus on content-based official exams along with a perceived lack of high-quality instruction, inadequate teacher training, a shortage of qualified teachers in certain regions, a dearth of local research data, and low achievement of students. The strategic plan discusses how technology may assist in addressing these weaknesses; given the lack of local, reliable, empirical research, the literature on which recommendations are based consists mostly of related learning theories and research on educational technology conducted outside Lebanon. Two national pilots for integration of ICT devices initiated in 2012 are mentioned. However, their relevance to implementation plans is not discussed in depth. The plan notes that these pilots, or new ones, could be expanded due to their relatively small size of 400 students (MEHE, 2012).

An important aspect of the plan is cultivating digital literacies along with integration of technology into curriculum and deepening of content knowledge with competencies based curricula. This is pivotal in the current global, digital age where students need to keep up with required and changing skill sets. Throughout the text, the *centrality of learning* is emphasized, where the vision is that every decision made will focus on improving all students' quality of learning. Areas addressed by the plan required for a holistic approach are:

- Procurement
- Placement and maintenance
- Support for curriculum, content, instruction, and assessment
- Ongoing professional development, formation and support
- Implementation and support
- Evaluation (MEHE, 2012)

As for the national procurement policy for ICT advised to be set up, in summary the focus of goals is to establish clear guidelines for procurement, transparency and fairness for bids, maintenance and support, training and solicitation of feedback from stakeholders. The plan calls for political pressures to be neutralized; this is well placed given the local culture of referrals and possible relation of public figures to privately owned vendor companies. Placement and maintenance refers to introduction of technology into schools and its upkeep. These activities complement technology integration into the curriculum and necessitate professional development to help educators use technologies effectively. Evaluation is a key component to help assess and calibrate technology use in line with learning goals.

Complexities of Classroom ICT Selection and Piloting

Research shows that for effective technology integration, teacher training in tandem with decision-making at the administrative level both play a significant role. With the growing plethora of educational technology products on the market, there is often not enough data to inform decision-makers when procuring technology for school use. Furthermore, purchasing can often be based on referrals; due to this, vendors are not inclined to carry out empirical studies on their products (EIA, 2014). Therefore, evaluating technologies for educational use to yield useful data for integration decision-making is left to academicians. Effective piloting is to be considered in this case.

> 'Piloting' of an ICT project is defined as the implementation of an ICT technology, software, or related project on a small controlled scale to allow for its full impact, benefits and weaknesses to be evaluated before implementation on a regional or nationwide basis. (GeSCI, 2009, p.6)

With the lack of empirical data to inform procurement decision makers, in districts in the USA, research shows a reliance on both referrals and pilot studies conducted on an independent basis within districts that wish to procure technology for classroom use. Interviews with educators from various districts indicate that the pilots conducted are more or less informal, like "tryouts" (EIA, 2014). Furthermore, rigorous pilots tend to present extra work for teachers. One challenge when trying to implement pilots is attempting to keep the work limited or simple enough such that it does not present a heavy load for teachers. Guidelines for structured pilots that do not appear taxing for teachers to yield empirical data were considered helpful by interviewees in the EIA's study. Overall, the results of pilots may not be reliable, lacking "structured, data-driven approaches with clear and inclusive decision-making processes within pilots" (EIA, 2014, p.14).

Alongside this, lack of empowerment or *inclusive decision-making* is prevalent in centralized systems. The feedback of students and teachers is highlighted as central to the piloting and evaluation process. However, teachers and students are more often than not some of the least involved stakeholders in the process, even when assessing instructional needs (EIA, 2014; UNESCO, 2002). Ministries draw up plans to equip schools with ICT, but ICT's are often considered a solution for a problem that is not clearly defined. Infrastructure and acquisition of technology is often given more importance than content, in some ways putting the cart before the horse: for instance, the purchase of tablets before thoroughly considering the specific learning problems to be solved or even properly considering potential disadvantages. Decisions about infrastructure are often separate from educational needs and made by technology professionals or administrators (UNESCO, 2002). Formal, instructional needs assessments are essential and must be the first step. Often, these are informal, incomplete, or non-existent (EIA, 2014).

Given the complexities of decision-making related to technology procurement for classroom integration, Global e-Schools and Communities initiative (GeSCI), presents a system-wide approach for effective deployment of technology in schools (see Figure 1).

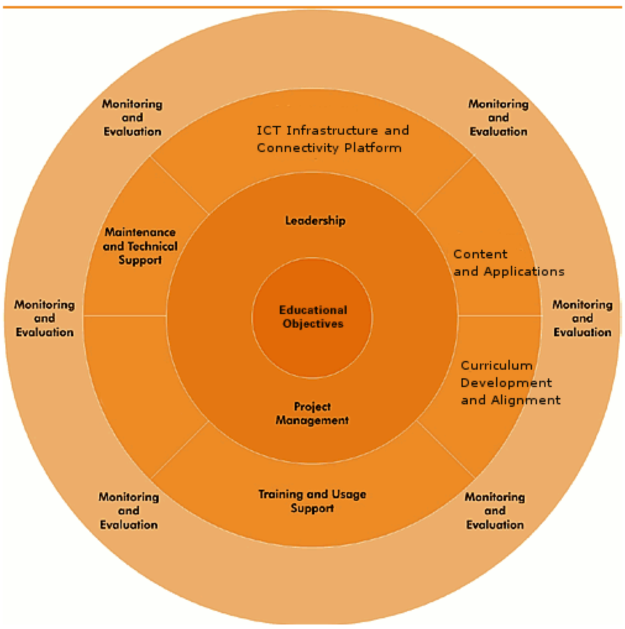


Figure 1. GeSCI system-wide approach.

The parts of this approach form a non-negotiable whole, which must be "comprehensive, demand-driven, efficient and well-coordinated" (GeSCI, 2009, p.5).

Educational objectives are central to any endeavour and so it is with the strategic plan. Therefore, procurement of virtually any sort of technology before determining curricular and learning goals along with learning problems to be solved can end up being ineffective: "It is important to not mistake infrastructure decisions for implementation planning, which may cause the system-wide transition to fall short of student engagement and achievement goals" (ISTE, 2015). Certainly, implementation planning is essential in any process; it grounds technology deployment (ISTE, 2015). In fact, 14 essential conditions to support technology in education are listed by the International Society for Technology in Education (ISTE). These include implementation planning, training, shared vision, evaluation, skilled personnel, curricular alignment, technical support, and empowered leaders. Essential conditions provide the means and support needed for sustainable and effective ICT integration (Roblyer & Doering, 2013; Smaldino &Lowther, 2012). In Figure 1, it is clear that essential conditions form part of the system-wide approach. Similar areas are recognized in the strategic plan as detailed in the previous section of this paper. Essential conditions add multiple layers of complexity to the selection and procurement process as internal factors making them critical for successful, sustainable integration. In support of a system-wide approach, effective piloting and selection of ICT are indispensable for long-term achievement.

Selection of ICT in Local Private Schools

Many private schools in Lebanon integrate technology to support learning activities. To compete in the digital age and global marketplace, integration has become necessary and expected, especially in schools demanding high fees. However, it is safe to say there are numerous challenges and shortcomings. For instance, the need for piloting as well as training and support is recognised in the strategic plan and highlighted in essential conditions and the system-wide approach (ISTE, 2015; Roblyer & Doering, 2013, GeSCI, 2009). However, a study of technology selection at four local private schools by Assaf (2015) indicates piloting is not prevalent on the agenda when it comes to ICT integration. At the administrative level, hardware such as interactive whiteboards was purchased without prior piloting or a clear indication of how it would serve to meet learning challenges or solve well-defined learning problems. Teachers are seldom asked for feedback regarding procurement decisions and in most cases lack sufficient training to contribute and integrate technology meaningfully. Training provided has focused mainly on the technical aspect of using given technologies such as the interactive whiteboard rather than on integration to address learning problems and curricular goals. Therefore, although technology may be provided, its use is limited. When integration of ICT was discussed in interviews, teachers did not have an agreed upon strategy or criteria for selecting applications. Though the sample of interviewees is limited, it reflects the shortcomings documented in literature on poor technology integration approaches and decision-making. In terms of training, Ali (2003) purported that teachers should be trained to use and integrate technology before any sort of technology is provided in the school. With the cost of technology placement and the need for effective integration of technology, this approach merits consideration.

Discussion and Recommendations

Given the limited integration of technology in Lebanese public schools, it is wise to tread carefully. In general, one problem with centralized approaches is that many ministries and governing bodies have limited experience in broad scale technology deployment and integration. Therefore, rigorous piloting and selection as well as guarantee of essential conditions must serve to support this process if the hope of *improved learning with technolo*gy is to be reached.

Selection, Piloting, and Integration

Complete implementation plans for ICT integration into Lebanon's public schools are to be finalized incrementally. For decision-making to be adequately informed, and to support desirable ICT integration practices, pilots can provide local, empirical data that reveal needs and suitability of technologies. Pilots should also be straightforward enough for teachers to participate in without having to fill in laborious amounts of data or perform overly complex tasks themselves or with students. At the same time, paying adequate attention to feedback from students and teachers who are actually involved in the teaching/learning process is key. Ensuring a well defined, sustainable process to actively seek and use structured feedback and empirical data from the classroom on a larger scale than previously acquired will require adequate training of staff to undertake the pilots. Lack of proper piloting and feedback at various institutional levels (from student to teacher, to administrators and ministries) often reflects centralised decision-making in the education sector whereby decisions are made in an autocratic fashion by an *oligarchy*. For example, before deciding that equipping all schools with interactive whiteboards or students with tablets, pilots would take place at multiple grade levels in different regions and school tiers; student learning experiences and achievement based on learning outcomes would then be evaluated to assess the benefit of this technology. National pilots thus far have been small and focused only on particular grade levels, possibly with contributing factors of lack of trained staff and budget to implement large pilots. Differences in the needs of grade levels and schools should be considered. Individual schools or areas may exhibit different needs in terms of access to resources and ICT infrastructure as well as teacher training. These would need to be studied for integration to be effective and sustainable. In terms of classroom learning, pilots should be conducted in answer to a well-defined learning problem existing in Lebanese schools rather than be rooted in an idealistic or perhaps general view of what ICT integration *should* look like. Re-exploration and definition of learning problems would be needed with implementation of the new curriculum. Furthermore, for pilots to be carried out effectively teachers would need to be well trained, and adequate funding would have to be allotted. These factors also possibly contribute to the previously small size of pilots.

Essential Conditions and the Local Education Landscape

Successful ICT integration is closely tied to essential conditions. The *essential conditions* in developing and post-conflict countries such as Lebanon may go beyond the 14 defined by ISTE but may be considered in what ISTE defines as supportive external context. These cannot be ignored, when looking at return on investment (ROI). One must ask whether there are other essential areas where funding and effort are required to create learning spaces conducive to 21st century learning. For instance, appropriate training of teachers before technology is introduced into schools should be considered to maximize efficacy of resources. Without a guarantee of essential conditions including but not limited to training, incentives, resources, shared vision, and supportive external conditions, ICT integration initiatives, including pilots, will fall short. Given the education landscape in Lebanon, external conditions and incentives are challenging as already mentioned. For instance, teachers in public schools have held multiple strikes demanding increases in remuneration; the latest strike took place on Thursday, April 23, 2015. Public school teachers along with some private school teachers took to the streets demanding that Parliament address the long-awaited wage hike ("Teachers go on Strike," Apr 24, 2015; Naharnet, 2015). Motivation and incentive to integrate technology and learn new skills is critical, as teachers tend to show reluctance towards updating their skills (UNESCO, 2002). Public schools in this sense are at a disadvantage, as private schools are often able to pay higher salaries and provide additional remunerations. Therefore, these private schools have the potential to attract the most highly qualified of teachers.

Not only is teacher remuneration problematic, but also general public school funding is an issue. Many public schools are barren and ill equipped. To add, the influx of Syrian refugees amounting to one quarter of the population and the highest refugee per capita in the world (UNHCR, 2014), with many children needing to join public schools, has taxed budgets and made conditions in all public services even more challenging than before. According to UNHCR (2014), half of the Syrian refugees are children, with school-aged children at over 400,000. Lebanese public schools have accepted around 100,000 Syrian students. After Pestalozzi's example, before teaching hungry children, we need to feed them. Although this may be an extreme example, its moral still applies. Likewise, expectations of technology should not be unreasonable, and are to be considered with external, environmental factors, such as the political situation (Hennessy, Ruthven, and Brindley as cited in Mndzebele, 2013) and capacity of national resources. Thus, alongside discussing technology integration, basic needs and comforts should be provided for students and teachers. This is by no means to say that ICT is extraneous, but rather that timing and support for education as a whole is also of the essence and that for long-term, sustainable achievement and successful implementation of any initiative including ICT, the most basic of conditions must be satisfied.

Finally, challenges exist with respect to the national curriculum. The current curriculum was implemented in 1997, lacks any integration of technology and focuses on knowledge-based learning encouraging direct teaching approaches. The complete and much-needed curriculum review is currently underway and ICT integration will inevitably need to be connected to this process.

Impressions of Private School Practices
Related issues at local private schools can also bring to light undesirable practices in ICT selection and integration. Based on the four schools mentioned in the literature, not much attention is paid to pilots or evaluation of technologies such as software applications for classroom use. Furthermore, training often focuses on technicalities of using various technologies rather than integrating technology to enhance and improve learning experiences. Technology is continuously developing, and a versatile skill set with ongoing professional development, noted in the strategic plan, is needed for long-term achievement. With their professional development, teachers should be viewed as both stakeholders in the process and as one of the most valuable inputs of information for decision-making. However, decision-making in private schools appears centralized with little teacher and student involvement. Student feedback, which is often neglected, should be highlighted in importance for a democratic, participative integration in line with 21st century ideals, rather than a top-down, autocratic one. This problem is not only present locally, but is found widely in the literature on ICT selection and integration. Although there are local private schools that are ahead of others in ICT integration, the lack of national standards for ICT has most likely made it challenging for private schools to integrate technology, having little guidance and little opportunity for training in the field. Alongside this, learning problems must be well defined so ICT can be integrated more effectively.

Recommendations

Given the local context and dire circumstances affecting the education landscape in Lebanon, careful piloting for selection and procurement of ICT in line with well-defined learning goals is ever more critical.

Therefore, we may add basic, essential elements or conditions for consideration to the holistic approach discussed in this text to reinforce their prevalence:

1. Guaranteed supportive learning spaces conducive to 21st century learning (with and without technology).
2. Guaranteed teacher incentives for excellence in teaching to promote improved learning experiences with ICT integration.

Given that resources and teacher professional development are among the essential conditions for ICT integration, they need to be guaranteed. As the curriculum will be changing, definition of learning goals and clarification of learning problems through empirical evidence along with guaranteed, appropriate professional development will be pivotal to the effective integration of ICT. Data on classroom-level needs and educational objectives should lead the way. The above two points can contribute to readiness that is mentioned numerous times in the strategic plan having various facets including willingness of teachers, school contexts, as well as a budget for ICT resources. Part of the recommended action plan described also includes the MEHE identifying necessary teacher incentives. In considering potential incentives, merit-based pay could be studied to encourage poorly remunerated teachers to participate in rigorous pilots, professional development activities, and ICT integration. Proper formation in these areas is essential for limited funding to be effectively allocated. It must be noted that existing political pressures and nepotism, a subject beyond the scope of this paper, would have to be adequately neutralized to achieve positive ROI. Furthermore, evaluation and accountability systems that are discussed in the plan, may prove to be frustrating without other incentives given the current landscape.

Conclusion

As the new national curriculum is still subject to development and implementation, and the current curriculum is sorely outdated, decisions at this point are critical. Researchers and technology vendors recommend procuring technology based on local instructional needs at the classroom level, not solely on an idealistic view of what learning is. An inclusive, non-autocratic, data-driven process with ample feedback from pilots bearing in mind grade levels and learning needs is imperative for decision-making. This being said, basic essential conditions play a pivotal role. For long-term achievement in ICT integration, incentives for teacher participation and excellence such as merit-based pay as well as fully supportive learning spaces must be considered in tandem with strained budget. In Lebanon's unique political situation, an external supportive context coupled with further consideration of the education landscape is fundamental to the success of initiatives and must be in place for appropriate ICT selection decisions in Lebanese public schools.

References

Ali, A. (2003). Faculty adoption of technology: Training comes first. *Educational Technology: The Magazine for Managers of Change in Education*, *43*(2), 51- 53.

Assaf, C. R. (2015). *Selecting appropriate digital applications in fopreschools in Lebanon* (Unpublished master's thesis). Notre Dame University - Louaize, Zouk, Lebanon.

Education Industry Association. (2014). *Improving ed-tech purchasing: Identifying the key obstacles and potential solutions for the discovery and acquisition of K-12 personalized learning tools.* Retrieved from http://www.digitalpromise.org/page//dpdocuments/marketplace/Improving_Ed-Tech_Purchasing.pdf?nocdn=1

Global E-Schools and Communities Initiative. (2009, June). *Deploying ICT's in schools: A framework for identifying and assessing technology options, their benefits, feasibility, and total cost of ownership*. Retrieved from http://www.gesci.org/old/files/docman/TCO-deploying-framework.pdf

International Society for Technology in Education. (2015). *Essential conditions*. Retrieved from http://www.iste.org/standards/essential-conditions

Ministry of Education and Higher Education. (2012). *Teaching and learning in the digital age: Lebanon's National Educational Technology Strategic Plan.* Retrieved from http://www.mehe.gov.lb/uploads/file/tlsp.pdf
Mndzbele, N. (2013). Teachers' readiness in using ICT in the classroom: The case of a developing country. *International Journal of Information and Education Technology*, *3*(4), 409-412. Retrieved from http://ijiet.org/papers/309-JR122.pdf
Nahranet. (2015, April 24). Mahfoud warns: SCC to paralyze school year. Retrieved from http://www.naharnet.com/stories/en/176499-mahfoud-warns-scc-to-paralyze-school-year
Roblyer, M., & Doering, A. (2013). *Integrating educational technology into teaching* (6th ed.). Boston, MA: Pearson/Allyn and Bacon.
Smaldino, S. E., Lowther, D. L., & Russell, J. D. (2012). *Instructional technology and media for learning* (10th ed.). Boston, MA: Pearson/Allyn and Bacon.
Teachers go on strike to demand long-awaited wage hike. (2015, Apr 24). *The Daily Star Lebanon.* Retrieved from http://www.dailystar.com.lb/News/Lebanon-News/2015/Apr-24/295582-teachers-go-on-strike-to-demand-long-awaited-wage-hike.ashx
United Nations Educational, Scientific, and Cultural Organization (UNESCO). (2002). *Technologies for education: Potentials, parameters, and prospects.* Retrieved from http://unesdoc.unesco.org/images/0011/001191/119129e.pdf
United Nations High Commissioner for Refugees (UNHCR). (2014, Apr 3). *The number of Syrian refugees in Lebanon passes the 1 million mark.* Retrieved from http://www.unhcr.org/533c1d5b9.html

Author Details

Maria Ghosn-Chelala
mchlela@ndu.edu.lb
mariachelala@gmail.com

Back to Contents page

A LEARNING MANAGEMENT SYSTEM'S EFFECT ON PEDAGOGY

Voula Karvelas
Melbourne Graduate School of Education
The University of Melbourne, Australia

Abstract

A study of a learning management system (LMS) used by two secondary school teachers to deliver a unit of work to middle-school students was conducted to examine the planning and development of a virtual learning environment (VLE) and determine the LMS's effect on pedagogy. Data was elicited via observation of the teachers' planning sessions, interviews and a survey rating teachers' perceptions of their VLEs. The study revealed that pedagogical design using an LMS was governed by three key factors: teachers' philosophies about teaching and learning, teachers' teaching styles and repertoires, and the LMS's pedagogical bias and usability.

Introduction

The widespread use of learning management systems (LMSs) in educational institutions has prompted the need to investigate pedagogical design of the virtual learning environments (VLEs) created by using such software. Especially when examining the usability of LMSs and VLEs, it is important to make the distinction between an LMS and a VLE (particularly in light of the fact that the two are often confused or interchanged in literature); an LMS is the tool used to create a VLE – as explained in the Definitions, following.

This paper reports on the results of a study that examined the effect on teachers' pedagogies when using an LMS, revealing that the way the developers designed the software influenced the way that teachers teach. This, coupled with the teachers' philosophies on teaching and the teachers' teaching styles, governed the pedagogy implemented when using an LMS.

Educational institutions have adopted web-based LMSs to be used as both administrative systems and as pedagogical tools. Used as administrative tools and as general content management systems (CMSs), LMSs have the potential to be extremely convenient for both student administration and for content management, but there is strong criticism of their use as pedagogical tools; research indicates that "passive models of teaching and learning" are encouraged by using LMSs in their current state, rendering them "page-turning tools" (Steel, 2009, p. 400). The notion of LMSs as simplistic platforms that fail to adequately provide the environment for sophisticated pedagogical practices has been expressed by researchers who have critically examined the effects of LMSs on teaching and learning (cf. Coates, James, & Baldwin, 2005, pp. 26-27). Criticism has subsequently led to a less teacher-centred emphasis in LMS design as LMSs become more adaptive and learner-oriented by "putting student's expectations, motivation, habits, learning styles, needs, etc., in the focus of interest" (Despotović-Zrakić, Marković, Bogdanović, Barać, & Krčo (2012).

Whether LMSs become more sophisticated and learner-centric and overall more adaptive, the teacher-developers of the VLEs still develop the content and largely drive the pedagogy; thus, a comprehensive examination of an LMS requires examining teacher-developers' own styles, philosophies and their techno-pedagogical skills to reveal the effectiveness or limitations of LMSs.

Definitions

An *LMS* refers to a (proprietary or open-source) program used to develop, assemble and deliver personalised learning content. LMSs are sometimes referred to as *content management systems, learning content management systems, course management systems, portals, courseware, instructional management systems, e-learning suites* or *online delivery platforms*. Popular open source LMSs such as *Moodle* or *Claroline* and commercial LMSs such as *Blackboard* or *Scholaris* are examples of LMSs. While there is no agreed terminology for these terms and their differences (LMS cf. CMC, for instance), Alfadly (2013) claims the "primary objective of LMS in educational settings […] is to manage learners, i.e., to track their implementation and performance across different types of learning activities. In contrast, CMS or LCMS manage the content provided to the learner" (Ahmad, 2013, p 158).

While an LMS is sometimes referred to as a VLE, in this study an LMS is a software program that has been developed for educational institutions to use as a content management *tool* for online learning; it does not contain any *curriculum content*. Once it does contain curriculum content, (that is, teachers have used the LMS to create lessons, courses, or resources for their students) then that area of the LMS is said to be a VLE. The interchanging of terms most likely stems from the fact that LMSs contain in-built, scalable pedagogical design features (such as quizzes and assignment tasks) which would imply that the LMS is a *learning environment*; however, learning will not necessarily occur if the pedagogy and the content have not been developed. If a student enters an empty classroom or lecture hall, she is no more in a learning environment than she is anywhere else (arguably, any space – real or virtual – has the potential to be a learning environment). A VLE does not need to be created using an LMS; it can be created using any programming or software that can integrate tools that support various learning functions (such as communication and collaboration).

The developers of an LMS are usually not the developers of a VLE. Indeed, there are at least two levels of development for a VLE created by using an LMS: there are the developers of the LMS who have designed the program and its architecture and functional attributes, and there are the developers of the VLE who are the teachers who have designed the learning material, resources and tasks for their students. To ensure that the distinction remains clear, the terms *LMS developers* as opposed to *teacher-developers* (or *VLE developers*) are used in this study. The teacher-developers (of the VLE) are the primary end users of the LMS (as opposed to the students or learners who are the secondary end users of the LMS). The teacher participants' roles, therefore, can be termed as *developers, designers, creators*, or even VLE *managers*. The significance of the relationship between the LMS's developers and the teacher-developers of the VLE using the LMS is displayed in Figure 1.

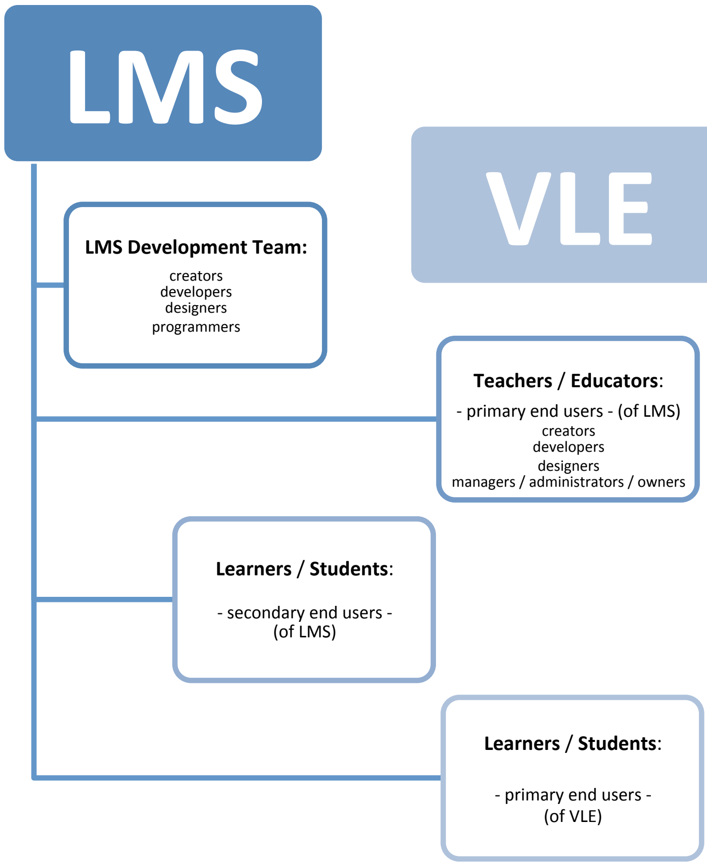


Figure 1. Program developers' relationship to end-users.

The Study

Context

A study of an LMS used by two secondary school teachers to deliver a unit of work to middle-school students was conducted to investigate the planning and development of a VLE using an LMS. The study took place in a secondary school in Victoria, Australia with two English classes of students. The school's LMS was used by the teacher participants to create a VLE on a unit of work specifically chosen for the project. The experiment was carried out with the aim of collecting data from all aspects of the design, development and execution of a VLE.

Origins

In previous research (Karvelas, 2004), *myclasses*, an LMS being used at a state secondary school, was tested for its technical usability. In spite of being found falling short of meeting standard practice usability criteria, the software continued to be used as the school's LMS because it seemed similar to other options available at that time. Questions, however, were raised about the efficacy of using that LMS (or any other LMS); for instance, was using the LMS helping *teachers teach* and *learners learn*? This prompted a need to examine *how* the teachers were using the LMS to create VLEs for their students.

Brief History of the LMS

As proprietary software specifically developed for secondary school teachers by Australian company *myinternet* Limited, the LMS*, myclasses*, experienced some business success in Australia and the United Kingdom since its launch in 2003. In 2006, the company changed its name to Editure (having also operated under the names *CSM Technology* and *Schoolsnet*). By 2010, Editure released *myPLS* –which effectively replaced *myclasses* (Editure, 2012). The newer LMS is similar to *myclasses* and is used by K-12 schools in several countries, including Australia.

Research Questions

The central questions of this paper relate to the LMS's impact on pedagogy: how does using an LMS to develop and deliver online learning affect teachers' pedagogies? Furthermore, what factors not directly related to the LMS contribute to pedagogy when creating a VLE?

Study Design and Methodology Rationale

The focus of the research was on the use of the LMS by teachers (who were not software experts and relied on an LMS specifically developed to cater for their levels of technical literacy), rather than on the effectiveness of the VLE *compared to* face-to-face (f2f) instruction; therefore, a comparative analysis was not necessary. Furthermore,

> The flaws inherent in conducting comparative analysis of different media types have been cogently articulated (Saloman & Clark, 1977; Hagler & Knowlton, 1987; Clark, 1983; Niemiec & Walberg, 1987; Belmore, 1983; Welsh & Null, 1991). These researchers concluded that effects resulted more as a result related to the teacher's instructional method than the software. (Stirling, 2005, para.4)

Thus, when examining an LMS, it is more useful to focus on the teachers' *instructional method* instead of just the effects of the software on learners.

Methodology

The four data collection methods used in this study to examine the impact of using an LMS on teachers' pedagogies are summarised in Tables 1-4.

Table 1

Précis of Data Collection Method 1

Method	**1) Preliminary Interviews**
Format	• semi-structured interviews with the teacher-developers
Duration	• two hours per participant (4 hours total)
Aim	• to elicit rich qualitative data pertaining to the teacher participants' perceptions and methods of learning and teaching
Significance to the research questions	• data pertaining to the teacher participants' existing pedagogies, teaching styles and understanding of their students' learning styles were used to examine the ways the teacher participants established the pedagogical aims of the VLE • data were used as the basis for understanding *why* the teachers used the online teaching methods that they devised for the VLE

Table 2

Précis of Data Collection Method 2

Method	**2) Development of the VLE**
Format	• informal meetings with the teacher participants who developed the unit of work collaboratively (the same content was used by both teachers in their VLEs)
Duration	• 8 meetings over a 3-4 week period each lasting 30-90minutes (8 hours total)
Aim	• to design and create a VLE to be used with the learner participants
Significance to the research questions	• understanding the *process* of developing the VLE was crucial to the research questions which examined how teachers create VLEs in real-world situations • the data were collected for three main reasons: first, to assess the level of teacher computer proficiency and competency as developers of VLEs; second, to highlight differences in the planning of the VLEs; and, third, to underscore the limitations (or value) of the LMS that was used

Table 3

Précis of Data Collection Method 3

Method	**3) Survey**
Format	• 16-item Likert-scale Survey rating teacher participants' perceptions of the VLE
Duration	• 15 minutes per participant [15 minutes x 2 participants] (30 minutes total)
Aim	• to obtain data on 'user satisfaction' of the teachers as developers of the VLE and users of the LMS
Significance to the research questions	• examining the impact upon the teacher participants of developing the VLE in terms of factors that were not strictly technical or pedagogical – such as fatigue and confusion - were linked to the LMS's usability and the Development Process of the VLE

Table 4

Précis Of Data Collection Method 4

Method	4) Final Interviews
Format	• structured interviews with the teacher participants
Duration	• approximately 20 minutes each (40 minutes total)
Aim	• to elicit qualitative data pertaining to the teacher participants' satisfaction with the VLE
Significance to the research questions	• the data pertained to the teacher participants' perceptions of the success (or failure) of the VLE course in terms of: ⇢ their satisfaction with the VLE ⇢ the pedagogical goals and effectiveness of the VLE ⇢ the usability of the VLE.

Findings

Teaching Philosophies

The teachers' philosophies about teaching and learning played an important role in the VLE's pedagogy because they provided a context for the pedagogical considerations implemented in the VLE. The integrity of the pedagogical goals of a VLE largely depend upon the teacher-developers' concepts of the nature and purpose of learning. The results of the study indicated that the teachers did not share the same foundational concepts of learning even when developing a VLE in collaboration (for example, defining or explaining terms such as *knowledge* and *skill).* This meant that when setting the pedagogical aims and goals of their VLE, the two teachers were in agreement in general terms ("to teach students about bias in news media"), but were not in agreement about the specific goals because their understanding of *learning* and *teaching* differed (one teacher believed learning was "Taking information from the outside and putting it inside," and the other teacher believed learning was "The gaining of skills and discovering how to do things"). Furthermore, both teachers claimed that they were not familiar with any learning theory (other than Gardner's Multiple Intelligences Theory in the case of one teacher). With respect to the teachers' inability to articulate the learning theories which underpin their pedagogy, this is not unusual and is supported by Shulman (1987) who highlighted how tacit knowledge is difficult to deconstruct and teachers have difficulty in voicing what they know and how they know it. The fact that the teachers lacked learning theory knowledge, however, is significant for at least two reasons. First, the teachers' *usual* pedagogical repertoire may have lacked the rigour required to deliver the unit of work irrespective of the method used (viz. whether it was delivered online or in a traditional f2f setting). Second, if they were more trained in, or aware of learning theory, they might have been more conscious of the LMS's pedagogical bias or designed their VLEs differently. Regardless of the teachers' lack of theoretical knowledge, the LMS remained biased because it still influenced the pedagogical design of the VLE, to some extent. It has been suggested:

> Perhaps the pedagogical possibilities are linked to teacher knowledge and expertise. More experienced technology-using teachers may be less constrained by the use of LMS as they are able to work around the technology to express their pedagogical vision. On the other hand, beginner and novice technology-using teachers may be significantly challenged to express their intentions in systems that are pedagogically biased. (Steel, 2009, p. 400)

Teaching Styles

The teachers' teaching styles and repertoires played an important role in the VLE's pedagogy. The teachers' individual teaching styles were ascertained using the Grasha-Riechmann (Grasha, 1996) "Teaching Styles Survey" (TSS) (a 40-item tool used as an adjunct to the preliminary interviews). This tool was used because the teacher participants' teaching styles were anticipated to be largely reflected in the ways they chose to present their learning materials in VLEs. Both teachers rated HIGH for the Formal Authority and Personal / Demonstrator styles on the TSS and both also characterised their teaching styles as *Demonstrators*; this supports the teachers' philosophies on teaching in which they emphasised the importance and necessity of the role of a "*real*" (f2f) teacher (as opposed to a virtual facilitator).

Table 5

Teaching Styles Survey Results

	Expert	Formal Authority	Personal / Demonstrator	Facilitator	Delegator
Teacher 1	MODERATE	HIGH	HIGH	MODERATE	HIGH
Teacher 2	HIGH	HIGH	HIGH	MODERATE	MODERATE

By definition, the Demonstrator model is teacher-centric, and both participants strongly defended the need for the physical presence of a teacher in the classroom. Indeed, in response to being asked what one teacher saw as the *school of the future*, he believed computers should never take over the role of a teacher:

> I think it's really important that human interaction is maintained in education particularly. I think a big part of education is – at high school education, school education – is about learning to be a grown-up. And I think you learn that from other people. So, it's important that technology stays in its place […] as long as it doesn't take over f2f teacher-student and student-student interaction.

The TSS results ranked the teachers HIGH for the Formal Authority style, which is less suited to delivery via a VLE; the teachers *transferred* their pedagogical styles to the VLE. In the final interviews, teachers acknowledged that students generally did not read the prescriptive and lengthy instructions, and this was evident in the results. The teachers had converted their f2f instructions to text verbatim because: firstly, they were inexperienced at creating VLEs and therefore appropriated their current teaching methods of giving lengthy verbal instructions to students; and, secondly, they could not think of any strategy to keep students following the linear structure of the VLE other than using guiding adverbs such as *now* and *then* as signposts in the instructions.

In theory, VLEs encourage teachers to adopt a more facilitator role in the teaching and learning process, but the teachers in this study exhibited strong elements of the *Expert* role. A sports coach does not flex an athlete's muscle, but encourages the athlete to perform certain physical exercises; the coach designs a routine or training circuit with the athlete's particular needs in mind and monitors that athlete's progress until the desired goal is achieved. Similarly, a teacher should, ideally, design a VLE mindful of learners' needs and encourage students through the process. In their personal repertoires in f2f teaching environments the teachers did not apply learning theory or best practices, and this was also the case in the development and planning of the VLE's content production, which was more of a didactic design than constructivist. The rigid sequential structure of the VLE did not cater for varying learning styles of students. Since the teachers saw learning as a *process* they designed the tasks to have a cumulative cognitive effect where one section of the VLE depended upon another one being completed *first* in the way that the teachers taught in f2f environments. The study showed that the teachers' teaching styles were a contributing factor in making the VLE less learner-centric than it might have been if teachers had considered constructivist learning theory and their students' learning styles in the pedagogical design of the VLE.

LMS Bias and Usability

The LMS's pedagogical bias, including its usability, played the largest role in determining the pedagogy of the VLE. The low technical usability of the LMS (as per Karvelas, 2004), had a direct impact on the pedagogical design of the VLE. Put simply, if a user of an LMS cannot adequately use the LMS, it has a negative impact on the sophistication and overall pedagogical design of the VLE. The study showed that the LMS's low *learnability* (a key element of technical usability) had a profound effect on the pedagogical usability of the VLE. The study showed a significant relationship between VLE activity (student VLE participation rate) and usability: the greater the techno-pedagogical error rate, the less likelihood for VLE completion (Karvelas, 2013). Related technical usability problems, such as the *findability* of key features of the LMS (e.g., Property Box for individual submission of work), changed the pedagogical design of the VLE. For instance, teachers instructed students to submit completed work (*answers*) in Property Boxes designed for collaborative discussion instead of Property Boxes for private submission of work. This re-shaped the pedagogical design, as public posts of answers enabled cheating by copying.

Although the misuse of the LMS's tools was the result of the teachers' lack of experience in teaching with VLEs, the LMS's technical usability was a significant contributing factor, as the tools were not explained clearly in the user manual (which was not read by the teachers as it was over 140 pages long and deemed unusable). Some of the LMS's tools that were more user-friendly, but not necessarily more usable, were included in the pedagogical design during the VLE construction stages, even though they were not part of the original pedagogical design. For instance, the Vote tool was used by teachers simply because it was available and gave the VLE a semblance of more interactivity, which the teachers believed was evidence of an interactive VLE. This revealed the extent to which the LMS guided teachers' pedagogical design. The LMS's tools options had a significant impact upon the final construction of the VLE; this showed that LMS software plays a role in pedagogy - it is part of the teaching process because the VLE depends upon the functional options and tools of an LMS.

Conclusion

This study examined the impact upon teachers' pedagogies of using an LMS to design a VLE. It did so by delineating the teachers' philosophies on teaching and learning, as well as determining their teaching styles; then critically examining the teachers' methodology as developers of the content and its pedagogical execution. An LMS is designed to be used by teachers – the primary end users of the software. If the primary end users find significant difficulties using the LMS, then regardless of how advanced the level and pedagogical effectiveness of the features of an LMS are *theoretically*, the LMS is not highly usable and does not possess high educational value as such features are simply not used:

> A recurrent message arising from the study of educational technologies, however, is that it is not the provision of features but their uptake and use that really determines their educational value. It seems that, to this point, LMS have been largely based on training-type models, even though many have emerged from universities. (Coates et al., 2005, p. 26)

An LMS is not pedagogically neutral, and while it may be useful in some cases to have the technology drive the pedagogy, an LMS should be purpose-built for teachers' needs, rather than lead teacher-developers to create VLEs that limit instructional design. Instead they need to address the variations of teaching and learning philosophies, individual teaching styles and the differing technical skills of teacher-developers to provide a system that adequately allows for sophisticated pedagogy to underpin online learning.

References

Ahmad, A. A. (2013). The efficiency of the 'Learning Management System (LMS)' in AOU, Kuwait, as a communication tool in an e-learning system. *International Journal of Educational Management*, *27*(2),157-169.

Coates, H., James, R., & Baldwin, G. (2005). A critical examination of the effects of learning management systems on university teaching and learning. *Tertiary Education and Management*, *11*(1), 19-36.

Despotović-Zrakić, M., Marković, A., Bogdanović, Z., Barać, D., & Krčo, S. (2012). Providing adaptivity in Moodle LMS courses. *Educational Technology & Society*, *15* (1), 326–338.

Editure. (2012). Company Website: About Us – Snapshot – Corporate History. Retrieved 31st August, 2012 from www.editure.com.au/about/snapshot

Grasha, A. F., (1996). *Teaching with style: A practical guide to enhancing learning by understanding teaching and learning styles*. Pittsburgh, PA: Alliance Publishers.

Karvelas, V. (2004). *Delineating usable interface characteristics of an online teaching and learning platform* [e-book]. Available from University of Melbourne's Catalogue, Ipswich, MA. Accessed March 21, 2015.

Karvelas, V. (2013). *Pedagogical and cognitive usability in online learning* [e-book]. Available from University of Melbourne's Catalogue, Ipswich, MA. Accessed March 21, 2015.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, *57*(1), 1-22.

Steel, C. (2009). Reconciling university teacher beliefs to create learning designs for LMS environments. Science Education, *Australasian Journal of Educational Technology*, *25*(3), 399-420.

Stirling, D. L, (n.d. accessed 2005). *Evaluating instructional software*. Accessed 20/5/2005 from http://www.stirlinglaw.com/deborah/software.htm

Author Details

Voula Karvelas
voula@karvelas.com.au

Back to Contents page

E-LEARNING SPACES AND THE DIGITAL UNIVERSITY: WHERE THE PHYSICAL MEETS THE DIGITAL

Dominic Pates and Neal Sumner
City University London
London, UK

Abstract

How do we realise the potential of flexible learning spaces in the digital university? What skills and literacies will help users to take maximum advantage of the digitally-enhanced learning space? Drawing from lessons learned and work in progress, we explore City University London's policies and initiatives in rethinking and redesigning several physical classroom environments. Through an examination of a number of institutional initiatives and the current work of the Learning Spaces team, this paper highlights the need for the development of digital literacies among academic staff and students in order to realise the potential of technology-enhanced active learning spaces.

Introduction

Higher education in the developed world is arguably undergoing one of the most profoundly turbulent set of challenges in living memory. Global economic, technological and pedagogical currents are interweaving to produce paradigmatic changes that challenge many of the traditional practices and environments of higher education institutions (HEIs). A discourse concerning the extent to which HEIs are being disrupted by the impact of these developments has now become well-established (Christensen, n.d.).

> Education is the key quality of labour; the new producers of informational capitalism are those knowledge generators and information processors whose contribution is most valuable to the firm, the region and the national economy. (Castells, 1996, p.18)

Building on the notion asserted by Castells of the contemporary importance of education, there is a growing recognition amongst nation states in the developed world that graduate-level skills and knowledge are increasingly needed to drive the 21st Century knowledge economy. One direct consequence of this recognition has been the drive towards the massification of higher education. In the UK, for example, the longstanding state ambition to have 50% of 18-24 year olds in HE has almost been met (Adams, 2013). This vast increase in the sheer number of students puts significant pressure on the existing infrastructure of HEIs. It has also happened largely in parallel with a dramatic rise in the level of tuition fees that HEIs can charge. The UK has seen an eightfold rise from £1,000 per annum in 1998 to up to £9,000 per annum in 2012. Although the full impact of these changes have yet to work through the system, there appears to be a shift taking place in the attitudes of students who, in some ways, are now positioned as consumers rather than scholars of higher education.

A further development, which challenges the conventional role of HEIs as exclusive knowledge providers, is the explosion of open educational resources available across the Web and the increasing accessibility of the online classroom (Bates, 2015). An example of this is the recent rapid growth in MOOCs that has occurred since 2009. These developments serve to decentre the pivotal role of the traditional academic as a *sage on stage*, since students are now able to easily access a world of knowledge on their own digital devices unavailable to previous generations of learners.

HEIs face rising student expectations, which can include greater personalisation of their study experience, a reliable technological infrastructure, digitally literate staff, and support for developing their own digital literacies (JISC, 2015). These factors collectively contribute to a shifting dynamic between learners in HE and their institutions, which is in part reflected in the emergence of new models of learning and teaching. One example is a growing understanding that the traditional lecture, based as it is on a largely transmissive and behaviourist model of instruction, is an ineffective method of knowledge construction and does not meet the needs of today's learners to prepare them for the modern workplace (Cuseo, 2007; Kaddoura, 2011; Fukawa-Connelly, 2012; Broadwater, 2013; Severiens, Meeuwisse, & Born, 2015). Whilst such a view of the effectiveness of lecture-based instruction is not new in itself (Pulliam, 1963), more recent responses from the educational development community have been to promote more active and collaborative forms of learning. This is based on constructivist pedagogies and invariably supported through appropriate use of educational technologies. The current trend towards the flipped classroom is an example of such a constructivist-aligned, technology-enhanced approach.

This paper serves to illustrate one way in which a British HEI, City University London (City), is facing up to these challenges via an extensive programme of redevelopment, reconfiguration and refreshment of several of its formal learning spaces that has followed on from significant research, experimentation and evaluation around the rethinking of the HE learning space. This programme includes a rebuilding of parts of its estate and a major development of existing digital infrastructure coupled with a strong focus on staff development, including efforts to provide staff with the knowledge and skills to realise the potential of the digitally-enhanced classroom.

Principles Underpinning Developing Learning Spaces

Over the last 40 years, there has been a gradual shift in the pedagogic models that underpin the delivery of teaching and learning practices in developed world HEIs. The traditional lecture theatre design, relatively unchanged for centuries, has been shaped by a broadly transmissive approach. This was reflective of a period when access to knowledge was restricted, expensive and often shaped by the scarcity of resources (Beichner, 2014; Bates, 2015). However, in recent decades, there has been a significant shift in our understanding of what constitutes effective pedagogies. There is now a broad acceptance (Fry, Ketteridge, & Marshall, 2014) that constructivist and social constructivist approaches can be more effective in terms of enabling student learning. Coterminous with this development, the emergence of the Internet and then the Web have transformed the availability and accessibility of information and therefore traditional practices on which university curricula are based.

The three trends identified here – contemporary massification, which has further distanced the relationship between the lecturer and student and often results in a reduction in face-to-face contact time, the pedagogic shift from a conventional transmissive approach to a recognition of the effectiveness of the constructivist approach, and the growing influence of digital technologies on teaching and learning – combine to challenge how physical learning spaces suited to the 21st century campus are designed.

So, how far do the traditional tiered lecture theatre and conventional seminar rooms with their serried ranks of inflexible furniture meet the new demands that are indicated above? Over the past 20 years, HEIs in Australia, the US and the UK have attempted to answer this question through the redevelopment of their existing spaces, the design and creation of entirely new digitally-enhanced active learning spaces, and the provision of experimental 'sandbox' environments for the exploration of new possibilities in teaching and learning within HE. Renowned examples range from the collaborative, circular-tabled large capacity classrooms of North Carolina State University's SCALE-UP project in the mid-1990s (Beichner, 2014) and MIT's Technology Enhanced Active Learning (TEAL) environments (Rimer, 2009), to the swivel-seated lecture space of Iowa State University's LeBaron Hall Auditorium (Twetten, 2006) and Loughborough Design School's lecture theatre with its modular sofa-seating (Peberdy, 2014).

Changes in the physical environment within some of these HE learning spaces have included the provision of more flexible furniture, which facilitate the reconfiguration of the teaching and learning space in multiple ways, expanded writing surfaces, the decentring of the teaching podium as the sole focus of the direction of attention, an expansion in the availability of power sockets, and ubiquitous wifi connectivity. This period has also seen the impact of a wide range of digital technologies into lecture theatres and seminar rooms. In some spaces, students have access to a wider range of better-positioned display screens and the provision of electronic voting systems. Many students will also bring the expectation of wireless connectivity and the opportunity to charge their own devices in these spaces.

The academic toolkit can now include web-enabled teaching podiums that consist of desktop PCs, touch panel controllers, audio-visual projection including visualisers, inputs for own devices, and interactive screens, as well as whiteboard capture technologies, and, increasingly, lecture capture capabilities. Enabling faculty to make effective use of these technologies in the classroom is one of the major challenges facing the educational development community.

What follows is an exploration of some of the ways in which City has responded to these challenges. This will cover an examination of the overarching policy framework, examples of completed projects, reference to the stakeholder interests that have driven these changes, and an outline of current projects and practices developed by the Learning Spaces theme team within the Learning Enhancement and Development department (LEaD).

New Learning Spaces at City

City currently has 101 multipurpose, non-specialised teaching rooms across the institution that can be utilised by different schools for timetabled classes. These rooms are where a significant amount of teaching and learning takes place across the institution and run alongside other spaces specifically set aside for individual schools or for specialised teaching requirements and other spaces for students and academic staff such as dedicated computer and meeting rooms. At the time of writing (Spring 2015), a total of 45 of these multipurpose rooms, described as *flexible learning spaces*, have been launched over the last five years. These are defined by City as “rooms… which have flexible furniture to support group-based learning and discussions” (Flexible Learning Spaces, nd). At 45% of all multipurpose learning spaces, this amounts to a significant institutional and financial investment in the perceived benefits of providing flexibility in a learning space for fostering a broad range of models of teaching and learning. This estate redevelopment is part of City’s Vision for 2016, which strives to establish City amongst the top 2% of global universities (Building the Vision, nd).

An early indicator of rethinking of learning space provision at City can be traced to the renaming of the Classroom Experience Steering Group, largely comprised of IT staff, to the Learning Spaces Group, a collective which also included students, academics from different disciplines and other senior Professional Services members such as Properties and Facilties (PAF) and Information Services, alongside educational technologist staff (Bowdler, 2011). Amongst other considerations, this group was tasked with reviewing under-utilised rooms across campus, leading to a number of key initiatives in investigating experimental and flexible spaces. One new room was characterised by multi-height furniture, which was designed to explore creating natural groups within the space. Two others were developed as alternatives to traditional computer rooms. These were to incorporate both lecturing and student computer work, and were driven by a requirement to support a curriculum designed around problem-based learning (Bullimore, Reader, & Sultany, 2013). They comprised of a room with pop-up computers on circular tables and a room that included a new form of tablet chair (known as a *node chair*), supported by a laptop locker in an adjacent room that enabled easy access to mobile devices in support of the learning activities. Other node chair room experiments were also conducted, including one where a flexible room set-up with node chairs, extended writing surfaces and a teaching pod was augmented with an iPad Cart, a mobile multi-tablet storage and syncing device (Reader, Pamplin, Cancienne, & Solkin, 2013). This environment enabled staff to develop more active learning approaches in their teaching, therefore creating new opportunities for learning not available with previous room configurations.

Further influences on City's Learning Spaces project came from papers by Fisher (2005a, 2005b) and Cuseo (2007), and an extensive review of learning spaces literature (Pamplin, 2013). Chickering and Gameson's (1987) principles for undergraduate education good practices were mapped to learning space configurations to produce a set of Guiding Design Principles (Cancienne, 2013a).

These research and evaluation efforts and stakeholder discussions were amongst the major contributory inputs that culminated in the creation of a Learning Spaces Manifesto:

> Our learning spaces will be bright, inviting agile spaces, able to accommodate the full breadth of teaching and learning approaches. Students and lecturers will be able to communicate with one another easily, and share and develop ideas between themselves in these spaces. Our spaces will communicate the pride we have in our learning, and help engage students in the university academic community through being world class spaces that meet their learning needs. (Cancienne, 2013b)

This statement has framed the ongoing and extensive redevelopment of City's stock of formal and informal learning spaces.

Campus development projects such as these inevitably draw out differing perceptions of what the primary educational drivers are, determined by the position of the interested stakeholder. For example, the further scaling-up in size of the student body may seem to demand ever larger lecture theatres that in turn support the continuation of transmissive modes of teaching. Greater room flexibility, however, may require an increase in the availability of actual empty space. The involvement of City's Education Committee in approving flexible seating in new lecture spaces (Cancienne, 2013c) is an example of where the issue of academic quality of space prevailed over timetabling needs. Two other groups with typically differing perceptions of educational requirements – students and the University executive – engaged with each other via a Student Community Working Group paper for Senate as a part of this process (Cancienne, 2013b)

Further operational decisions and ideas around City's new learning spaces were explored within the forum of the Learning Spaces Group, which acted in an advisory capacity to various other committees that granted permissions in developing additional spaces, and which included heads of PAF, Associate Deans of Education, the Pro-Vice Chancellor and senior LEaD staff.

City's Learning Spaces Team

In 2014, a new Learning Spaces-themed team of dedicated educational technologists was created within LEaD. This team was tasked with running a focused programme of staff development in order to realise genuine educational change by enabling academic staff to make optimum use of the new learning spaces. The team remit includes raising awareness amongst faculty of the potential of these new spaces, encouraging or supporting them in the adoption of more interactive and collaborative practices in their teaching, working on the integration of digital technologies in the face-to-face classroom, and contributing to the design and development of new and additional formal learning spaces, including via the engagement of faculty in the design process. These multi-faceted approaches for reaching and engaging the academic staff within the institution can be largely grouped into the following areas – staff development, communications, and research and evaluation. A brief indication of how this engagement is being driven is outlined here.

Staff development work includes generic and bespoke group training sessions and workshops, and acting in advisory capacities for individual academics on curriculum enhancement ideas. Workshops have covered sessions on core technologies, such as lecture capture or in-class use of the web-based BYOD (Bring Your Own Device) voting tool Poll Everywhere, as well as termly sessions for all academics looking at approaches for large or small group teaching within these spaces, or for extending classroom teaching through multimedia tools. Communications activities have so far included email and poster campaigns, sections on learning spaces within e-newsletters, posts on the main LEaD blog (http://bit.ly/CityLS) and a short film (https://www.youtube.com/watch?v=sAVtiuHCfCM) produced in collaboration with LEaD's Multimedia team to promote the range of new rooms and their affordances to academic staff.

Research and evaluation activities have built on the work completed before the theme came together and have included evaluations of new rooms and supported technologies, as well as horizon scanning investigations into technologies yet to be deployed but which could potentially provide further enhancements to the teaching and learning experience. Here are some examples of work conducted in these areas.

An extensive mixed methods investigation (Kogan, Ntonia, & Smith, 2015) into staff and student perceptions of City's physical learning spaces (flexible or otherwise) concluded that many institutional learning spaces have an overall positive impact on user stakeholders and also identified areas for improvement. This has fed into further research currently underway, in areas such as wireless projection and whiteboard capture. Conference participation and engagement with other HEIs have brought in new good practice ideas for lecture capture, with an evaluation of the impact of lecture capture usage at City due in the next academic year. A literature review into best practices for evaluating learning spaces (Pates, 2014) identified additional frameworks such as Radcliffe, Wilson, Powell, and Tibbetts'Pedagogy-Space-Technology (PST) framework (2009) to help guide and inform ongoing and future room evaluations.

Developing Staff and Student Digital Literacies

The NMC Horizon Reports (Higher Education editions) have described digital media literacies amongst staff and students as a significant or even critical challenge that is impeding the adoption of such technologies in higher education. The 2010 edition (Johnson, Levine, Smith, & Stone) proposed that "digital literacy must necessarily be less about tools and more about ways of thinking and seeing" (p 5). In the most recent edition (Johnson, Adams Becker, Estrada, & Freeman, 2015), the indication was that HEIs have now recognised that faculty need to be better equipped in order for digital literacies to be instilled in their students, but that there remains an absence of consensus as to what digital literacy comprises. The two examples that follow relate to the digital technologies used at City in face-to-face teaching for enhancing the learning experience, rather than the use of distance or asynchronous tools such as blogs or online forums.

An academic wishing to use a tool such as an Poll Everywhere with a 'live class' may face additional performance pressures that extend beyond how to build and configure polls or that are not present in the use of asynchronous teaching tools. Effective incorporation into a lecture can also require imagining the range of mobile devices that students may (or may not) bring to the lecture, knowing that what will be displayed on the screens of student devices will differ from what is displayed on the main room projector, as well as the actual live operation of the poll. LEaD provides one-off training and ongoing support for individuals or groups of academics wishing to investigate this particular tool, ensuring a focus on the challenges of using mobile devices for learning and differences between using these and dedicated 'clickers' for in-class voting.

The addition of video-based lecture capture to City's learning spaces (currently available in 51 teaching spaces at City) is another recent challenge for educational technology staff, who help academics balance fast and easy solutions for capturing a lecture with considering further activities that may take additional time but which can extend teaching or add further educational richness. While the recordings are automated, the output can be enhanced by tagging and/or adding chapters to the recording. As ever, there are both development and pedagogic questions to consider, both for the educational technologist and the academic.

Beetham (2014) suggested, that "the confidence of teaching staff has a strong impact on students' satisfaction with the use of technology," but that, despite rising expectations, many students are "still unclear about how the technologies they use at university can help them to succeed." It follows that universities should consider the digital skills of their students and recognise that there will be a breadth of skills and expectations within that diverse student group. While providing support for developing students' digital literacies goes beyond the remit of City's educational technologists, encouraging faculty to make such considerations in their teaching and assisting staff with their own development makes some contribution towards student literacies.

Conclusion

City has now amassed significant experience in researching, developing, implementing and supporting flexible and innovative HE learning spaces at an institution-wide scale. This has included experimenting iteratively, conducting extensive and broad ranging research and evaluation, actively involving multiple stakeholders in the process, and incorporating a varied programme of staff development. Drawing on innovative work from HEIs in the US, UK and Australia has informed City's discussions as to what constitutes effective contemporary learning spaces, as have visits to sector leaders in this area and inviting pioneering thinkers to contribute to the evolving vision. These have collectively provided evidence for many of the learning space innovations developed at City in tandem with research conducted within the institution. The existence of a multistakeholder specialist group as forum has fed in to senior decision makers, and has therefore been instrumental in driving the changes from both operational and strategic levels. Making the best use of the available space under budget restraints, balancing pedagogic needs with the pressures of massification, and sourcing and supporting appropriate in-class technologies have all shaped how City has responded to the need for upgrading our learning spaces. Staff development initiatives, including workshops for promoting and sharing good practice, the provision of resources for teaching activities within these spaces, and help with the use of in-class technologies, have built on the successful implementation of institution-wide flexible learning spaces.

These are all steps along the route to realisation of the full potential of flexible learning spaces that City has taken. It is the authors' hope that these experiences will be helpful to other individuals and institutions engaged in promoting the effective use of learning spaces in the digital university.

References

Adams, R. (2013, April 24). Number of students going on to higher education almost reaches 50%. *The Guardian*. Retrieved from http://www.theguardian.com/education/ 2013/apr/24/students-higher-education-almost-50-per-cent

Bates, A. (2015). *Teaching in a digital age*. Retrieved from http://opentextbc.ca/teachinginadigitalage/

Beetham, H. (2014, June 23). Students' experiences and expectations of the digital environment. *JISC Blog*. Retrieved 27/04/15 from http://www.jisc.ac.uk/blog/students-experiences-and-expectations-of-the-digital-environment-23-jun-2014

Beichner, R. J. (2014). History and evolution of active learning spaces. *New Directions for Teaching and Learning*, 2014, 9-16.

Bowdler, R. (2011, December 9). A day in the life of a teaching pod. *Educational Vignettes*. Retrieved from https://blogs.city.ac.uk/educationalvignettes/2011/12/09/a-day-in-the-life-of-a-teaching-pod/#.VT3qBK1VhBc

Broadwater, P. (2013). Death of the lecture? *Bucknel Magazine*. Retrieved from https://www.bucknell.edu/x80297.xml

Building the vision. (n.d.). London: City University London. Acessed 27/04/15 at http://www.city.ac.uk/building-the-vision

Bullimore, A., Reader, K., & Sultany, A. (2013). Flexible learning spaces evaluation report. *Learning at City Journal*, *3*(1), 79-91.

Cancienne, A. (2013a). *Guiding design principles: Flexibilty, visibility, vibrancy* (Unpublished document mapping Chickering & Gameson's

"Seven Principles for Good Practice in Undergraduate Education" to learning space design). Accessed 22/04/15.
Cancienne, A. (2013b). *Learning spaces manifesto* (Unpublished manifesto document). London: City University London.
Cancienne, A. (2013c). *Large lecture theatre position statement* (Unpublished position statement0. London: City University London.
Castells, M. (1996). The network society. In Hargreaves, A. (2003). *Teaching in the Knowledge Society*. New York: Teachers College Press.
Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *American Association of Higher Education Bulletin*, *39*(7) 3-7.
Christensen, C. (n.d.). Disruptive innovation. Retrieved 02/04/15 from http://www.claytonchristensen.com/key-concepts/
Cuseo, J. (2007). The empirical case against large class size: Adverse effects on the teaching, learning, and retention of first-year students. *The Journal of Faculty Development*, *21*(1) 5-21.
Fisher, K. (2005a). *Research into identifying effective learning environments.* Paper for OECD/PEB, Evaluating Quality in Educational Facilities (pp. 159-167). Lisbon, Portugal.
Fisher, K. (2005b). *Proposed planning principles*: *Linking pedagogy and space*. Victoria, Australia: Department of Education and Training Victoria University.
Flexible learning spaces. (n.d.). London: City University London. Accessed 26/04/15 at http://www.city.ac.uk/visit/timetabling-rooms/priority-rooms
Fry, H., Ketteridge, S., & Marshall, S. (2014). *A handbook for teaching and learning in higher education: Enhancing academic practice*. London: Routledge.
Fukawa-Connelly, T. P. (2012). A case study of one instructor's lecture-based teaching of proof in abstract algebra: Making sense of her pedagogigcal moves. *Educational Studies in Mathematics*, *81*(3), 325-345.
Hargreaves, A. (2003). *Teaching in the knowledge society*. New York: Teachers College Press.
Holtham, C., & Cancienne, A. (2014), Collective learning spaces: Constraints on pedagogic excellence. In J. Branch, P. Bartholomew, C. Nygaard, & L. Scott-Webber (Eds.), *Learning space design in higher education* (pp.225-240). Faringdon, Oxfordshire: Libri Publishing.
JISC. (2015). Digital students are different (posters). Retrieved from https://drive.google.com/file/d/0B4y3qNoTbFdYd0ttdEx1STVyeDRFOGdvMVhkeWhMdjZYcVBR/view?pli=1 [Accessed 02/04/15].
Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). *NMC horizon report: 2015 higher education edition*. Austin, Texas: The New Media Consortium.
Johnson, L., Levine, A., Smith, R., Stone, S. (2010). *The 2010 horizon report: Higher education edition*. Austin, Texas: The New Media Consortium.
Kaddoura, M. A. (2011). Critical thinking skills of nursing students in lecture-based teaching and case-based learning. *International Journal for the Scholarship of Teaching and Learning*, *5*(2).
Kogan, P., Ntonia, I., & Smith, S. (2015). *An evaluation of learning spaces at city university London* (Unpublished report). London: City University London.

Pamplin, M. (2013). Learning spaces in higher education: A literature review (Unpublished literature review). London: City University London.
Pates, D. (2014). Effective practice for the evaluation of learning spaces. (Unpublished literature review). London: City University London.
Peberdy, D. (2014). *Active learning spaces and technology: Advances in higher and further education*. Droitwich Spa: DroitwichNet.
Pulliam, L. (1963). The lecture: Are we reviving discredited teaching methods? *The Phi Delta Kappan*, *44*(8), 382-385.
Radcliffe, D.,Wilson, H., Powell, D., & Tibbetts, B. (Eds.). (2009). *Learning spaces in higher education: Positive outcomes by design. Proceedings of The Next Generation Learning Spaces 2008 Colloquium*. University of Queensland, Brisbane. Brisbane, Australia:University of Queensland and the Australian Learning and Teaching Council, Brisbane. Retrieved from http://www.uq.edu.au/nextgenerationlearningspace/proceedings
Reader, K., Pamplin, M., Cancienne, A., & Solkin, L. (2013, June). *Energizing the classroom: Reconceptulising learning spaces for higher education in the 21st century.* Paper for EDEN Annual Conference 2013. Oslo, Norway.
Rimer, S. (2009, January,13). At M.I.T., large lectures are going the way of the blackboard. *The New York Times*. Retrieved from http://www.nytimes.com/2009/01/13/us/13physics.html?pagewanted=all&_r=0
Severiens, S., Meeuwisse, M., & Born, M. (2015). Student experience and academic success: Comparing a student-centred and a lecture-based course programme. *Higher Education* (in press). doi: 10.1007 / s10734-014-9820-3
Twetten, J. (2006). Iowa State University: LeBaronHall Auditorium. In D. Oblinger (Ed.), *Learning spaces* (Chapter 22). Educause. Retrieved from https://net.educause.edu/ir/library/pdf/P7102cs9.pdf

We would like to acknowledge Annemarie Cancienne and Stef Smith's input and advice related to this paper and thank them for their contributons.

Author Details

Dominic Pates
Dominic.Pates.1@city.ac.uk

Neal Sumner
N.Sumner@city.ac.uk

Back to Contents page

PRODUCING OPEN EDUCATIONAL RESOURCES THROUGH MASSIVE COLLABORATION

Vilson J. Leffa
University of Pelotas
Pelotas, RS, Brazil

Abstract

Open Educational Resources (OERs) have drawn the attention of professionals in the area of Computer Assisted Language Learning (CALL) for their potential in making classroom activities more rewarding. OER expansion in CALL, however, has been hindered by two recurring problems: (a) custom-made production of OERs is expensive or time consuming for the teacher, and (b) off-the-rack OERs typically do not meet the specific educational contexts faced by the teacher. To solve these problems we offer an authoring system that allows both teachers and students to work collaboratively, producing, remixing, adapting, distributing and sharing their OERs.

Introduction

The purpose of this paper is to show the evolution that occurs as we move from Learning Objects (LOs) to Open Educational Resources (OERs), considering the impact on language teaching in both theoretical and practical aspects. For the theoretical aspects, we bring the conception of Democritus, Greek philosopher of the fifth century BC, for whom matter was made up of both particles and the restructuring of these particles, which are internally rearranged in different combinations. Democritus is used as a metaphor to reinforce the idea that the term *open*, which is included in the acronym OER, can be used not only in the sense of *open for access*, but also in the sense of *open for change*, meaning the ability to manage and reorganize the constituent parts of the OER. On the practical side, we describe an authoring system that was developed to implement the proposal, based on mass collaboration resources, as provided by the Internet. That is what we will try to demonstrate in this text, divided into three parts, as follows.

The first part contains a summary of the theoretical journey that starts with the concept of LO and ends up with that of OER. That is where we refer to the Democritus concept on the constitution of the substances in the universe and show its relevance to computer sciences based on object-oriented programming, bringing up the concepts of modularity, recursion, polymorphism and especially elastic modularity, proposed in this paper.

In the second part, we describe and justify our preference for OERs, detailing each of its elements: (a) what the term *resource* means and why we opt for it; (b) how the *educational* content is inaugurated inside a resource; and (c) what makes a resource *open*, considering accessibility and mutational aspects.

Finally, in the third part, we try to instantiate these theoretical elements into an authoring system, practical in nature, allowing teachers to create, recreate and adapt their own OERs, recursively encapsulating smaller modules into larger activities to meet the needs of their students and the demands of their teaching contexts.

From LOs to OERs

LOs have been defined in various ways, from the more generic idea of any object used for educational purposes to the more specific notion of a small electronic unit of educational information. LOs started with an emphasis on modularity, based on the object-orientation paradigm, as used in computer science (Wiley, 2000), in which certain blocks of code, carefully designed and tested, were saved as objects that were later reused by other programmers. When this is done, all the programmer has to do is send variables to the pre-existing code block, which automatically processes and outputs the desired result without the need for the programmer to rewrite it again. Wiley's idea was that the same principle of reuse could be used in the construction of LOs.

Defining LOs as minimum learning units, seen as the basic elements of a larger educational unit, leads to the concept of atoms, traditionally seen as indivisible particles of matter, a concept that permeates Western philosophy. Obviously, these minimum units, either LOs or atoms, can be combined with other minimum units and produce different results, depending on how they are internally organized. Combining atoms to create new substances or combining objects to produce learning is a fascinating aspect of both chemistry and learning. In chemistry, this is called allotropy: substances entirely different in their physical appearance are made up of the same elements. They differentiate only by the way their atoms are organized in the molecules.

The idea that matter is made up of smaller and smaller parts can be traced back to the Greek philosophers. Democritus in the fifth century BC already stated that everything in the universe was made of atoms, so that the difference between earth and water, for example, was in the shape and arrangement of these atoms. An iron rod is not a monolithic block but a cluster made of particles that attach to each other. Although the current view of the atom is no longer that of Democritus, in which the atom was seen more like a molecule, what he says is still important today. It suggests that the universe is made not only of elements, but also by the combination of these elements, creating new substances with voids between them, no matter how compact they can look.

The conception of Democritus that a change in the arrangement of the atoms could cause a change in the substance, transforming steel into salt, for example, is still true today, confirmed by the property of allotropy: diamond and graphite are allotropes that differ only by the geometric arrangement of the atoms in the molecule. In a way, we can argue that allotropy resurrects the concept that Democritus had of the universe, apparently as eternal as diamonds. Even if the psychic atoms, proposed by Democritus to describe the composition of the soul and fire, can no longer be accepted to the letter, it is not difficult to associate these psychic atoms to the current notion we have of light particles.

The atoms of Democritus can also be associated with the elements of a Lego set, which, not surprisingly, have been used as a metaphor to explain the Universe: a giant Lego set, consisting of little blocks of different sizes and shapes that fit into each other, as seen in movies, games, and popular literature. In *Sophie's World*, for example, Alberto, the philosopher character, explicitly compared Democritus' atoms to Lego pieces. The Lego metaphor is relevant to the concept of LOs because it crystallizes the idea of modularity, not as a puzzle, which always produces the same result, restoring the original object from which the pieces were taken, but as a Lego set, wherein the parts can be combined in different ways, producing different results.

The turning point in the rearrangement of particles happens when we move from the analog to the digital world, from matter to light. Negroponte (1995) addressed this point in a creative way, drawing attention to the difference between atoms and bits, showing that CDs and printed books, for example, are made of atoms, while the content of these books and CDs, transformed into computer files are bits. Unlike printed material, digital material is extremely inexpensive, easily transmitted from one country to another, easily modified, and weightless: a laptop with a million e-books in the hard-drive does not weigh a gram more than an empty one. We are in the world of light.

LOs, over time, seem to have lost their solidness as objects. Initially seen as monolithic blocks, they gradually replaced reusability, one of their main characteristics, by adaptive repurposing, allowing their reuse with the introduction of changes and thus evolving into OERs. Wiley himself, one of the early proponents of LOs, became over time one of the main advocates of OERs (Wiley, 2007). In fact, OERs are more easily implemented in a "produsage" world (Bruns, 2007), when we move from Web 1.0 to 2.0, from matter to light, from the atom to the bit, being free to mix the elementary particles that make up the digital world.

The Elements That Make Up an OER

One interesting way to define an OER is by focusing on the meaning of the three words that make up the acronym: What does it mean to be *open*? What makes an OER *educational*? What does it mean to be a *resource*? When we do that, we find out that the choice of these words is extremely appropriate, as we will try to show below, explaining what makes an OER open, which elements in it contribute to make it educational, and finally what constitutes a resource.

Being open entails two meanings here: (a) open to access and (b) open to change. Open to access leads to the idea of public domain without any restriction, whether operational, financial or geographical.

In operational terms, open access means that the resource can be accessed by any user, regardless of the device being used at the moment, be it a smartphone, a tablet, a netbook, a desktop computer and even a TV; and regardless of the device's operating system: Windows, IOS, Android, or Linux. Ideally, it should be open to what we have today and whatever we may have tomorrow. This is the interoperability principle, one of the aspects that have evolved more dramatically in computer hardware. The first computers in the 1950s, such as the IBM 704, had a single operating system for each machine, blocking communication from one machine to another. It was only in the 1980s that generic operating systems such as UNIX and DOS came about, allowing for different machines to run the same operating system, thus affording intra-system compatibility: a DOS machine could communicate with another machine running DOS, but not with one running UNIX, for example. With the expansion of the Internet, especially with cloud computing, operating systems, literally and figuratively, go to space, and compatibility becomes universal: a file created on a machine running Windows can be viewed and modified on another machine running Linux, IOS or Android; and on any device, from a smartphone to a desktop computer. The movement known as *Bring your own device* (BYOD) finally materializes. Operating systems have become invisible. The average user, with time, does not know, and does not need to know, which system is running on his or her machine.

In financial terms, there are two aspects to consider: no-charge services for the user and free access to the Internet. The progress seems to have been greater with no-charge services, considering, for example, the expansion of social networks, Wikis, search engines, and even OERs. In terms of free access, the issue of the digital divide has been discussed in some circles, with some people arguing that extensive layers of the population are outside the information society and do not profit from the expansion of the digital networks. Sorj and Guedes (2005), for example, in one of the most frequently quoted studies in the area in Brazil, state that the introduction of the new ICT increases exclusion and social inequality. Obviously, in opposition to this pessimistic outlook, there is another one, more optimistic and positive, based mainly on Pierre Lévy's ideas (2001), expanded below. The main point is that what Sorj and Guedes stated needs some repairs. First, whenever a new technology emerges, a legion of people is excluded: when writing was invented, for example, the illiterate, who did not exist before, were created. Second, the study by Sorj and Guedes was conducted with data collected in Brazil in 2003, when there were not smartphones, netbooks, or the mobile Internet and a desktop would cost more than twice of what it costs today, with half of the processing capacity. The money needed to introduce a student to computer literacy at the time, today introduces four students, using conventional netbooks. If cloud-computing resources are used, seven students can be taken care of, with lighter, more portable and more user-friendly machines, without the need for lengthy updates and antivirus management. It is obvious that one cannot be so naive as to think that suddenly all human beings become fully generous and everything is resolved with technology; but one cannot deny that today, although a lot of information is still withheld, access to it is much cheaper and easier. Another aspect that should also be mentioned is that the exclusion is not always induced by financial problems; there are people who, for other reasons, choose not to join the digital world (Kvasny & Trauth, 2002).

Geography has long been an excluding factor. Living far from an urban center meant not having access to school, especially at higher levels of education. Currently, OERs offer the possibility of eliminating borders not only between the city and the countryside, but also between countries, allowing for a student living on a farm in Brazil to follow different courses offered by the most prestigious universities on the planet, including Massive Online Open Courses (MOOCS). The same technology that initially excludes people can also include them later, when disseminated.

OERs should be open not only for universal access, but also open for adaptation. Adaptation involves the disassembling of the OER into its components, the introduction of changes in one or more of the disassembled components, followed by a reassembly of the modified components into a different OER. This means that OERs, unlike LOs, may not be monolithic blocks; they must always be modular systems, open for changes to be introduced whenever necessary. This implies a repository of parts to be used on a just-in-time basis similar to what happens on an assembly line.

The second word in the OER acronym is related to E: education. The problem here is to explain how a particular resource becomes educational. Videos, lectures or expository texts are not educational resources by themselves. Leaving a group of students watching a video when the teacher is absent does not make the video automatically educational.

We will use an operational definition here: an *educational resource* is something that requires the student to do something. In educational terms, this is known as *experiential engagement*. A video by itself is not an educational resource, but a video attached to a questionnaire that students must respond and submit to the teacher is. A novel, by itself, is not an educational resource, but will be if interspersed with questions between chapters. An academic well-written English descriptive grammar is not an educational resource, but a beginner's grammar with fixation exercises is. The quality and relevance of the video, novel or grammar are circumstantial aspects; they may be important but do not essentially characterize the instructional content of a resource, using the operational definition presented here.

Instructional content is defined as an activity that involves the student's documented practice. It is not enough to just read a text or attend a lecture, supposedly understanding what is being read or listened to; the student needs to do something, experiment and act in a given system, leading to feedback, which in a digital environment is always immediate. This feedback may provide clues when students get it wrong and encourage them to go further when they get it right -- emphasizing experience and leaving traces that document what was tried and done. Places like social networks and especially games, which value participation and user performance, encouraging action, not merely reception, are also places that offer intense learning possibilities (Gee, 2004).

The process of providing a resource with instructional content is a risky venture because it can destroy the object of study, be it a poem, a Bahktin's text, a famous painting or a cult movie. This happens, for example, when the author of the activity brings in totally irrelevant details, which contribute nothing to the work that is being discussed. Instead of showing the student essential aspects of what qualifies a text, for example, the teacher, in the guise of some grammatical point, restricts himself or herself to some teaching liturgy, with the result of demotivating the student. The argument put forward here is that by using the digital resources available today, the production of instructional content is more feasible, interesting and creative, although not necessarily easier. Acquisition of this domain is a slow process that requires, from the subject, a positive attitude towards digital technology, using what we have proposed to define in our project as *critic dazzlement*. This involves a balance between enthusiasm and sustainability and the adoption of a constructive critical perspective, namely, not giving up when problems arise, and not summarily rejecting innovation possibilities, embarking on negative criticism. Essentially a resource with instructional content implies relevant action on the part of the students, not only doing something, but also doing something that is meaningful to them.

The third letter in the OER acronym, finally, R relates to resource. A *resource* is a means to an end. This is more precise than the word *object* in the LO acronym, which stands for both means and end. As far as LOs are concerned, we are never sure whether object is the cultural artifact used as a means to an end, such as a book or a video used to get information; or if object is the information itself. This ambiguity creates a serious problem in LO studies because instruments cannot be confused with objects. This becomes more serious because the same thing can be used as an object (a foreign language as an object of learning for the student) or an instrument (learning a foreign language to get a better job). Our point is that this distinction has to be made and that the use of an ambiguous word such as object, meaning both instrument and objective, brings unnecessary confusion to the area.

The socio-cultural perspective is of special interest here, considering a *pedagogy of action*, in which we learn by doing and by being empowered by the tools we use. The relationship between the subject and the object ceases to be direct to be mediated by some physical or psychological tool. This is taken primarily from Vygotsky and Activity Theory (Leontiev, 1978; Engeström, Miettinen, & Punamäki, 1999). The concept of resource becomes more important because it empowers the subject, enabling people to do what they would not be able to do alone. The relationship between subject and instrument is not competitive but collaborative: man *with* the machine, not *against* the machine. The player needs the ball to play; the pianist needs the piano to give the concert. People are able to develop to given points, in which they reach limits or ceilings of their capabilities, both mental and physical. To go beyond those ceilings, they may need the help of instruments (Leffa, 2013).

In terms of mental ability, our short-term memory, for example, is extremely limited (Sweller, 2003), getting to around seven items. When we use a laptop with a two-terabyte capacity, however, we can store the equivalent of a million books the size of the Bible, with almost immediate access to any word in any of these books. This disproportion between our mental capacity and the tools we use is found not only in data storage, but also in processing those data. A statistical analysis, performed in a few seconds by a computer, is impossible to be carried out by humans without the aid of a resource.

According to Pea (1993), intelligence is distributed among minds, people and symbolic and physical resources.

Implementing an Open Educational Resource Model

The purpose in this section is to describe an authoring system that was developed to create OERs, incorporating the four Rs proposed by Wiley (2007):

1. Reuse, reprocessing a resource already available in some repository.
2. Revise, adapting the resource for the needs of a particular context.
3. Remix, by combining different resources.
4. Redistribute, sharing the resource.

A small problem in Wiley's model is the absence of an initial OER, which initializes the four Rs, assuming that the OER is a digital artifact with instructional content, not merely any device available on the Internet. The prefix "re" in the sense used by the author suggests that we start from something already created: it is only possible to reuse something that was already created and used at least once. Before using any of the four Rs, it is therefore necessary that somebody created an OER, intentionally built with an educational goal; it is not something that arises spontaneously in the network. This is the first point: to create an authoring system that produces this original OER.

The second point is to afford the four Rs. The basic idea is to provide space in the cloud where OERs can be stored in a repository for the benefit of teachers and students, reusing, revising, remixing and redistributing what is stored there. For three of these Rs (reuse, remix and redistribute), there is ready-made technology, based on the creation of databases and numerous software proposals for the hybridization of different modalities. The problem is the fourth R: how to revise the OER, in the adaptive perspective, envisioned here.

To resolve this problem, we propose the *elastic modularity* approach, trying to solve a problem already anticipated by Wiley (1999): LOs are not pieces of a Lego set, which can be combined in any way to form a teaching unit but atoms, which can only be combined in a certain way. Wiley saw LOs as monolithic blocks, as the pieces of a Lego set really are. The point here, resuming the long journey from Democritus' atoms to Negroponte's (1995) electronic bits, is that the best way to change an OER is to modify the modules that comprise it, using the same molecular principle that transforms graphite into diamond, extremely easier here because we have moved from matter into light.

The modular approach, however, must be used with caution as the focus on the module can lead to OER fragmentation, seeing only the tree and losing sight of the forest. To avoid this problem, we have developed an authoring system that works from two perspectives, both from the producer, with an emphasis the part, and the user, with an emphasis on the whole, resuming the idea of "produsage" (Bruns, 2007). The person who produces the OER is concerned about its assembling and tends to concentrate on the separate parts, on the molecules, unable to see either the graphite or the diamond as a whole. The user, however, cannot see the molecules, but only the diamond or the graphite, enjoying perhaps the brightness and hardness of the first and despising the brittle and crumble structure of the second. To address this part/whole perspective we created two open spaces. One is for the teacher, where the OER is shown disassembled in its modules, the molecules to be modified and rearranged. The other space is for the student, where the OER is shown in an assembled form, mounted in a given configuration. Any change the teacher may want to do in the OER, whether to adjust or duplicate it will be made from the modules, changing its internal structure or leaving them as they are, but rearranging them in the OER. The module is not a monolithic block as the Lego piece, but malleable in nature, like the imaginary graphite molecule, where the molecular structure can be metaphorically modified to turn graphite into diamond.

Some aspects should be highlighted to understand how the proposed system works. For didactic reasons, we use the terms *module, activity* and *authoring system*. The *module* is part of the OER and the *activity* is the OER when mounted, seen as a whole, incorporating the modules. The modules are located in the production area, usually operated by the teacher. The activities are displayed in the student area, usually visualized by the student. We use the term *usually* because they are open spaces, and, because of that, students and teachers can exchange places. The *authoring system,* finally, is the computer open source program that allows students and teacher to reuse, remix, revise and redistribute the OERs. This program was called ELO, which stands for *Electronic Language Organizer* in English. It is free for use and is available at http://www.elo.pro.br/cloud/

ELO enables the production of eight types of modules, three of the expository type and five of the interactive type. This is not the place to describe the modules; they can be seen and tested on the project website, but we would like to show the distinction between having and not having instructional content. The expository modules are characterized by not having instructional content. They were included considering advanced students, who are usually able to manage their own learning, without the need for constant guidance. They are expository modules because they only display texts, images, sounds and videos. They are produced both in the teacher's space (Hypertext Modules and Video) and the student’s space (Composer Module). In the Composer module, the student produces a hypertext from the context created by the teacher: poster, advertisement, recipe, presentation, etc. By themselves, these three modules do not evaluate student's performance, failing to provide automatic feedback and, because of that, are classified as having no instructional content. As for the interactive modules, they are characterized as such precisely for providing some kind of feedback, accompanied by a score. Feedback can be of two types: (a) strategic, providing hints and tips for the student in case of failure in answering a question, or (b) progressive, building scaffolds to better assist the students in their performance.

Although the purpose here is not to describe these modules, we feel we should try to show how module and activity articulate with one another and how the revising process works, justifying why it can be seen as adaptive. It is on these two points that the originality of the project is based.

The part/whole articulation between modules and activities can be described tentatively, showing what happens when the student accesses a particular activity in the system. The description is tentative because there is no way to demonstrate on paper the dynamics of a virtual event with interactive features of text, image, audio and video. What the student sees is the integration of the modules into a single activity, as it was planned and assembled by the teacher. What he or she does not see is that this assembling is done in real time with the elements that are in the repository, using a "just-in-time" methodology in the fitting of the invisible elements into a cohesive whole. It reminds us of the hooks in Democritus' atoms; with the difference that in the world of light rearrangements are constantly made and remade in different configurations.

It is through the constant restructuring of the modules intra- and inter-activity that adaptation occurs. What seems ready for the student was disassembled and reassembled by the teacher to create the activity, using modules that he or she produced, reused, revised, remixed and redistributed from the repository. If the teacher has reused a module, produced by himself or by his colleagues, the system creates a copy of the module and saves it in the repository, leaving the previous version intact. This means that the modules may improve over time, producing activities not only tailored to specific contexts, but with the possibility of becoming more and more refined, reaching higher standards of teaching.

Modularity is elastic because, in activity adaptation, various treatments are possible. Here's an example: When browsing the repository, using the metadata mechanism provided by ELO -- including, language, age, advance level and keywords -- the teacher ends up finding the activity that suits his or her needs. Examining the activity, he or she finds it interesting, except for a small detail in one of the modules, which has inadequate information to his teaching context. As he likes the activity and knowing that he can modify it, he decides to use it by accessing teacher space and making the desired change in one of the modules. Later, while using the activity with his students, he receives from one of them the suggestion that it would be interesting to illustrate one of the texts presented in the activity. New change is introduced in the module to add the suggestion from the student. The next day another teacher, also adapting the activity, creates another version, without deleting the existing ones, so that there are now three variations of the same activity. Over time, other teachers may introduce more variations, and what was only a single activity may have hundreds or thousands of adaptations.

The production of an activity, as defined here, is laborious work, in practice only possible by using the principle of mass collaboration (Tapscott & Williams, 2007), with a large number of teachers, working independently with the same activity and producing different adaptations.

Conclusion

The aim of this paper was to present an authoring system for the production of adaptive OERs. OERs are seen as an evolution from LOs, with an emphasis on public domain and free access. The originality of the proposal is in breaking up OERs into their components, allowing for change in the components and then reassembling them into a different OER. The authoring system developed for the project uses crowd sourcing, based on a mass collaboration ecology, which empowers teachers to do more with less work.

References

Bruns, A. (2007, December 12). Produsage: A working definition. Retrieved from http://produsage.org/produsage

Engeström, Y., Miettinen, R., & Punamäki, R. L. (1999). *Perspectives on activity theory*. Cambridge: Cambridge University Press.

Gee, J. (2004, April). Learning by design: Games as learning machines. *Interactive Educational Multimedia*, (8), 15-23.

Kvasny, L., & Trauth, E. M. (2002). The digital divide at work and home: The discourse about power and underrepresented groups in the information society. In E. Wynn, M. D. Myers, & E. A. Whiley (Eds.), *Global and organizational discourse about information technology* (pp. p. 273-291). Boston, MA: Kluwer Academic Publishers.

Leffa, V. J. (2013). Distributed agency in avatar-based learning. In E. S. Junqueira & E. K. Buzato (Eds.), *New literacies in the context of Brazilian historical social-economic inequality: Past, present, and future trends* (pp. 69-87). New York: Peter Lang.

Lévy, P. (2001). *Cyberculture*. Minneapolis, MN: Univ. of Minnesota Press.

Leontiev, A. N. (1978). *Activity, consciousness, and personality*. Hillsdale, NJ: Prentice-Hall.

Negroponte, N. (1995). *Being digital*. New York: Alfred A. Knopf.

Pea, R. (1993). Practices of distributed intelligence and designs for education. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 47–87). Cambridge, England: Cambridge University Press.

Sorj, B., & Guedes, L. (2005). Exclusão Digital: Problemas conceituais, evidências empíricas e políticas públicas. *Novos Estudos CEBRAP*, (72), 101-117.

Sweller, J. (2003). Evolution of human cognitive architecture. In B. Ross (Ed.), *The psychology of learning and motivation* (pp. 215–266). San Diego, CA: Academic Press.

Tapscott, D., & Williams, A. (2007). *Wikinomics: How mass collaboration changes everything*. New York: Penguin.

Wiley, D. A. (1999, November). *The post-LEGO learning object*. Retrieved from http://opencontent.org/docs/post-lego.pdf

Wiley, D. A. (2000). *Learning object design and sequencing theory* (Doctoral dissertation). Retrieved from http://opencontent.org/docs/dissertation.pdf

Wiley, D. A. (2007, August 8). *Open education license draft* (Web log comment). Retrieved from http://opencontent.org/blog/archives/355

Author Details

Vilson J. Leffa
leffav@gmail.com

Back to Contents page

AN ONLINE MASTER'S DEGREE: TEACHING AND LEARNING STRATEGY VS. MANAGERIAL CONSTRAINTS

Andrew Doig and Claire Pekcan
Southampton Solent University
United Kingdom

Abstract

This paper illustrates the work of a course team at Southampton Solent University to establish a delivery model for an online distance master's degree. Working under the managerial constraint of ensuring that the course delivery is sustainably affordable, the focus was to develop a model that structures tutor to student engagement in such a way as to ensure the maintenance of a high standard of teaching and learning. This model is put forward as an approach that is applicable in a variety of contexts, and hence of value to course developers from other institutions investigating ways of effectively delivering online courses.

Keywords: online, distance, student engagement, learning design, instructional design, professional learners, master's degrees, delivery model

Introduction

Southampton Solent University (SSU) currently delivers one fully online distance master's degree, the MSc Shipping Operations. Collaboratively developed by a team of academics and learning technologists, with a tested teaching and learning strategy and high student satisfaction rates, the MSc has been cited as a flagship example of SSU's capacity for online course delivery. The course team embraced an unfamiliar mode of delivery and established a teaching and learning approach that created positive learning experiences for all of their students.

However, the development and early running of the course required significant staff resourcing. Managerial requirements to ensure that programme delivery fits an effective costing model made it imperative to find a way of structuring teaching delivery so that tutor time becomes manageable and comparable with classroom-based teaching hours. This work has potential high impact as the university looks to increase its delivery of online distance programmes. However, the risk has been that in reducing the number of staff hours allocated to online course delivery, we would reduce the effectiveness of the learning experience and our students' chances of successful completion.

The Solent Online Learning Standards

From 2010-12, SSU ran a Strategic Development Programme, which included a strand committing to more flexible forms of delivery. Each faculty put forward bids for developing new programmes that included some form of online learning. In response to this, the Learning Technologies department created a Flexible Delivery Development and Support Team (FDDST) with the remit of supporting these faculty projects in creating highly effective online distance and blended learning that presented a consistent and coherent SSU-wide presentation of this mode of delivery.

The FDDST's work led to the creation of the Solent Online Learning Standards for courses that are delivered entirely or predominantly online. The SOL Standards make reference to both design and delivery elements in online courses. The development of the SOL Standards has previously been reported on (Hogg & Doig, 2012; Doig & Hogg, 2013).

Design Elements
In order to achieve a consistent SSU-branded presentation of the online learning experience, the SOL Standards require:

- A menu of fixed components appearing on all course pages
- Video-based introduction from the tutor
- Course expectations in terms of effort, duration, levels of activity and assessment methods made explicit at the outset
- Clearly signposted pathways for the learners

The choice of these factors was influenced by an informal survey of the online learning landscape carried out by the FDDST at the outset of their project. Vai and Solulski's book, *Essentials of Online Course Design: A Standards-Based Guide* (2011) and *Design for How People Learn* by Dirksen (2011) have also proved helpful in selecting design elements that help create an intuitive and effective online learning environment.

Delivery Elements
The focus on how to effectively deliver online courses led to the inclusion in the SOL Standards of elements such as:

- Knowledge building, constructive learning opportunities
- Interactive high-quality and engaging activities
- Supported, not isolated learning
- Embedded opportunities for feedback

It was recognised that a fundamental challenge of online course delivery is to ensure the constructive alignment (Biggs & Tang, 1999) of the online activities with the learning outcomes set by the course descriptors and the assessment methods employed. Helen Beetham (2007) put forward a learning activity design model that influenced the approach of the course team in designing activities. Similarly, Salmon's (2011) 5-stage model provided a way forward in terms of creating effectively *scaffolded* support for learners coming in to online distance learning.

Implications
The underpinning and indeed overriding implications of applying the SOL Standards are a much more consistent presentation of VLE course pages and an improved student learning experience. When moving between different units of study within a course (SSU uses the term *unit* where other institutions

may talk of a *module*), a student will be met with a recognisable page in which the key information sets are presented in the same place and in the same way. Similarly, the manner in which they work through the content of the unit will be consistent (though the academic may present differing forms of learning activity, depending on the nature of the content and the alignment of the activity to be studied). However, a further implication that cannot be ignored is that it takes a lot of time and effort to achieve course delivery that meets the SOL Standards.

The MSc Shipping Operations

The collaborative work of the FDDST with the course team of the MSc Shipping Operations led to the first fully distance online degree programme at SSU, which made full use of the SOL Standards.

The online environment is used to instruct and facilitate independent and group learning activities, which prepare the students for their online assessments (the range of assessment methods includes essays, reports, presentations, interviews and portfolio submission), which have been designed to test the learning outcomes of the unit and of the course. There is a strong emphasis on learner activity that focuses on the individual student's role within the maritime industry, such as reflection and research into students' own working context using research models and theory to critically evaluate their industry practice and to plan for their future professional roles. In this way the distance delivery also aligns with the fact that it is best utilised by those who continue to work in their industry while studying.

The vast majority of the learning activity is asynchronous, which is better suited to a geographically dispersed cohort, some of whom may spend times at sea during the course. However, there are also occasional synchronous online events such as virtual classroom sessions or live online presentations. These tend to be used only for specific events such as induction or at the onset of a new unit of study.

Challenges

Resource Intensive Development Phase

The development of the MSc Shipping Operations was highly resource intensive. There are three identified areas of work that required intense staff activity:

1. Professional development of the academic staff
2. The development of each unit of delivery
3. The actual running of the units

Professional development. The course team at the outset of the MSc Shipping Operations development was made up of senior academics in the Warsash Maritime Academy with considerable experience and expertise in developing and running courses for classroom based delivery. They recognised from the start that in order to successfully deliver online distance learning, they would need to undertake an extended period of professional development in the principles and practices of teaching students via the VLE.

Stages in their professional development included:

1. Presentations from Learning Technologies.
   A series of course team meetings were held at which learning technologists presented on the various online tools.
2. A full day workshop.
   This was held so that the course team could participate in live online learning activities, gaining the experience of being an online learner.
3. One-to-one consultation.
   Each course team member has ongoing one-to-one consultation with the Instructional Developer, focussing on the workflow of content presentation, learning activities and assessment within the unit.

The development of each unit. It is estimated that each unit took on average 150 hours to develop so that it was ready to run with students. There was considerable variance in this, as different members of the team had different levels of experience in using the VLE, and because different units required different styles of online course content.

The running of the unit. From the outset of the course, the lecturers were each allocated 150 hours to teach a 15-credit unit. This proved necessary in order to manage the various elements required in the role for instance:

- Facilitating online activity
- Responding to student activity in discussion forums and journals
- Monitoring student engagement and intervening when necessary
- Responding to direct enquiries from students
- Maintaining the VLE pages

Consistently in the early iterations of the MSc, the units were taught by those academics that acted as the subject matter experts (SMEs) and developed the unit in its original form, thus having an intimate understanding of the structure and rationale of the unit. These were all senior or principle lecturing staff, thus increasing the cost of running each unit.

Bringing the Course in Line with Traditional Course Delivery
From a management perspective, the resources put into developing the MSc Shipping Operations, as described above, were worthwhile as a loss leader. It was viewed as sound investment in order to create a high-quality course provision that would be attractive to professional people within the maritime industry and would retain its students until successful completion of the course. Further, the MSc has been treated very much as a flagship course within SSU for online course delivery regularly cited by senior management as one of the successful outcomes of the Strategic Development Programme.

However, the reality of running a course in a modern HE institution is that in order to be sustainable, the course must become profitable – or at least break even – within a few years of its inception. Despite the considerable reduction in on-costs of delivering a course via the Internet, it was still the case that the number of lecturer hours allocated to the teaching of the MSc was causing the course to be running at a loss, and that it would continue to do so even with the student numbers running at a per-tutor capacity.

In the 2014/15 academic year, the decision was made to bring the hour allocation on the MSc in line with that given to teaching on units taught on campus. For each 15-credit unit, the teaching staff are allocated 30 hours to teach, a reduction to a fifth of the previous teaching hours. Hence, each lecturer has considerably less time to split between the support of the students, facilitation of online activity, and the grading and feedback on assessments.

From a course team point of view this created a very immediate risk of losing the level of engagement with and support for the students that had been provided up to this time. Maintaining student engagement was already recognised as challenging.

A New Delivery Model

In the original service level agreement (SLA), the lecturers committed to respond to email within 24 hours and all forum or journal posts within 48 hours in the working week. The amount of time spent on replying to students is greatly impacted by the size and activity level of the cohort (up to a maximum of 30 per academic); it is our experience that some cohorts are considerably more active in the online activities than others. It was recognised that this manner of engagement was a key factor that increased the amount of time the academics spent on teaching.

The Staff Workflow

In recognition of this, the Instructional Developer collaborating with the course team proposed a new model for engagement, which is gradually being brought into place in the 2014/15 presentation, and will be fully in use across all units, along with a new SLA, in the 2015/16 presentation. The key to this model is structured *events* occurring across the duration of the unit. These are the points at which the tutor will provide feedback on student work. This student work can either be of individual nature (usually postings into the online reflective journal) or student-to-student collaborative or discursive tasks.

If a unit is of 15 credits, and hence 30 hours of teaching allocation, it is presumed that the tutor would commit to 5 hours of feedback and interaction with students on each online learning event. Hence, a likely pattern of engagement would involve providing feedback on three individual tasks (reflective journal) and three student-to-student tasks to make up the teaching hours. The way that the tutor's work sits as a workflow across the unit is illustrated in Figure 1.

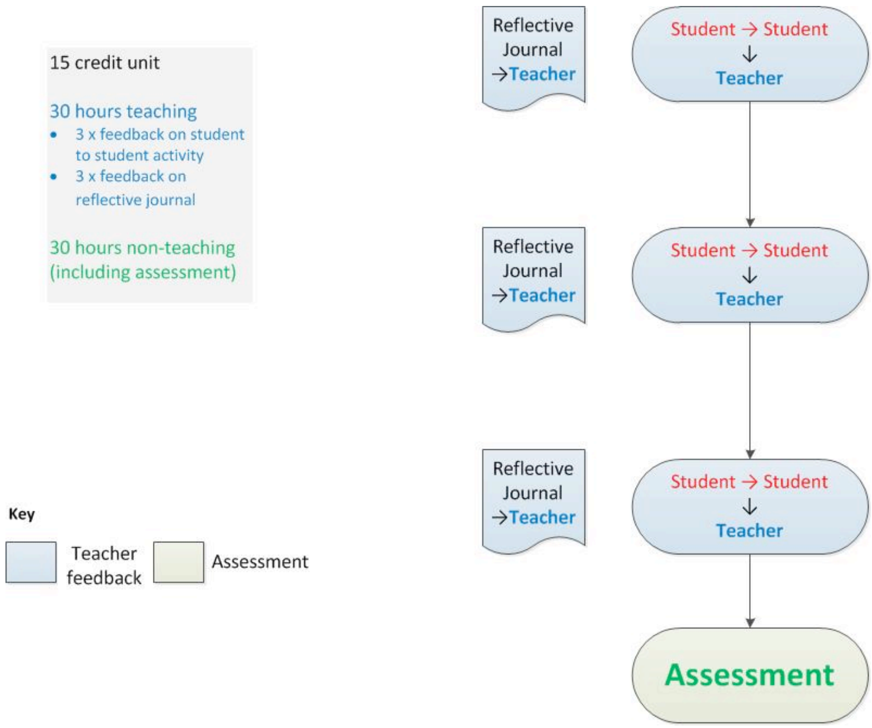


Figure 1. The staff workflow.

Figure 1 is indicative, and not exclusive; it may be that there are multiple points of assessment in a unit, and that the learning events correlate to these in progressive succession, or the nature of the learning events may vary from the pattern of three individual and three student-to-student tasks.

The time spent in general administration and on the grading of assessment work is seen as inherent in the 30 hours teaching allocation, in much the same way that in-class teaching is allocated to lecturers with the assumption that an equivalent number of hours will be spent in non-teaching duties.

One advantage of a structured model like this is that it allows the academics teaching the online units the ability to plan the dates and times of their interactions, rather than this being an open-ended contract to provide feedback and support as and when the students contribute to any of the online activities. The descriptor and syllabus of the unit can be written to make explicit where in the learning process these learning events will occur. They can be attached to expected completion dates following which the lecturer will then provide feedback.

Further, the model suggests a direct alignment between the activities that generate feedback from the tutor and the unit assessment; each activity should help the students to gain the knowledge and skills that will enable them to successfully complete the assessment. Indeed, this new model has led to a re-evaluation of the assessment methods employed in each unit in order to address this alignment, along with the tutor’s grading workload.

The Student Workflow

It should not be assumed that these learning events are the only learning activities that the students participate in while studying a unit run in this way. The model also puts forward a structured approach to learner activity that occurs independently, or with communication or collaboration with peers, but does not generate feedback from the tutor. Indeed, the underlying concept of the model is that the students will work independently towards the demonstration of knowledge or skill development that occurs in the learning events. Figure 2 illustrates an example of how the students' workflow may develop towards the learning events gaining tutor feedback.

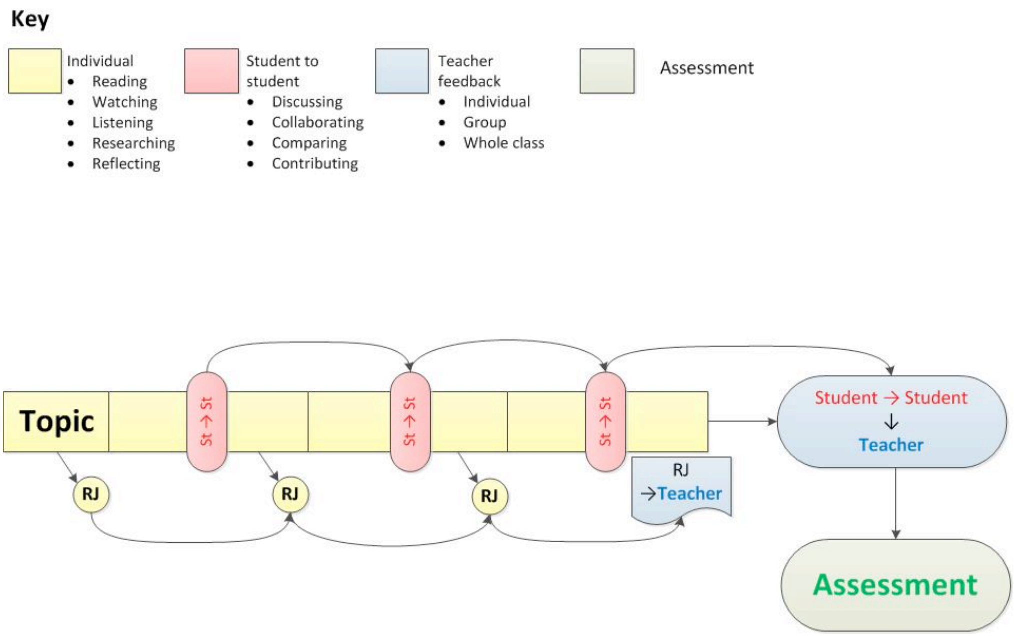


Figure 2. The student workflow.

Note that the reflective journal (RJ) posts are intended to be accumulative towards the post that the lecturer then provides feedback on. Similarly, the instructional content of the unit will guide the students towards participating in discussions or collaborations with their peers that will culminate in the production task that allows the tutor to provide feedback on their work. The outcomes of the student-to-student work may be posted individually for feedback, or may be the product of group or whole class collaboration. It is down to the tutor to design the learning activities and provide instructions in such a way as to make clear what type of output students are expected to provide and what aspects of this activity they will receive feedback on.

The Combined Staff and Student Workflow

An example of how the staff and student workflows illustrated in Figures 1 and 2 may combine into a workflow for an entire unit is provided in Figure 3:

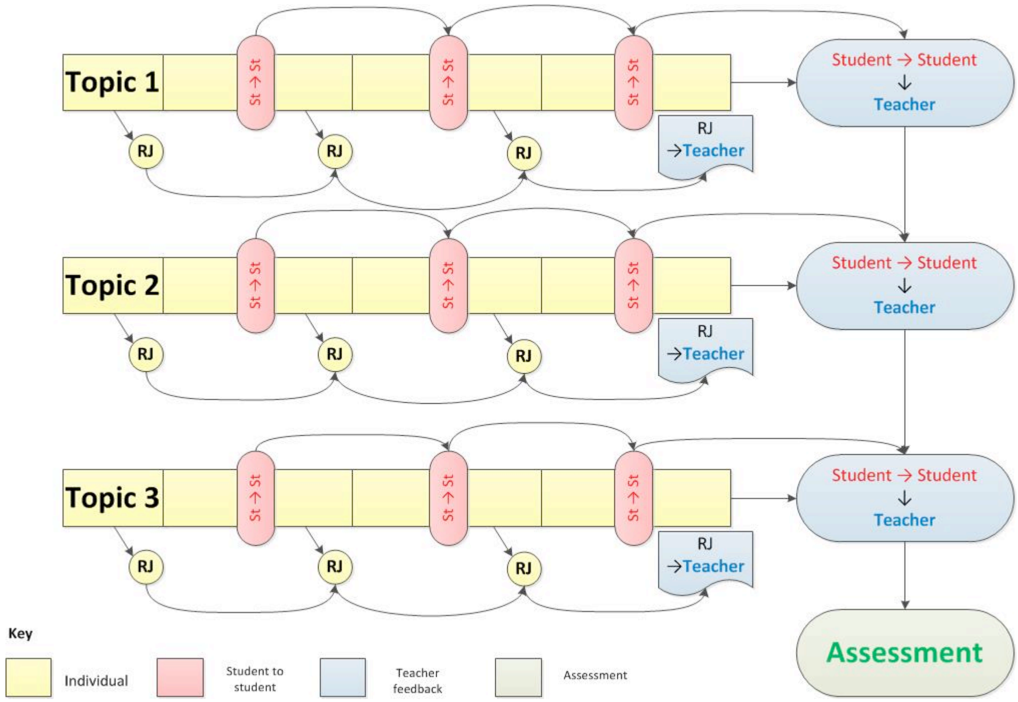


Figure 3. The overall workflow.

Given that the units are now being developed or redeveloped in such a way as to build a detailed structure around the expected workflow, it is important that this structure is made explicit to the students. This sets clear expectations of the amount of effort the students need to put in to successful completion of the unit, and also of the amount of input they should expect from their tutor.

This model also then allows for a new service level agreement (SLA) that informs the students exactly how much of an interaction with their tutor they can expect in each unit. The new SLA will be put into place at the induction of the 2015/16 cohort of students on the MSc Shipping Operations. Usefully, this SLA will also make explicit the expectation on the course team's part that in order to get meaningful input from their tutors, the students will need to actively participate in the work of the unit, and will need to contribute to learning activities in order to get formative feedback on their performance. The clear pattern of student activity also allows a means of monitoring student participation and timing interventions for non-participation. In this way, the model of learning events replicates or replaces the attendance that would be an indicator of student engagement or non-engagement in an on-campus course.

A further advantage of the new delivery model is that each unit has an established and declared pattern of interactions, making it easier for tutors other than the SMEs to teach these units. This is important. As the popularity of the course grows and student numbers increase, more lecturers need to be recruited to teach in this online distance manner. In cold financial terms, the successful implementation of this model of delivery will mean that less expensive teaching staff may be utilised.

Conclusion

The initial driver for the development of this new model of tutor to student engagement in online distance courses was the introduction of a managerial constraint in the number of teaching hours allocated to the tutor on each unit of study. Hence, the model was developed in order to make a clear definition and restriction on the number of hours the tutor commits to teaching online distance units. However, in developing the model, the course team have identified other benefits that they believe will contribute positively to the learning experience and outcomes of their students.

First of all, this formalised structure makes explicit the expectation of the amount of work needing to be carried out on the unit, not only of the academic tutor, but also of the individual student. In this way it will form a declared contract between the student and the university that will help in terms of monitoring individual student engagement and hopefully provide the opportunity for intervention. It is hoped that this will improve the learning engagement of the whole cohort. Where in the past, the most motivated and time-sufficient students would contribute actively to the ongoing learning activity throughout the unit, there is now a more level playing field of clear points of contribution that all students can strive to complete, with the knowledge that their efforts will lead to formative feedback from the tutor, and that this will help them towards successful completion of the unit assessment. Those students who have the time and motivation to carry out extended work will have the opportunity to carry out tasks that are identified as independent or collaborative work that does not elicit direct feedback from the tutor.

The impact of these innovations will need to be monitored and evaluated as they are implemented. This will be done by monitoring learner engagement, completion and success rates in comparison to previous years, as well as through collecting feedback from students on their experience of the learning journey, with a particular focus on the sufficiency of engagement with their lecturers. The course team will also take part in a reflective process of considering and discussing whether application of the model does allow for the control over teaching hours that it is intended to create.

The method of engagement between online tutors and their students outlined in this paper is in no way discipline or institution specific. It is hoped that those academics who are currently teaching in online contexts may find this a useful comparison to the methods they employ in teaching their distance courses; more particularly it is proposed that the re-application of this model in other contexts may allow those who are new to online teaching a structured approach to developing new courses for distance learning.

References

Barnett, M. L., Gatfield, D. I., Overgaard, B., Pekcan, C. H., & Graveson, A. (2006, October) Barriers to progress or windows of opportunity? A study in career path mapping in the maritime industries. *World Maritime University Journal of Maritime Affairs*, *5*, (2), 127-142.

Beetham, H. (2007). An approach to learning activity design. In H. Beetham & R. Sharpe (Eds.), *Rethinking pedagogy for a digital age* (pp. 26-38). Abingdon UK: Routledge.

Biggs, J., & Tang, C. (1999) *Teaching for quality learning at university*. Buckingham: Open University Press.

Dirksen, J. (2011). *Design for how people learn*. Berkeley, CA: New Riders

Doig, A., & Hogg, S. (2013). Engaging distance and blended learners online. In C. Wankel & P. Blessinger (Eds.), *Increasing learner engagement through cutting-edge technologies* (pp.229-260). Bingley, UK: Emerald Publishing

Hogg, S., & Doig, A. (2012). Engaging blended learning students: An evolving approach to engaging students through the VLE. *Journal of Learning Development in Higher Education, 4*. Retrieved from http://www.aldinhe.ac.uk/ojs/index.php?journal=jldhe&page=article&op=view&path[]=139

Salmon, G. (2011). *E-moderating: The key to teaching and learning online* (3rd ed.) Abingdon, UK: Routledge.

Vai, M., & Sosulski, K. (2011). *Essentials of online course design: A standards-based guide*. New York, N.Y.: Routledge.

Author Details

Andrew Doig
andrew.doig@solent.ac.uk
Claire Pekcan
claire.pekcan@solent.ac.uk

Back to Contents page

EFFECTIVE USE OF LECTURE CAPTURE IN LARGE LECTURE HALLS

Nick Linardopoulos and Steve Garwood
Rutgers University
United States of America

Abstract

This paper will report on the results of an iterative project that has been taking place at the School of Communication and Information (SC&I) at Rutgers University in the area of integrating lecture capture technology into a large lecture hall course. One gap that has been identified in the literature is that students are rarely trained in how to successfully use lecture recordings for learning; they often apply surface instead of deeper, more strategic approaches. Based on this understanding, a study was conducted focusing on the incorporation of a learning strategies training activity that utilizes self-explanation with recorded lectures viewing.

Introduction

Lecture is a highly used instructional approach in higher education, (Benson, 1989; Dunkel & Davis, 1994) and can be considered “a defining element of most university courses” (Bell, Cockburn, McKenzie & Vargo, 2001). While lecture may be a highly utilized instructional tool, it may not be as effective as many would like to think. In a study conducted by Mulligan and Kirkpatrick (2000), only nine percent of non-English speaking (NNES) background students indicated that they ‘understood very well’ the content and intent of a set of eight university lectures. Further, 22% of students overall (English speaking and NNES) indicated that they “did not understand a lot” (Mulligan & Kirkpatrick, 2000, p. 316). For instructors who use the lecture segment of their course to emphasize conceptual issues, inspire students and review problem solving approaches, these are potentially troubling numbers.

One approach to help students learn more from lecture has been to record them so that students can review content covered as part of learning and study strategies. Methods of recording include lecture capture, screencasting, vodcasting, podcasting, and creation of e-lectures or voice-over-PowerPoints (VOPP). While the process of recording and delivering lectures to students for both primary and supplementary viewing is not new, research articles using these terms began to appear in 2002, and the amount of academic articles written on the topic of video podcasts in education has increased dramatically since 2006 (Kay, 2012).

Bransford, Brown and Cocking (2000) accurately summarize the challenge for recorded lectures in higher education; “Technology-based tools can enhance student performance when they are integrated into the curriculum and used in accordance with knowledge about learning. But the mere existence of these tools … provides no guarantee that student learning will improve” (p.216).

Therefore, what we are facing in 2015 is similar to the findings of Bates and the Audio-Visual Media Research Group at the UK Open University in 1981 when they concluded, "Students do not automatically know how to use instructional television (video) to best advantage" (p. 10). At present, we have the ability to record and distribute lectures and the general belief that making recorded lectures available will improve learning. However, we need to find out more about if and how students use lecture recordings, what effects the use of recorded lectures has (and for whom), and if training on effective use of recorded lectures makes a difference in their use and level of effect.

A review of the literature and results of student surveys conducted over the last three semesters, reveal that students appreciate having lecture recordings available and believe that using the recordings helps them with course assessments. Yet, results on assessments are mixed other than for non-native English students where the results are overwhelmingly positive (Leadbeater, Shuttleworth, Couperthwaite, & Nightingale, 2012; Molnar, 2011; Pearce & Scutter, 2010). Although many instructors/schools capture recordings and make them available to students, very few train students on how to effectively use them for studying and learning. This study's hypothesis is that if training on how to use lecture recordings for studying is delivered to students (self-explanation method), it will make a significant difference in their learning strategies and assessment scores.

Self-explanation involves generating explanations to oneself that facilitates the process of integrating new knowledge with existing knowledge (Chi, Bassok, Lewis, Reimann, & Glaser, 1989). Self-explanation has shown to be an effective method for learning and studying (Bielaczyc, Pirolli, & Brown, 1995; Chi et al., 1989; Chi, Leeuw, Chiu, & LaVancher 1994; VanLehn, Jones, & Chi, 1992), is easy to implement with a brief training intervention (Bielaczyc et al., 1995; Chi et al., 1994; Hodds, 2014), and is presently being researched vis-a-vis multimedia learning (Roy & Chi, 2005), under which lecture recording applies. The combination of effectiveness, easy implementation, and connection to multimedia learning raised this method above others that were explored for a potential learning and study strategies intervention.

Research Questions

Since the Spring 2013 semester, multiple facets of lecture recording and use have been studied. In former research efforts, the focus has been on whether students in higher education have utilized lecture recordings and, if so, how and why. The most recent study, conducted in the Fall 2014 semester, continued this approach but also expanded to assess the impact of training students to utilize a learning strategy, self-explanation, so that they can make more effective use of recordings for studying and learning. This paper will specifically address the effects of the learning strategies training and these specific research questions.

If students are trained to utilize self-explanation with lecture recordings:

1. How will the training affect how they utilize lecture recordings?

2. Will the training have an impact on their level of achievement as evidenced by course assessment scores?

Literature Review

This literature review explores two primary areas that relate to this study. The first area covers the impact on learning outcomes when students use lecture recordings. The second area covers the literature of self-explanation and explores more of what self-explanation is, validates its effectiveness, and indicates methods for effective training.

Utilization of Recorded Lectures and Impact on Learning Outcomes
Availability and use of recorded lectures resulted in a positive impact, with a 9% increase in two midterm exam scores, in an Introduction to Psychology course (Cramer, Collins, Snider & Fawcett, 2006). This quasi-experimental study of 884 students reviewed use of a *Virtual Lecture Hall* (VLH) in which recorded lectures were made available. Unique in this study is that recordings were used as supplementary (review) content for in-class students and primary content for an online section. While online students used the VLH more heavily, moderate use gains were seen across both groups. Vajoczki, Watt, Marquis, Liao, and Vine (2011) also found a positive correlation between the use of lecture recordings and student learning outcomes. In their study of first and second year students in large Economics and Sociology courses (n=1675), they found that both deep and surface learners reported on surveys and focus groups that they were more satisfied with their courses and retained more knowledge when they utilized the recordings. Finally, use of lecture recordings resulted in significantly higher student test scores, 6% higher than previous year, in a graduate biochemistry course (Molnar, 2011). These gains and reported knowledge happened across social science and science disciplines for undergraduate and graduate students.

While promising, this type of positive correlation between recorded lecture viewing and gains in student learning was not seen across all studies. Other articles indicated no significant difference in outcomes when students had access to recorded lectures. (Euzent, Martin, Moskal & Moskal, 2011; Owston, Lupshenyuk, D., & Wideman, 2011; Traphagan, Kucsera &, Kishi, 2009). While the findings of 'no significant difference' on learning outcomes for students who utilized captured lectures may not seem like a positive outcome, it does suggest that if a course is heavily lecture based that students would be able to obtain a certain level of proficiency without the requirement of being present. Indeed, the long held concern of increased absenteeism due to recorded lectures, though accurate, seems to have little effect on student outcomes provided students had access to and used the recordings (Euzent et al., 2011; Owston et al., 2011; Traphagan et al., 2009; Vajoczki et al., 2011). Indeed, the findings of Owston et al. (2011) in his study of large undergraduate health courses indicated that those students who stopped attending often achieved the highest grades. The results of this study however should be mitigated by the fact that only 19% of those students in his sample allowed for access to course grades, and only the highest achievers may have granted access.

Finally, in a quasi-experimental study Le, Joordens, Chrysostomou and Grinell found that students who “augmented their class attendance with online viewing were actually the students who performed the most poorly” (2010). Much of this was attributed to student reports that they used surface level learning strategies with the lecture recording by using the pause feature in their attempt to memorize content. Further this course was in the subject was mathematics, and the authors indicated that the viewing of recorded lectures was perhaps not well suited for learning tasks in this area. In comparison, the studies reviewed that indicated no significant difference or a positive correlation were in the domains of biochemistry, psychology, geology, sociology, and economics.

In regards to Bransford et al. (2000) on the integration of the technology of lecture capture into the curriculum, there appears to be no evidence that students were significantly trained, technically or pedagogically, on the use of the lecture recordings. Instead recordings were made available and students were left to their own means to figure out how to best use them. Given this void, students seemed to generally treat lecture recordings in the same way that they treated face-to-face lectures and merely passively viewed them.

Self-explanation

As a result of the depth of research in the specific area, self-explanation was chosen as the method to train students to use when studying and learning with recorded lectures. Self-explanation involves generating explanations to oneself, which facilitates the process of integrating new knowledge with existing knowledge (Chi et al., 1989). In the education literature, the concept of self-explanation theory traces back to 1989 and Chi, Bassok, Lewis, Reimann, and Glaser’s seminal work in which they review the behaviors of “good” and “poor” students and how good students differed in their action of explaining to themselves particular concepts and examples were presented to them. Since then, there have been many studies which have affirmed self-explaining as an effective learning strategy and there have also been several studies which have examined the attributes of effective training approaches for the use of self-explanation.

The process of self-explaining has been shown to be an effective technique for learning in math (Atkinson, Renkl, & Merrill, 2003; Berthold, Eysink, & Renkl, 2009; Hodds, Alcock, & Inglis, 2014; Rittle-Johnson, 2006), science (Chi et al., 1989; Chi, Leeuw, Chiu, & LaVancher, 1994; Ionas, Cemusca, & Collier, 2012; O'Reilly, Symons, MacLatchy-Gaudet, 1998), and language arts (Huang & Reiser, 2012). Beneficial to our study is that of the studies reviewed on effectiveness, all but three, Chi et al., 1994; Huang & Reiser, 2012; and Rittle-Johnson, 2006, were conducted with college age students.

Some of the particular approaches needed to ensure that self-explanation is effective is that it is frequent (Chi et al., 1989; VanLehn, Jones, & Chi, 1992), helps students fill-in gaps in explanations and/or examples (Atkinson et al., 2003), and incorporates past knowledge and/or experience (Chi et al., 1994; Kiewra, 2002; King, 1994). Additionally, self-explanation is effective whether students are highly prompted (Atkinson et al. 2003; Berthold et al. 2009; Chi et al., 2009; Huang et al. 2012), receive low level prompts (Huang & Reiser, 2012), or training to prompt themselves (Kiewra, 2002; O'Reilly et al., 1998).

Effective training on self-explanation needs to meet several criteria: (a) it must indicate to students that self-explanation is a highly effective learning and study strategy (Kiewra, 2002; O'Reilly et al., 1998), (b) should be simple and brief (Hodds, 2014; Huang et al., 2012; Kiewra, 2002) and (c) should include practice time (Bielaczyc et al., 1995; Kiewra, 2002; O'Reilly et al., 1998) so that students can effectively incorporate self-explanation. In our Fall 2014 study we built all three of these elements into our training intervention and thus enabled students to more effectively incorporate self-explanation into their study and learning strategies.

At present, members in the educational community have the ability to record and distribute lectures and the belief that making recorded lectures available will improve learning. Further research is needed about if and how students use lecture recordings, what effects the use of recorded lectures have (and for whom), and if training on learning strategies, for this study self-explanation, to use with recorded lectures makes a difference in use and level of effect. By ascertaining more in these areas students can be effectively engaged with those resources and not look at the recordings simply as a video to watch but rather as a learning tool they can use to become competent in a subject.

Research Design and Method

Setting

This study took place in one section of the Introduction to Communication (Comm 101) course at Rutgers University in the Fall 2014 semester with a final enrollment of 227 students. Comm 101 is required for anyone who wants to major in Communication and fulfills several general education requirements at Rutgers University. The course was delivered over 15 weeks in a face-to-face format for two 80-minute sessions per week. Each 80-minute session was recorded. Recordings consisted of the instructor's voice, his PowerPoint presentation, and anything else he projected through his laptop's screen. Recordings were released to students via a link in the course management system (CMS) and all students were given a Panopto viewer-only account using their university credentials to access the recordings. In addition to the lecture, each class session also incorporated the use of a classroom response system (iClicker - http://www1.iclicker.com/) for both attendance and engagement.

Students were assessed through attendance/participation (determined via iClicker responses), three objective question exams given in weeks 5, 10, and 14, and a brief three page essay. Exam #2 was the assessment most aligned to explanation and analysis, and thus it was selected to be the one used to determine the efficacy of the self-explanation training intervention. Further, two questions on exam #2 on the Shannon and Weaver Model of Communication that were aligned with the treatment and control activities were selected for further analysis.

As confirmed by past surveys and comparison to Rutgers institutional planning data, students in the Comm 101 course are representative of the population of undergraduate students at the University (Rutgers University, 2013). For the Fall 2014 semester the demographics of students in the Comm 101 course who participated in the study were:

- Gender - 58.3% female, 40.7% male
- Race/ethnicity - 36.1%, Caucasian (non-Hispanic), 27.8% Asian/Pacific Islander, 16% African-American (non-Hispanic), 12.4% Latino or Hispanic, 7.2% Other

Method

After the add/drop period at the beginning of the semester each student in the Comm 101 course was asked to participate in a study on instructional methodology and learning strategies and to allow access to their student records. Any student who declined participation in the study was able to take part in the course, but no data were collected on or about the student. A total of 204 students opted to participate and completed the consent form, a demographic survey, and the brief version of the Approaches and Study Skills Inventory for Students (ASSIST). ASSIST indicated whether students utilize surface, strategic, or deep approaches when studying and learning (Entwistle, Tait & McCune, 2000). The results of ASSIST were utilized in the analysis of lecture recording use, adoption of self-explanation, and impact on assessment scores. This mixed-methods study was conducted in two phases. Phase 1 addressed traditional questions focusing on overall use, overall impact, and impacts based on student demographics. Phase 2 focused on the self-explanation intervention.

Phase 1 of the study began at the end of week #2 of the course with the instructor recording each lecture and making the recording available via the course management system (CMS). Links to lecture recordings were posted on a page within the CMS with a brief "How to Use Recordings" tutorial on how to use the lecture viewing system. Each recording was captioned and these captions were then indexed within the Panopto system to allow for a higher level of searching for students. Students were thus able to view a list of all the recordings over the semester, view individual recordings, search individual recordings and search across all recordings for lecture content. The Panopto system enabled students to start/stop/pause the recordings, search, and, as we had captioning done, read along with the lecture.

Phase 2 of the study began in week #8 of the semester with the students in the course being invited to a lesson and activity based on whether they were assigned to the treatment or control group. To help control for issues of compensatory demoralization, compensatory rivalry and diffusion of treatment (Creswell, 2009), both groups received training and were required to complete an assignment. Successful completion of the assignment resulted in a very small amount of extra credit. While both groups continued to have access to lecture recordings and the "How to …" screencast, the treatment group received training on self-explanation and how it could be incorporated with the lecture recordings. The control group received training on the lecture capture system's features (e.g., navigation, search, captions). Training for each group was delivered as embedded lessons in the CMS utilizing an e-learning object for content and a follow-up assessment, which allowed us to have students practice and verify how well those in the treatment group were able to use self-explanation.

In phase 2, students were randomly assigned to either treatment or control groups. At final analysis, 58 students who were engaged in the study fully participated in the treatment activities, while 57 students fully participated in the control activity. Table 1 indicates the demographic characteristics of each group and shows the homogeneity between each group.

Table 1

Demographic Characteristics of Students in Treatment and Control Groups

	Gender	Credits earned prior to course	Major or intended major in Comm	Prior Interest in course or subject	ASSIST Approach to studying & learning
Control group n=57	M: 21 F: 36	0-12: 25 13-30: 11 31-60: 13 61+: 8	Y: 10 N: 27 U: 19	SD: 2 D: 2 N: 28 A: 21 SA: 4	Deep: 18 Strategic: 32 Surface: 6
Treatment group n=58	M: 21 F: 37	0-12: 27 13-30: 12 31-60: 13 61+: 6	Y: 16 N: 28 U: 14	SD: 2 D: 3 N: 19 A: 27 SA: 7	Deep: 35 Strategic: 20 Surface: 1

Note: Where data is missing the number for each criteria will not match the n.

Throughout the study multiple types of data were captured at multiple points in time. The most applicable items for the research questions addressed in this article come from the initial demographic survey and ASSIST questionnaire, exam #2 scores, scores on the Shannon and Weaver Model of Communication questions from exam #2, exam preparation surveys, final course grades (1000pt and 4pt scales), and Panopto server log-files. The results on exam 2, Shannon and Weaver questions, and final course grade focused on the effects of student use associated with the lecture recordings and the intervention. The exam preparation survey simply asked students how they studied, if they used the recordings, and, if yes, how they used the recordings. The survey results provided valuable feedback not just on if students used the recordings but how they used them. Further, the results revealed if students indicated the incorporation of self-explanation into their study strategy. Finally, the Panopto server log-files confirmed student use of lecture recordings offering another data point on student use and timing of that use.

Results

Overview

The analysis and review of the end-of-semester survey, shows that:

- Students spent a combined total of 18,261 minutes viewing the recordings.
- Students watched an average of four recordings and about 20% watched every single recording that was made available.
- Use of the recordings peaked 3-5 days before the three principal exams.
- Overall, the students who used the recordings as part of their preparation for the exams used a combined approach of searching for specific content to review, pausing when needed to take notes or complete their study guide, and/or viewing entire recordings for class sessions they missed.
- A large majority of the students (79%) believe that the availability of the lecture recordings helped them meet the learning objectives of the course, allowed them to do better in the exams, and should continue in future terms.

Effectiveness of Use of Lecture Recordings

Table 2 shows the mean scores and standard deviations on three outcomes.

Table 2

Effect of Use of Lecture Capture Recordings on Select Course Outcomes

	Overall n=204	Overall (No-LC) n=47	Overall (LC) n=148
Exam #2	mean=16.78 sd=3.35	mean=15.28 sd=3.53	mean=17.24 sd=3.17
Final Grade (1000pt scale)	mean=852.27 sd=88.62	mean=837.49 sd=78.36	mean=862.89 sd=74.64
Final Grade (4pt scale)	mean=3.16 sd=.72	mean=2.98 sd=.722	mean=3.26 sd=.67

Note: Six students did not indicate whether they used LC or not; LC use determined from Exam #2 - Exam Preparation Survey.

Significance of these results was determined by independent samples t-tests on each dependent variable and use of the lecture capture recordings. These results indicate significance for exam #2 scores ($p=.001$) and the final grade on a 4pt scale ($p=.021$). Results for the final grade on a 1000pt scale were not significant ($p=.054$). Therefore, those students who utilized the lecture recordings did achieve a higher level of results in the course.

Self-explanation intervention results. The study attempted to determine if the training intervention on the use of self-intervention would have an effect on how students use lecture recordings and if there would be further learning gains.

Effect on lecture recording use. Upon comparing the results of the Exam Prep Survey from exam #2 to exam #1 for the treatment group, ~~we found~~ no specific mention of self-explanation or indication of a rise in deep learning or studying behaviors was found. There was a slightly increased indication of lecture capture use, which correlates to what was seen from the Panopto log-files, but overall *how* the system was used was less affected than *that* it was used.

Impact on course assessment scores. Table 3 provides results on multiple assessments and outcomes for treatment and control groups. Table 3 also shows the results for those who did not participate in either activity for comparison.

Table 3

Effect of training on self-explanation on select course outcomes

	Non-participants or incomplete n=86	Control (How to…) n=57	Treatment (Self-explanation) n=58
Exam #2	mean=15.83 sd=3.49	mean=17.7 sd=3.16	mean=17.28 sd=2.98
S&W Q.1	correct=33 incorrect=56	correct=32 incorrect=25	correct=30 incorrect=28
S&W Q.2	correct=59 incorrect=30	correct=45 incorrect=12	correct=46 incorrect=12
Final Grade (1000pt scale)	mean=830.00 sd=105.66	mean=875.88 sd=63.13	mean=863.24 sd=73.24
Final Grade (4pt scale)	mean=2.972 sd=.81	mean=3.421 sd=.52	mean=3.198 sd=.65

Note: 6 of 57 control participants indicated that they did NOT use the lecture recordings for exam #2; 2 of 58 treatment participants indicated that they did NOT use the lecture recordings for exam #2, 1 of 58 did not indicate use.

To compare results one-way analysis of variance (ANOVA) tests were conducted. Results of these tests are indicated in Table 4 below. For the dependent variables - Exam #2, Final Grade (1000) and Final Grade(4) there is no violation of variance as per Levene's test as the tests of significance indicate results of: .212, .226, and .369 respectively. For each of these variables no significant results between the treatment and control groups are observed. However, the results are significant between the control group and the no/incomplete group for all outcomes and, for exam #2 results, between the treatment group and the no/incomplete group.

Table 4

ANOVA Results for Treatment, Control, and Non-Participatory Groups

	Treatment vs. Control	Treatment vs. No/Incomplete	Control vs. No/Incomplete
Exam #2	.763	.025*	.003*
Final Grade (1000pt)	.715	.062	.006*
Final Grade (4pt)	.202	.135	.001*

Conclusion

Based on the analysis above it can be concluded that:

- Students will use lecture recordings if made available and they highly value having them available for studying and learning.
- Students who utilized the lecture recordings achieved higher assessment scores and overall outcomes than those who did not.
- Students who received training in self-explanation did not indicate a change in their approaches to learning/studying, nor did they achieve higher assessment scores or overall outcomes than those who did not.
- Students who received further training on how to use the lecture recording system did achieve higher assessment scores and overall course outcomes.

In light of the above conclusions, the issue that Bates (1982) determined regarding students uncertainty of how to use multimedia recordings is still relevant and transferable to recorded lectures. In our hypothesis we believed that training students in a study/learning technique, self-explanation, would help them to utilize the lecture recordings more effectively and that would result in an increase in student learning outcomes. Instead, it seems that it was more beneficial to train students to effectively use the lecture recording system.

There are three plausible reasons based on which the results of the study can be explained. First, training in how to use the system allowed students to better incorporate the lecture recordings into the study and learning techniques that they already utilized. Second, and related to the first explanation, student perceptions of the best study techniques for the types of assessments in the course (objective exams) were not aligned to self-explanation but more directed to memorization. Therefore being able to find, play, pause, replay, etc., in the lecture recording system seemed more valuable to students than trying to have a deep understanding of content. Third, by focusing on self-explanation, either the process was not thoroughly explained or did not effectively enough incorporate system based training. It seems that students in this study were not ready for the self-explanation approach, a topic area that warrants further research.

References

Atkinson, R. K., Renkl, A., & Merrill, M. M. (2003). Transitioning from studying examples to solving problems: Effects of self-explanation prompts and fading worked-out steps. *Journal of Educational Psychology*, *95*(4), 774.

Bates, A. W. (1981). *Learning from audio-visual media: The Open University experience* (IET Papers on Broadcasting, No. 183). ED268965.pdf.

Bell, T., Cockburn, A., McKenzie, B., & Vargo, J. (2001). Digital lectures: if you make them, will students use them? Constraints on effective delivery of flexible learning systems. *Interactive multimedia electronic journal of computer-enhanced learning*, *3*(2).

Benson, M. (1989). The academic listening task: A case study. *TESOL Quarterly, 23*(3), 421-445.

Berthold, K., Eysink, T. H., & Renkl, A. (2009). Assisting self-explanation prompts are more effective than open prompts when learning with multiple representations. *Instructional Science, 37*(4), 345-363.

Bielaczyc, K., Pirolli, P. L., & Brown, A. L. (1995). Training in self-explanation and self-regulation strategies: Investigating the effects of knowledge acquisition activities on problem solving. *Cognition and instruction*, *13*(2), 221-252.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school*. Washington: National Academy Press.

Chi, M. T., Bassok, M., Lewis, M. W., Reimann, P., & Glaser, R. (1989). Self-explanations: How students study and use examples in learning to solve problems. *Cognitive science*, *13*(2), 145-182

Chi, M. T., Leeuw, N., Chiu, M. H., & LaVancher, C. (1994). Eliciting self-explanations improves understanding. *Cognitive Science*, *18*(3), 439-477.

Cramer, K. M., Collins, K. R., Snider, D., & Fawcett, G. (2006). Virtual lecture hall for in-class and online sections: A comparison of utilization, perceptions, and benefits. *Journal of Research on Technology in Education, 38*(4), 371-381.

Entwistle, N., Tait, H., & McCune, V. (2000). Patterns of response to an approaches to studying inventory across contrasting groups and contexts. *European Journal of Psychology of Education*, *15*(1), 33-48.

Euzent, P., Martin, T., Moskal, P., & Moskal, P. (2011). Assessing student performance and perceptions in lecture capture vs. face-to-face course delivery. *Journal of Information Technology Education, 10*, 295-307.

Gunderman, R. (2013). Is the lecture dead? *The Atlantic*. Retrieved from http://www.theatlantic.com/health/archive/2013/01/is-the-lecture-dead/272578/

Hodds, M., Alcock, L., & Inglis, M. (2014). Self-explanation training improves proof comprehension. *Journal for Research in Mathematics Education*, *45*(1), 62-101.

Huang, X., & Reiser, R. A. (2012). The effect of instructional explanations and self-explanation prompts in worked examples on student learning and transfer. *International Journal of Instructional Media*, *39*(4).

Ionas, I. G., Cernusca, D., & Collier, H. L. (2012). Prior knowledge influence on self-explanation effectiveness when solving problems: An exploratory study in science learning. *International Journal of Teaching & Learning in Higher Education*, *24*(3).

Kay, R. H. (2012). Exploring the use of video podcasts in education: A comprehensive review of the literature. *Computers in Human Behavior*, *28*(3), 820-831.

Kiewra, K. A. (2002). How classroom teachers can help students learn and teach them how to learn. *Theory into Practice*, *41*(2), 71-80.

King, A. (1994). Guiding knowledge construction in the classroom: Effects of teaching children how to question and how to explain. *American Educational Research Journal, 31*(2), 338-368.

Le, A., Joordens, S., Chrysostomou, S., & Grinnell, R. (2010). Online lecture accessibility and its influence on performance in skills-based courses. *Computers & Education, 55* (1), 313-319.

Leadbeater, W., Shuttleworth, T., Couperthwaite, J., & Nightingale, K. P. (2012). Evaluating the use and impact of lecture recording in undergraduates: Evidence for distinct approaches by different groups of students. *Computers & Education, 61*(2013), 185-192

Molnar, D. (2011). Non-native English language speakers benefit most from the use of lecture capture in medical school. *Biochemistry and Molecular Biology Education, 39*(6), 416-420.

Mulligan, D., Kirkpatrick, A. (2000). How much do they understand? Lectures, students and comprehension. *Higher Education Research & Development*, *19*(3), 311-335.

O'Reilly, T., Symons, S., & MacLatchy-Gaudet, H. (1998). A comparison of self-explanation and elaborative interrogation. *Contemporary Educational Psychology*, *23*(4), 434-445.

Owston, R., Lupshenyuk, D., & Wideman, H. (2011). Lecture capture in large undergraduate classes: Student perceptions and academic performance. *Internet and Higher Education, 14*(4), 262-268.

Pearce, K., & Scutter, S. (2010). Podcasting of health sciences lectures: Benefits for students from a non-English speaking background. *Australasian Journal of Educational Technology, 26*(7), 1028-1041.

Rittle-Johnson, B. (2006). Promoting transfer: Effects of self-explanation and direct instruction. *Child development*, *77*(1), 1-15.

Roy, M., & Chi, M. T. (2005). The self-explanation principle in multimedia learning. In R. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 271-286). Cambridge, UK: Cambridge University Press.

Rutgers University. (2013). *2013-2014 Rutgers University fact book*. Rutgers, The State University of New Jersey. New Brunswick, NJ: Rutgers University Press. Retrieved from http://oirap.rutgers.edu/instchar/factbook.html

Traphagan, T., Kucsera, J. V., & Kishi, K. (2010). Impact of class lecture webcasting on attendance and learning. *Educational Technology Research and Development, 58*(1), 19-37.

Vajoczki, S., Watt, S., Marquis, N., Liao, R., & Vine, M. (2011). Students approach to learning and their use of lecture capture. *Journal of Educational Multimedia and Hypermedia, 20*(2), 195-214.

VanLehn, K., Jones, R. M., & Chi, M. T. (1992). A model of the self-explanation effect. *The journal of the learning sciences*, *2*(1), 1-59.

Author Details

Nick Linardopoulos
nick.linardopoulos@rutgers.edu

Steve Garwood
sgarwood@rutgers.edu

Back to Contents page

STUDENT AND STAFF PERCEPTIONS ON THE IMPACT OF LECTURE CAPTURE

Daran Price and Timos Almpanis
Southampton Solent University
Southampton, UK

Abstract

This paper summarises interim research findings from a pilot project on lecture capture. The background and the objectives of the pilot are described, followed by a literature review on the subject in order to contextualise the research focus of the project. The methodology followed is outlined, and the project findings with a focus on staff and student perceptions of lecture capture's impact on satisfaction, attendance and performance are subsequently described and discussed. The main outcomes from the research are summarised and ideas for further research on the subject are indicated in the conclusion.

Introduction

Lecture capture has been cited (Greenberg & Nilssen, 2011) as one of the most transformative technologies to impact Higher Education Institutions (HEIs) in recent times. It is rapidly being adopted as a core service by the majority of UK HEIs and has a marked positive impact on levels of student satisfaction. Whilst being cautious about the nature of some of the claims that may be attached to the adoption of lecture capture, interim findings of a pilot study at Southampton Solent University (SSU) offer a demonstrable enthusiasm toward the availability of recorded lectures.

Background

Lecture capture is often used as an umbrella term describing a range of technologies used to digitally record and distribute lectures. Some of the characteristics that now might be expected of a lecture capture system, such as automated recordings alongside associated lecture notes and annotations, were germinating 20 years ago, as in the Classroom 200 project initiated in 1995 at Georgia Tech (Abowd, 1999).

Historically, the term was inclusive of various ad hoc methods of recording a session including video cameras, flip cameras, or even plain audio recorders. Whilst the breadth of technologies used has varied significantly, recent developments have seen Software as a service (SaaS) solution come to the fore. The main advantages of SaaS solutions for lecture capture are lower entry thresholds for hardware and infrastructure, as well as the training and support requirements needed to enable lectures to be recorded easily and at scale.

The 2012 UCISA survey Technology Enhanced Learning (TEL) within UK HEIs (Walker, Voce, & Ahmend, 2012), highlighted that lecture capture was one of the top five demands faced by universities, with 50% of institutions having adopted its use. This had increased over the two years leading up to the

2014 UCISA survey (Walker et al., 2014) where 63% of HEIs were now seen to be supporting lecture capture as a core service.

The Learning Technologies Department at SSU initiated a series of pre-pilot trials to evaluate the potential lecture capture solutions might afford. The trials' focus enabled a comparative study against existing services being delivered at SSU, alongside the usability, interoperability and pedagogic benefits for staff and students. The outcome of the investigative trials was the selection of Panopto as a preferred solution to be adopted for a pilot period over the academic year 2014/15. A call for participation to all academic staff was issued via the University news channels as well as via the university's main annual conference in September 2014 (Price & Almpanis, 2014). Academics were asked to submit proposals outlining their expressions of interest; a resultant 28 members of staff were invited to participate in the pilot.

Proposals were received across the three University faculties, representing a broad range of courses, and a total of 68 unit pages were enabled for lecture capture on the Virtual Learning Environment (VLE). The enabled units had at least one active recoding attached to them and 1,501 enrolled students in total. During the period under consideration, a total of 455 lectures were recorded, which equates to 253.36 hours of recordings; these were viewed a total of 3,910 times.

Objective

This paper will examine the perceptions and self-reported use of lecture capture of both academics and students. It considers project findings over a fifteen-week period during semester 1 of the pilot.

Students and staff were invited to take part in online surveys and focus groups to gather interim feedback on the impact lecture capture seen to have had on teaching and learning. By focusing on the perceptions of participants at this interim stage, the authors of the paper aim to use these initial findings towards comparative longitudinal studies.

Literature Review

This section will look at studies in the area of lecture capture that have taken place in the UK and globally, with an emphasis on lecture capture impact on satisfaction, attendance and performance.

Lecture Capture and Student Satisfaction

A number of studies in the area of lecture capture show that students are generally positive about its use. According to a study by Cooke et al. (2011), students largely perceived lecture capture to be useful both during the course and in preparation for assessment. Another study showed that students consider lecture capture to be an effective tool to help them succeed on the course and expressed their wish for all lecturers to record their lectures (Nashash & Gunn, 2013). Furthermore, a large study on the impact of recorded lectures with 746 students showed that 80% of students claim that recorded lectures "makes it easier to learn" (Gosper, McNeill, Phillips, Preston, Woo, & Green, 2010).

Lecture Capture and Student Attendance

Some studies on lecture capture have looked at the impact of lecture capture on student attendance. One study focusing on the impact of audio recorded lectures showed that attendance remained high throughout the semester and that “contrary to popular belief, generation Y students in general, do not aspire to replace lectures with downloadable, online versions” (Larkin, 2010, p.238). In another study (Nashash & Gunn, 2013) students indicated that the availability of the recordings did not encourage them to skip or miss any classes. In a study by Copley (2007), which surveyed 84 students, the majority of them (59%) stated that recorded lectures would not reduce their attendance, while 12% of students stated that access to recordings would increase likelihood of absence. The remaining 31% of students stated that their decision would depend on the course. A study by Traphagan, Kucsera, and Kishi (2009) showed that the availability of webcasts negatively impacted student attendance by 9% on average.

Lecture Capture and Student Performance

Some studies in the area of lecture capture have looked at correlations of lecture capture and student performance. A study on lecture availability in introductory psychology (Hove & Corcoran, 2008) suggested that posting lectures to supplement a traditional college class was associated with a small, positive effect on academic achievement. Another study (Traphagan et al., 2009) regarding webcasts’ impact on performance found that among students with access to webcasts more viewing was associated with higher performance; however, overall, students with webcast access did not differ on performance measures from students in the control group who had no webcast access. According to the same study, webcast viewing appears to nullify the negative effect student absenteeism can have on student performance.

While student satisfaction is evident in most studies on lecture capture so far, as students respond positively to having their lectures recorded and express their wish for more of them to be captured, the impact of lecture capture on student attendance and student performance is far more complex and context specific, as there are many variables involved. Acknowledging this, the authors of this paper have decided to investigate these areas - impact on attendance and impact on grades - as perceived by staff and students who participated in the lecture capture pilot. In other words, instead of making any claims that the introduction of lecture capture has or has not impacted student attendance and grades at this early stage, the results will highlight the impact on attendance and performance as perceived by students and staff who participated in the pilot.

Methodology

A mixed methods approach has been adopted in this research, as either the quantitative or qualitative approach by itself would be inadequate to best understand staff and students' attitudes to lecture capture. Two surveys were devised, one aimed at staff and one at students and they were administered electronically using Google Forms. These surveys were followed up by three student focus groups and two staff focus groups. Two members of staff who were not available for the focus group were interviewed individually. The focus groups and the interviews covered the same questions with the survey but allowed participants to respond in a more discursive way, expanding on the answers given in the surveys.

Results

Student Perceptions

Students were sent an email link to an online survey created with Google Forms to which there were 93 respondents. Following that, three student focus groups (with 6-8 participants in each) took place in order to further elaborate on the questions providing some additional qualitative data.

Student use of lecture captures. The survey highlighted the variety of devices and platforms students used to view recorded lectures, taking advantage of the flexibility and manner in which they could engage with the resources. With applications for Panopto available for smart phones and tablets, they both featured in the responses, and 42 (45%) students indicated they had used more than one device. However, as shown in Figure 1, the most common device was a laptop (n.56 - 60%).

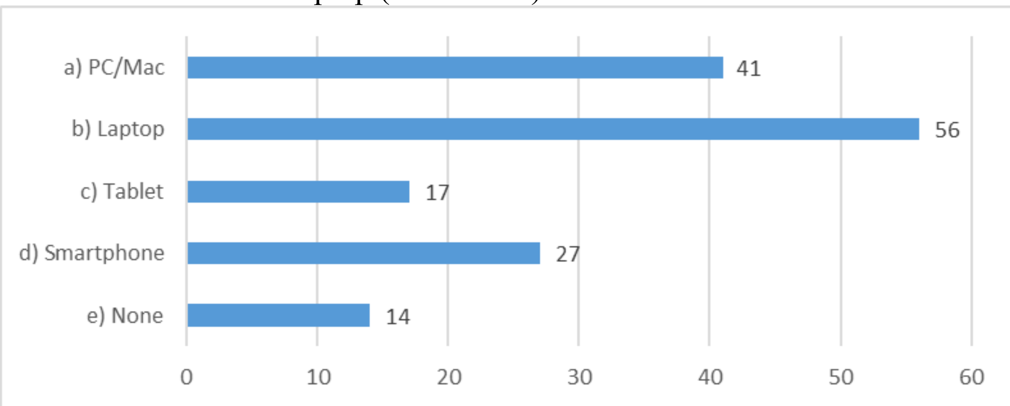


Figure 1. I have accessed video recordings from the following devices (tick all that apply).

The majority of students reported viewing the recordings with 76 (82%) of students indicating they had viewed at least a few of the resources. When asked how many of the resources they were expecting to watch by the end of the academic year, this figure increased to 87 (93%), as shown in Figure 2.

Options	Results
a) All	32
b) Most	32
c) A few	23
d) None	6
Grand Total	93

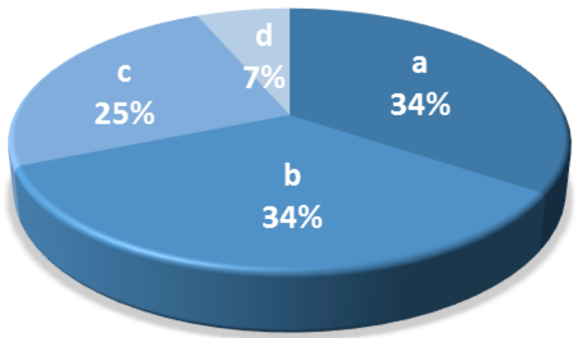


Figure 1. How many of the recordings are you planning to watch by the end of the academic year?

The recordings were seen to be easy to understand, with 66 (71%) of students either agreeing or strongly agreeing. An equally positive response was received when students were asked about ease of access, with 77 (82%) agreeing or strongly agreeing that they were easy to access.

When asked if they would like to see the continuation of lecture capture, a significant majority 74 (80%) of students expressed they would agree or strongly agree as shown in Figure 3.

Likert	Results
1) Strongly Disagree	0
2) Disagree	5
3) Neutral	14
4) Agree	22
5) Strongly Agree	52
Grand Total	**93**

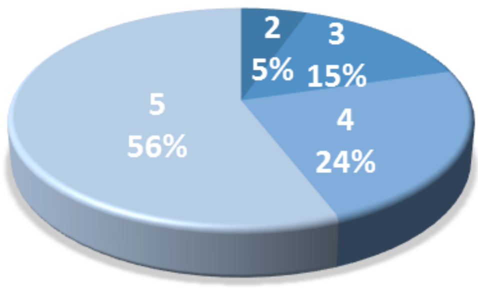


Figure 2. I would like to see more of my lectures being recorded in the future.

Student perception on whether lecture capture will improve their grade/performance. Both the survey and focus groups considered the benefit lecture capture might have in supporting students learning and learning outcomes. When asked if the recordings supported their learning, 59 (64%) either agreed or strongly agreed they had.

There was a strong perception that lecture capture would improve students' performance and grades with 67 (72%) of respondents agreeing or strongly agreeing there would be a positive impact, as shown in Figure 4.

Likert	Result
1) Strongly Disagree	3
2) Disagree	6
3) Neutral	17
4) Agree	39
5) Strongly Agree	28
Grand Total	**93**

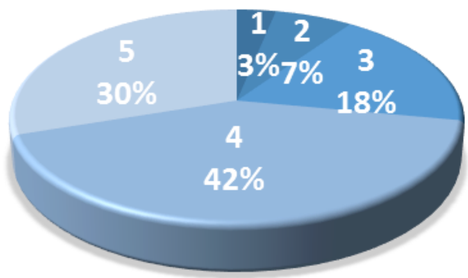


Figure 3. I think that the lecture recordings/video tutorials will improve my grades/performance.

The focus groups firmly reiterated the perspective that lecture capture met their learning needs; one student for instance commented:

> It’s like exceeding them really because you wouldn’t get that anywhere else. If you went to school you wouldn’t go home and get a lecture capture and video of your lessons, so it is like better than I expected when I came here.

Another student reflected on the benefits of being able to engage more effectively in class rather than concentrate on taking lecture notes:

> I also find lecture capture really useful instead of those notes because usually other classmates have questions about those slides and they ask the question and the lecturer can answer the question instead of everyone sending emails to the lecturer. Lecture capture is good because everyone gets the same information at the same time.

Moreover, one student added that access to the lectures might have a positive impact on student grades:

> Definitely, because a lot of the time I do not want to be sitting there and writing notes (in class) when I write notes I miss out on what the lecturer is saying. So it is better for me to write out what I can in the lesson and the things that I missed I can go home and look at. It definitely helps to improve my grades because I get more from the lesson.

Whilst it is often problematic to empirically prove an actual positive impact on student grades based on the introduction of a new technology alone, it seems to be clear that students' perceptions are that lecture capture will improve their performance. The initial findings of the pilot clearly indicate a beneficial impact on student satisfaction.

Student perceptions on whether lecture capture will encourage them to skip lectures. When asked tor the reasons why they accessed the lecture capture resources, 58 students (62%) selected more than one option. The majority of students --55 (59%) -- indicated they would view the recordings to revise before an assessment point and 53 (56%) in order to clarify difficult concepts. However, 31 (33%) of students also indicated they had viewed recordings in part due to a missed lecture.

This raises a commonly expressed concern, that the provision of recorded lectures will have a detrimental effect on student attendance. Whilst some studies have indicated a reduction in levels of student attendance, this is not a consistent outcome of published research, as discussed in the literature review section of this paper. Furthermore, when students were asked if lecture capture would impact their attendance, the majority of them stated that lecture capture would not encourage them to skip lectures, as shown in Figure 5.

Likert	Results
1) Strongly Disagree	44
2) Disagree	30
3) Neutral	9
4) Agree	7
5) Strongly Agree	3
Grand Total	**93**

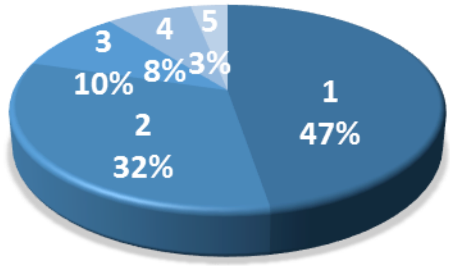


Figure 5. The availability of the recordings will encourage me to skip classes.

The significant majority of students (n.74 - 79%) indicated that they strongly disagreed or disagreed that lecture capture would encourage them to miss lectures. This appears to reflect recommendations in the Quality Assurance Agency (QAA) report on Student Expectations and Perceptions in Higher Education where it is highlighted that students want to utilise technology in order to enhance their learning through teaching, rather than replace it:

> Institutions should be cautious of using technology as a replacement for face-to-face interactions, or as a substitute for developing an active and collaborative learning environment and community. (Kandiko & Mawer, 2013, p2)

Responses from the student focus groups echoed the survey findings, with the importance of lecture attendance being highlighted:

> I think it's your own personal mind-set, how much you want to get out of university yourself; because I think if you miss a lecture, you are going to miss out what the tutor said and it's not really the same - having it recorded - as being there. You can't ask individual questions, if you got your own problems. I think it's better to be there.

Another student comment reflected on the importance of lecture attendance and interaction with peers:

> The most important thing for me is the interaction; like, you are in the mood, in the class mood, you are interacting with all that is happening around you whereas at home you are just in front of the screen; you need a lot of attention to concentrate; and you are not going to sit and watch video every single day.

Whilst there is strong justification that any potential adverse impact is carefully monitored and evaluated over a longer period than represented by these initial pilot findings, student perceptions are that attendance will not be impacted by the use of lecture capture.

Staff Perceptions

The 28 members of staff who participated in the pilot close to the end of the first semester received an email with a link to an online questionnaire and were also invited to attend a focus group or interview in order to provide some more detailed feedback about the project. The online questionnaire returned 12 responses, while 8 members of staff attended a focus group or an interview. As the questionnaires were anonymous, it is possible that some members of staff that took the online survey subsequently participated in a focus group or interview, and, due to this, but also due to the small number or responses, no statistical analysis will be attempted on the staff perceptions of lecture capture at this stage. Instead, these datasets will be discussed qualitatively, with an aim to highlight lecturers' early responses to lecture capture practices and in particular their perceptions on whether lecture capture can support students' learning and the possible impact on student attendance, student satisfaction and student performance.

Staff perceptions on whether lecture capture can support students' learning. The majority of staff agreed or strongly agreed that lecture recordings can support their students' learning; only a couple of them were unsure but nobody disagreed with that statement. One lecturer who thought that lecture capture could support students' learning attributed this to the fact that students can focus more on the session, as they don't need to take notes:

> It's actually the learning cycle stuff, the Kolb stuff; by giving students the lecture, one of the things I found is that I can say to them "don't write things down, pay attention to me, let's problem solve this as a class" and then they can go back and then make notes…

Another lecturer pointed out that lecture recordings offer various benefits depending on the type of the recording; these include the ability to catch up with the lecture if one has missed it, but also for revision for those who have been in the class:

> Where you're just doing a traditional lecture and going through a PowerPoint, then it's most useful for the ones who have missed it, but when I'm teaching numerical based subjects and problem solving type things, then they find it incredibly useful to be able to go back and listen...

One member of staff claimed that lecture capture could support students' learning near assessment points in particular:

> I think in terms of having that as a resource, as assessments and assignments come in, when they see the relevance of it immediately they can go back and look at it. In terms of supporting their learning it is a valuable resource.

Furthermore, the sole presence of the video provided some sense of security to students, as they knew that the lecture would be available as and when they need it, according to another lecturer.

Staff perceptions on whether lecture capture will encourage students to skip lectures. Most members of staff did not think that lecture recordings would negatively impact student attendance. On the contrary, two members of staff said that they had noticed the opposite:

> It increases attendance because you get students more confident to come back here if they miss a session.
>
> I've only seen evidence to the contrary, in that we've used a previous system clearly to this one over the last two years and found an increase in level 6 in student attendance of about 20%.

One lecturer in the focus group expressed some concerns regarding lecture capture and student attendance:

> There is a danger that, I'm thinking in that one professional course, I have put some very comprehensive content and a couple (of students) made a comment that '"you've got such a lot up there I don't think that I need to come," which is a danger for me because actually what is discussed in class is important and has made me thinking that perhaps I shouldn't be putting everything up on myCourse (Moodle VLE); I don't know.

However, as another lecturer pointed out, lecture capture is more likely to be seen by students as a complementary technology rather than a replacement for classes:

> I think that when PowerPoint started to go on myCourse there was a worry that students would not come, that's another step on from that but students do on the whole still go to lectures; they might then use it as additional resource and I think ultimately, students will see this is an additional resource and nothing like being in the class; the atmosphere and the discussion, the interactivity cannot be replaced with a video; I think it enhances the class rather than replaces it.

Staff perception on whether lecture capture will improve students' grades/performance. Most staff agreed or strongly agreed that the lecture recordings will improve students' grades/performance. Only one member of staff was unsure and another one disagreed with that statement.

The possible improvement of students' grades was attributed to the fact that lecture recordings provide an opportunity to students to catch-up with their course, which in turn raises their confidence:

> Yes, I do. If a student is more confident to come for the next lecture it's because he feels up-to-date and that's inevitably going to affect their grades. If a student is more confident about a subject, they may wish to enquire deeper into some of the questions and become more interested and cognitively more engaged in the process.

Another member of staff agreed that the availability and re-usability of lecture recordings will improve the grades of those who will use it, while another mentioned that although that improvement of grades due to lecture recordings would be hard to prove, he gets better questions by students as a result of lecture capture:

> Difficult to prove empirically but I would say that, anecdotally, I get better questions in the classroom because I think that those who watch it and come back to the next session are much more confident.

Conclusion

This paper summarised the interim findings from piloting lecture capture at Southampton Solent University. Background information on the uptake of similar technologies has been provided and the literature review in this area has been discussed in order to contextualise the project. It has been noted that some of the key areas of focus around the deployment of such technologies include student satisfaction, impact on student attendance and impact on student performance. The pilot's initial findings have indicated a beneficial impact on student satisfaction. Regarding student attendance, there has not been an indication that the introduction of lecture capture will negatively affect student attendance, but that, however, it will provide a fall back plan for those students who might miss a session for whatever reason. Whilst it is often problematic to empirically prove an actual positive impact on student grades based on the introduction of a new technology alone, students' perceptions are that lecture capture will improve their performance.

The project will continue, and more data will be gathered in the end of year 1 in order to see whether there are any changes in staff and students' perceptions of lecture capture. Furthermore, usage data will be looked at more closely, in order to fully understand how and when students engage with lecture recordings. Peak times of student usage will be identified and will be compared against assessment points in order to see whether there is a correlation between the two. The nature of the recordings with the most views will also be discussed with participating lecturers and students in an attempt to understand the parameters that affect usage. Furthermore, viewings of the recordings will be compared with physical attendance records in order to find out more about whether students view the recordings more for revision or in order to catch-up with a missed lecture.

References

Abowd, G. (1999). Classroom 2000: An experiment with the instrumentation of a living educational environment. *IBM Systems Journal*, *38*(4), 508-530.

Cooke, M., Howards, M., Watson, B., Johnston, A., Blacklock, E., Tower, M., Mansah, M., & Murfield, J. (2011). Lecture capture: First year student nurses' experiences of a web-based lecture technology. *Australian Journal of Advanced Nursing*, *29(*3), 14-21.

Copley, J. (2007) Audio and video podcasts of lectures for campus-based students: production and evaluation of student use. *Innovations in Education and Teaching International*, *44*(4), 387–399.

Greenberg, A., & Nilssen, A. (2011). *Lecture capture deployment models* (Wainhouse Research white paper*)*. Wainhouse Research [Online]. Retrieved from www.wainhouse.com/files/papers/wr-lecture-capture-deploy.pdf

Gosper, M., McNeill, M., Phillips, R., Preston, G., Woo, K., & Green, D. (2010). Web-based lecture technologies and learning and teaching: A study of change in four Australian universities. *Research in Learning Technology*, *18*(3), 251- 263.

Hove, M. C., & Corcoran, K. J. (2008). If you post it will they come? Lecture availability in Introductory Psychology. *Teaching of Psychology*, *35*, 91-95.

Kandiko, C. B., & Mawer, M. (2013). Student expectations and perceptions of higher education. London: King's Learning Institute. Retrieved from http://www.kcl.ac.uk/study/learningteaching/kli/research/student-experience/QAAReport.pdf

Larkin, H. (2010). "But they won't come to lectures…" The impact of audio recorded lectures on student experience and attendance. *Australasian Journal of Educational Technology, 26*(2), 238-249.

Nashash, H. A., & Gunn, C. (2013). Lecture capture in engineering classes: Bridging gaps and enhancing learning. *Educational technology & Society, 16* (1), 69-78.

Price, D., & Almpanis, T. (2014). Supporting student learning with lecture capture. *Solent eXchange 2014*. Southampton, UK: Southampton Solent University.

Traphagan, T., Kucsera, J. V., & Kishi, K. (2010). Impact of class lecture webcasting on attendance and learning. *Educational Technology Research and Development*, *58*(1), 19-37.

Walker, R., Voce, J., & Ahmend, J. (2012). 2012 *Survey of Technology Enhanced Learning for higher education in the UK*. Oxford, UK: Universities and Colleges Information Systems Association (UCISA): Retrieved from http://www.ucisa.ac.uk/~/media/groups/ssg/surveys/TEL_survey_2012_final_ex_apps

Walker, R., Voce, J., Nicholls, J., Swift, E. Ahmed, J., Horrigan, S., & Vincent, P. (2014). *2014 Survey of Technology Enhanced Learning for higher education in the UK*. Oxford, U.K.: Universities and Colleges Information Systems Association (UCISA). Retrieved from http://www.ucisa.ac.uk/~/media/groups/dsdg/TEL%20Survey%202014_29Sep2014.ashx

Author Details

Daran Price
daran.price@solent.ac.uk
Timos Almpanis
timos.almpanis@solent.ac.uk

Back to Contents page

COGNITIVE AND METACOGNITIVE PROMPTING IN ILL-STRUCTURED TASKS: THE ART OF ASKING

Victoria Smy, Marie Cahillane, and Piers MacLean
Centre for Cyber Security and Information Systems
Cranfield University, Defence Academy of the UK
United Kingdom

Abstract

This review of prompting and its applications within ill-structured problems connects a number of literature/research bases to derive prompting principles that foster learning and skill acquisition among trainees/novices performing complex, ill-structured problem-solving tasks. Relevant theoretical inputs and research are reviewed, from which a practical model is derived outlining how reflective metacognitive prompting can support learning and the adoption of an internalized learning approach. Future research should aim to empirically test the proposed model.

Introduction

The present paper attempts to connect the literatures on ill-structured problems, developing competence/expertise, metacognition, and scaffolding (in particular prompts). Such an undertaking should prove informative in the scaffolding of novice problem-solving in ill-structured environments. Consideration is given to laying the groundwork for continual development with the aim of instilling metacognitive strategies for continued exploitation beyond taught environments. The remainder of this introduction outlines the relevant literature bases. A prompting method is then developed and proposed alongside some considerations for its implementation within technology enhanced learning environments.

Problem Structure

Many researchers have highlighted the crucial features, differences, and distinctions between well-structured and ill-structured problem-solving tasks (Byun, Lee, & Cerrato, 2014; Ge & Land, 2004; Ge, Chen, & Davis, 2005; Kim & Hannafin, 2011; Krizan, 1999; Lynch, Ashley, Pinkwart, & Aleven, 2009; Pirolli & Card, 2005). Generally, an *ill-structured problem* has vague goals, unclear solution pathways, undefined problem spaces/domains, and no best solution method. Lynch et al. (2009) characterise ill-structured problems as lacking some definition or being intractable, both of which require the problem solver to characterise aspects of the problem before solutions can be developed. Examples of problems or domains that lack clear definition include scientific enquiry, design problems, intelligence analysis, decision-making, troubleshooting, dilemmas, and policy problems (Kim & Hannafin, 2011, Pirolli & Card, 2005). Solving such problems is complex and poses higher demands on cognitive and metacognitive ability (Ge et al., 2005).

Table 1 captures and categorises some of the crucial distinctions between well-structured problems and problems lacking various degrees of structure (partly adapted from Krizan, 1999). Also captured are some distinctions in the higher-order cognitive skills attributed to effective performance for problems of differing structure (Ge & Land, 2004). Some of the skills listed are interrelated. For instance, critical thinking and metacognition exhibit considerable overlap (e.g., Helsdingen, van den Bosch, van Gog, & van Merriënboer, 2010), with metacognition underpinning the ability to think critically. Other skills represent either stages of sensemaking or solution generation (e.g., Pirolli & Card, 2005). *Sensemaking* involves a series of activities that focus on constructing an understanding of the problem and problem domain and may incorporate problem definition, structuring the problem space and finding an appropriate way to represent the problem. Table 1 indicates that as the level of problem structure decreases, an increasing number of higher-order cognitive skills are needed for efficient problem solving, which may be problematic for novices.

Table 1

Key Characteristics and Cognitive Processes as a Result of Problem Structure

Features	**Problem Structure**			
	Well-structured	Semi-structured	Ill-structured	Severely ill-structured
Typical problem	How much/ many?	Determine best configuration, or rank outcomes	Identify outcomes in an unbounded context	Predictive identification of outcomes in a dynamic situation
Role of facts	High	Moderate	Low	Lowest
Role of judgment	Low	Moderate	High	Highest
Probability of error	Low	Moderate	High	Highest
Higher-order cognitive processes		Problem structuring Problem representation Alternate generation Evaluation Critical thinking Metacognition	Problem definition Problem structuring Problem representation Alternate generation Evaluation Mental simulation Critical thinking Metacognition Expert intuition /recognition	Problem definition Dynamic reframing Problem structuring Problem representation Alternate generation Evaluation Mental simulation Critical thinking Metacognition Expert intuition /recognition Foresight

Novice-Expert Distinctions

Novices differ from domain experts in the way in which they approach an ill-structured problem (Vogel-Walcutt, Fiorella, & Malone, 2013). Novices tend to over-simplify problems by selecting a sub-set of components to attend to, they often have difficulty in identifying the relevance of problem information, and they may fail to consider alternative solutions (An & Cao, 2014; Kim & Hannafin, 2011). Novices may not take time to explore the problem or engage in planning activities and may prematurely skip to developing a solution (Roll, Holmes, Day, & Bonn, 2012, Ge et al., 2005) as their knowledge and solution strategies are not interconnected (Vogel-Walcutt, Fiore, Bowers, & Nicholson, 2009). Novices are more likely to make unfounded assumptions and be unwilling to abandon non-productive strategies (Kim & Hannafin, 2011). Finally, novices do not tend to monitor or evaluate their strategizing and rarely spontaneously engage in metacognitive activities (An & Cao, 2014; Roll et al., 2012). In contrast, experts have well-developed schemata that help organise and structure their problem framing activities. They are quick to recognise salient problem features/cues and generate appropriate solutions (Klein, 2090). Experts are also better aware of when they have made errors and will adjust their strategies accordingly (Ge & Land, 2004), demonstrating an improved ability to monitor and evaluate their performance, indicative of the application of metacognitive skill.

Models of expert behaviour state that expertise is acquired by learning the basic domain knowledge, the appropriate procedures, and then engaging in extensive and varied practice whereby knowledge management improves and the frequency of errors decreases (Fitts & Posner, 1967). Increase in competence is consolidated via reflective and integrative metacognitive practices that help identify strengths and weaknesses in the problem-solving approach in order to consolidate effective strategies and explore the mitigation of ineffective ones (Baartman & de Bruijn, 2011).

Metacognition

As indicated by previous sections, metacognitive ability underlies effective performance in many ill-structured domains (Lai, 2011). Metacognition refers to an awareness of one's own cognitive processes, along with knowledge and regulation of appropriate cognitive strategies (Schraw & Dennison, 1994). Metacognition incorporates activities such as planning, monitoring and evaluation, and can be implemented before, during, or after a problem-solving or learning episode (Vogel-Walcutt et al., 2013). An important distinction can be made between metacognitive reflection after, and metacognition within a problem-solving episode (Schön, 1983; Eraut, 1994). Reflection metacognition after the problem-solving episode is aimed at explicitly identify the cognitive strategies and decisions made during a problem-solving episode as well as learning about their relative strengths and weaknesses. Such activities help consolidate knowledge and identify relevant cues that can then be anticipated in future problem-solving activities (Dinsmore, Alexander, & Loughlin, 2008). On the other hand, metacognition within a problem-solving episode refers to the monitoring and regulation of cognition whilst engaging in problem-solving activities, making use of relevant contextual cues and knowledge concerning strategies to enable better decision-making. Such activities are indicative of growing competence within a domain.

From a novice perspective, there are differing cognitive load considerations (Sweller, 1994) for each approach. Metacognition within a problem-solving task places additional cognitive load on limited mental resources that may already be overwhelmed with the processing of task-relevant information. Such activities, when based around no/scant previous experience and little relevant knowledge can prove ineffective. However, metacognitive reflection after a learning episode enables a novice learner to evaluate their performance once cognitive load has eased. With repetitive practice, key evaluative principles will be assimilated into schemata that will activate relevant knowledge and aid in the processing of problem information in subsequent problem-solving episodes. As a result, cognitive load is lightened and spare mental resources can be dedicated to monitoring and regulating cognitive processes within the learning episode. As such, reflective metacognition may act as a precursor to metacognitive monitoring, prompting subsequent self-regulation, with iterative cycles of reflection and improved self-regulation (Berthold, Moore, Steiner, et al., 2012; Sitzmann & Ely, 2010). Notwithstanding their different applications, both metacognitive approaches emphasise learning through learner-environment interaction (Dinsmore et al., 2008), and authentic practice opportunities are vital to supporting the efficacy of metacognitive applications (Coulson & Harvey, 2013; Halpern, 1998).

Scaffolding and Prompts

The principle of scaffolding has been developed around the notion of a *zone* of *proximal development* (ZPD: see Wood, Bruner, & Ross, 1976; Vygotsky, 1980). The ZPD represents the gap between a learner's current performance, and the level of performance that can be supported through assistance. Scaffolding can take many forms. The method developed presently adopts the form of a series of prompts (targeted questions), that when considered collectively, constitute a scaffolding technique (Holden & Sinatra, 2014) combining cognitive and metacognitive strategies that a learner/trainee can adapt and utilise as required. In doing so, the application of our method employs both hard and soft scaffolding techniques (An & Cao, 2014). Hard prompts are those that can readily be planned and anticipated, whereas soft scaffolds are more dynamic in nature and reflect the need to tailor scaffolds to the learner's experience and the structure of the task.

Such an approach has two main benefits. Firstly, in ill-structured and uncertain environments prompts generate explicit and actionable feedback by guiding individuals to explicitly evaluate key problem-solving decisions and concepts. Where feedback indicates good performance, the additional information generated can be consolidated into appropriate schemata and may help to mark crucial task features for future recognition and exploitation (Byun et al., 2014; Ge et al., 2005; Halpern, 1998; Kim & Hannafin, 2011). Where feedback indicates ineffective performance, prompts can be used to uncover and explore the causes of any faulty reasoning (Kim & Hannafin, 2011), and strategies can be developed to mitigate future errors. Secondly, an additional benefit of prompts is in teaching metacognitive skill to novices. A small body of research in ill-structured contexts suggests that novices demonstrate improved problem-solving performance when exposed to metacognitive scaffolding (e.g., Ge & Land, 2003; Roll et al., 2012; Vogel-Walcutt et al., 2009), that metacognitive skill can be taught (e.g., Coulson & Harvey, 2013; Vogel-Walcutt et al., 2009), and that metacognitive activity continues once scaffolding has been removed (Roll et al., 2012). Byun et al. (2014) suggest that prompts can act as explicit processing guidelines that can be assimilated into a problem-solving schema and applied to novel problems (Byun et al., 2014). In doing so, scaffolding has equipped the learner with a technique that they can exploit (Holton & Sinatra, 2014). Such notions have been captured under terminology such as a *self-scaffolding heuristic* (Holton & Clarke, 2006) and metacognitive mindsets Roll et al., 2012).

Development of a Model

The previous review of relevant literature bases, whilst not exhaustive, can be drawn together to derive principles and scaffolding content that should foster learning among novices performing ill-structured problem-solving tasks. Table 2 presents a list of prompts, aligned to the required higher-order cognitive processes required of severely ill-structured problems. To adapt to semi-structured and ill-structured tasks simply omit prompts aligned to cognitive processes not required of tasks of that structure (see Table 1.).

Table 2

Scaffolding Prompts for Severely Ill-Structured Tasks

Higher-order cognitive process	**Reflective scaffolding prompts (after problem-solving)**	**Scaffolding prompts (within problem-solving)**
Problem definition	• How did you identify gaps in your understanding of the problem? • What efforts were made to understand the problem before you developed solutions? What more could have been done? • How did you determine essential and desirable solution features?	• What are the gaps in your /my understanding of the problem? How can you fill them? • What features must my solution incorporate? What else could be included?
Problem structuring	• How did you formulate appropriate goals? How could this be improved? • How did you plan to accomplish your goals? How effective was your planning? • How did you determine what information was relevant to the problem? What other information would have been useful?	• What are my goals? Are they appropriate? • What relevant information do I need?
Problem representation	• What format(s) (e.g., tables, pictures) did you use to capture important problem information? How appropriate was this? What might you do differently?	• Am I capturing my task efforts in an appropriate format?
Dynamic reframing	• Describe any instances in which you had to re-examine your problem definition. Why did this happen? • Describe any instances where you had to revise your task goals. Why did this happen?	• Do I need to revise my goals?
Alternate generation	• What efforts were made to generate alternative solutions? Were they sufficient? • What other lines of inquiry could have been pursued?	• What other options are feasible? Are they worth pursuing? Are there any obvious flaws?

Table 2 *Scaffolding Prompts for Severely Ill-Structured Tasks* (continued)

Higher-order cognitive process	**Reflective scaffolding prompts (after problem-solving)**	**Scaffolding prompts (within problem-solving)**
Evaluation	• What criteria did you use when evaluating your solutions? • Why did you select this solution? What were its strengths and weaknesses?	• Does my preferred solution meet all of the problem requirements? Can it be improved?
Mental simulation	• What efforts were made to test your solution for errors? What more could have been done?	• How can I test my solution?
Critical thinking	• What relevant information was missing? ▪ *Information problems:* What assumptions were made or what theories were constructed to fill information gaps? Were these assumptions/theories challenged? ▪ *Design problems:* Or what constraints/restrictions were implemented to enable a solution to be reached? Were constraints/ restrictions revised at any point? • Given more time/resources, what further efforts could you make to improve upon your solution?	• Am I missing any crucial information? • Do I need more time/resources?
General metacognition	• What were the advantages of your problem-solving approach? • What were the weaknesses of your problem-solving approach? What errors were made? What could have been done differently?	• What are the strengths and weaknesses of my problem-solving approach? •
Engendering better intuition/ recognition	• What errors/misunderstandings occurred during problem-solving? Why did these occur? How could they be avoided? • Did the problem bear any resemblance to other problems you have encountered? What are the similarities and differences?	• Does the problem bear any resemblance to other problems?
Foresight	• What further information is needed to better anticipate whether your solution will remain robust/relevant? How might you anticipate this?	• How can I ensure my solution is robust?

The reflective prompts in the model combine a number of sensemaking and solution-focused prompts with other cognitive processes often demonstrated by experts. Whilst this list is somewhat extensive, novice learners will benefit from early exposure to all categories of prompts following some initial problem-solving experience. Here, reflective principles can be learned and practiced in a well-timed fashion so that cognitive load remains manageable. Once reflective principles have been practiced a number of times, it should be possible to select a smaller subset of prompts to cue and maintain an improved level of cognitive strategizing. Also listed in Table 2 are a number of prompts for scaffolding cognitive and metacognitive activity during a problem-solving episode (Schön, 1983; Eraut, 1994). This list of scaffolding prompts demonstrates the self-regulatory principles that a learner could adopt to monitor and hone their cognitive strategies within a problem-solving episode. This set of prompts is necessarily smaller in order to minimise the additional cognitive processing load

Guidelines for Implementation

There are a number of scaffolding principles that should, wherever possible, be implemented alongside a set of prompts. These are outlined below:

- Care should be taken to promote the benefits of prompts, including the *metacognitive mindset* that can be instilled, at the point where the learner is initially exposed to a prompts (Ge et al., 2005; Roll et al., 2012). This should act to encourage engagement with the prompts and can increase motivation to learn within practice opportunities.
- The learner may require additional support when first exposed to reflective prompts, and additional support may be required when first attempting to engage in within problem metacognition using scaffolding prompts. Worked examples and modelling may fulfil this purpose (Coulson & Harvey, 2013).
- The learner should be made aware that prompts will be gradually withdrawn. The planned withdrawal of support should create an impetus for the learner to switch from relying on prompts to structure their thinking to actively internalising prompts and the principles they instil in order to structure their own generative learning techniques. Setting such expectations aids in promoting the adoption of self-regulatory processes.
- The method detailed presently was developed in order to be generically applicable to a wide-range of ill-structured tasks in a variety of domains. As such, some of the prompts may need some small semantic adjustments in order to more closely align the prompts with the context.
- An additional benefit of the present method is its potential for exploitation in group settings (e.g., Byun et al., 2014). The lines of cognitive enquiry promoted by prompts may act as discussion points between group members. Such dialogue can aid in attaining a greater depth of problem understanding, identifying misunderstandings, and generating more relevant knowledge.

Conclusions

The present paper has drawn together a number of literature bases in order to propose a model for scaffolding cognitive and metacognitive activities in ill-structured problems. In conjunction with the model, some guidelines concerning its implementation have been proposed. The remainder of this paper outlines implications for technology enhanced learning environments. An essential feature of these environments is that they support interactivity between learners, the system, and tutors. Some potential limitations of prompting methods along with avenues for future research are addressed.

The methods and techniques proposed here can be assimilated into computerised learning materials or, for example, online blended learning activities where there is communication between learners and support functions (i.e., peers, tutors, and the system). There is some evidence that prompting can be beneficial in simulated training environments (Berthold et al., 2012; Vogel-Walcutt et al., 2009). There are also numerous researchers that advocate the use of scaffolding prompts in web-based learning environments (e.g., Ge et al., 2005), and within cognitive tutoring systems (e.g., Roll, Aleven, McLaren, & Koedinger, 2007).

There are a number of limitations to the use of question prompts, identified by Byun et al. (2014) that could impact on prompting. Firstly, prompts may be ignored or answered superficially. This may be especially problematic in distance learning environments where the level of perceived accountability is diminished. Whilst promoting the benefits of scaffolding and prompts early on may improve the level of engagement with prompts, consideration should be given to methods of capturing and auditing a learners prompted responses. Secondly, some prompts can only be answered if the relevant level of knowledge is held. Whilst the present method has been designed to be generic to novices within multiple problem-solving domains, it may be that there will be a minimal number of practice trials before the learner is confident that they can respond to prompts appropriately. This minimal level may fluctuate from learner to learner. Learners should be made aware that in ill-structured problems there are no correct answers and that answering prompts will engender greater understanding. Information concerning individual differences could also be incorporated into an introduction in order to motivate learners to persist with attempting to answer prompts. A final limitation is that exhaustive and overly complex prompts may reduce motivation. Once again, promoting the utility of prompts may mitigate such effects and highlighting the gradual withdrawal of structured prompting as the learner becomes responsible for regulating their own generative learning episodes.

A primary focus of future research will be to test and refine the model proposed presently. Such an undertaking would require examination of problems of varying degrees of structure (as depicted in Table 1) and within varying domains. Control comparisons should be utilised where possible, given due ethical considerations. Secondly, closer examination of the depth and timing of prompt engagement could prove fruitful in refining scaffolding guidelines.

References

An, Y.J., & Cao, L. (2004). Examining the effects of metacognitive scaffolding on students' design problem solving and metacognitive skills in an online environment. *Journal of Online Learning and Teaching, 10*(4)*,* 552-568.

Baartman, L. K., & de Bruijn, E. (2011). Integrating knowledge, skills and attitudes: Conceptualising learning processes towards vocational competence. *Educational Research Review*, *6*(2), 125-134.

Berthold, M., Moore, A., Steiner, C. M., Gaffney, C., Dagger, D., Albert, D., & Conlan, O. (2012). An initial evaluation of metacognitive scaffolding for experiential training simulators. In A. Ravenscroft, S. Lindstaedt, C. Delgado Kloos, & D. Hernández-Leo (Eds.), *21st*

Century learning for 21st Century skills (pp. 23-36). Springer Berlin Heidelberg.

Byun, H., Lee, J., & Cerrato, F. A. (2014). Relative effects of three questioning strategies in ill-structured, small group problem solving. *Instructional Science, 42*(2)*,* 229-250.

Coulson, D., & Harvey, M. (2013). Scaffolding student reflection for experience-based learning: a framework. *Teaching in higher education*, *18*(4), 401-413.

Dinsmore, D.L., Alexander, P.A., & Loughlin, S.M. (2008). Focusing the conceptual lens on metacognition, self-regulation, and self-regulated learning. *Educational Psychology Review*, *20*(4), 391-409.

Eraut, M. (1994). *Developing professional knowledge and competence*. London: Psychology Press.

Fitts, P., & Posner, M.I. (1967). *Human performance.* Belmont CA: Brooks/Cole.

Ge, X., Chen, C.H., & Davis, K.A. (2005). Scaffolding novice instructional designers' problem-solving processes using question prompts in a web-based learning environment. *Journal of Educational Computing Research, 33*(2)*,* 219-249.

Ge, X., & Land, S.M. (2003). Scaffolding students' problem-solving processes in an ill-structured task using question prompts and peer interactions. *Educational Technology Research and Development, 51*(1), 21-38.

Ge, X., & Land, S.M. (2004). A conceptual framework for scaffolding ill-structured problem-solving processes using question prompts and peer interactions. *Educational Technology Research & Development, 52*(2)*,* 1042-1629.

Halpern, D. (1998). Teaching critical thinking for transfer across domains. *American Psychologist*, *53*, 449-455.

Helsdingen, A.S., van den Bosch, K., van Gog, T., & van Merriënboer, J.J.G. (2010). The effects of critical thinking instruction on training complex decision making. *Human Factors, 52*(4), 537–545.

Holden, H. K., & Sinatra, A. M. (2014). Instructional strategies for ITSs. In R. Sottilare, A. Graesser, X. Hu, & B. Goldberg (Eds.), *Design recommendations for intelligent tutoring systems: Volume 2 - Instructional management* (pp 265-282). U.S. Army Research Laboratory, Florida.

Holton, D., & Clarke, D. (2006). Scaffolding and metacognition. *International Journal of Mathematical Education in Science and Technology, 37*(2)*,* 127-143.

Kim, M.C., & Hannafin, M.J. (2011). Scaffolding problem solving in technology-enhanced learning environments (TELEs): Bridging research and theory with practice. *Computers & Education*, *56*(2), 403-417.

Klein, G. (2009). *Streetlights and shadows: Searching for the keys to adaptive decision-making*. Cambridge, MA: MIT Press.

Krizan, L. (1999). Intelligence essentials for everyone. Occasional paper 6. Joint Military Intelligence College, Washington, DC. Retrieved from http://www.dtic.mil/ dtic/tr/ fulltext/u2/a476726.pdf

Lai, E.R. (2011). Metacognition: A literature Review. Retrieved from http://images.pearsonassessments.com/images/tmrs/metacognition_literature_review_final.pdf

Lynch, C., Ashley, K. D., Pinkwart, N., & Aleven, V. (2009). Concepts, structures, and goals: Redefining ill-definedness. *International Journal of Artificial Intelligence in Education*, *19*(3), 253-266.

Pirolli, P., & Card, S. (2005). The sensemaking process and leverage points for analyst technology as identified through cognitive task analysis. In *Proceedings of International Conference on Intelligence Analysis 5*, 2-4.

Roll, I., Aleven, V., McLaren, B. M., & Koedinger, K. R. (2007). Designing for metacognition – applying cognitive tutor principles to the tutoring of help seeking. *Metacognition and Learning, 2*(2-3)*,* 125-140.

Roll, I., Holmes, N.G., Day, J., & Bonn, D. (2012). Evaluating metacognitive scaffolding in guided intervention activities. *Instructional Science, 40*(4)*,* 691-710.

Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology*, *19*(4), 460-475.

Schön, D.A (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.

Sitzmann, T., & Ely, K. (2010). Sometimes you need a reminder: the effects of prompting self-regulation on regulatory processes, learning, and attrition. *Journal of Applied Psychology*, *95*(1), 132-144.

Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction, 4(4),* 295-312.

Vogel-Walcutt, J. J., Fiore, S., Bowers, C., & Nicholson, D. (2009). Embedding metacognitive prompts during SBT to improve knowledge acquisition. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting 53* (pp. 1939-1943). SAGE Publications.

Vogel-Walcutt, J. J., Fiorella, L., & Malone, N. (2013). Instructional strategies framework for military training systems. *Computers in Human Behavior*, *29*(4), 1490-1498.

Vygotsky, L.S. (1980). *Mind in society: The development of higher psychological processes.* Cambridge: Harvard University Press.

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, *17*(2), 89–100.

Author Details

Victoria Smy
v.smy@cranfield.ac.uk

Marie Cahillane
m.cahillane@cranfield.ac.uk

Piers MacLean
p.j.maclean@cranfield.ac.uk

Back to Contents page

KNOWLEDGE AND SKILLS RETENTION IN SUSTAINING E-LEARNING CAPABILITY

Marie Cahillane, Piers MacLean, and Victoria Smy
Centre for Cyber Security and Information Systems
Cranfield University, Defence Academy of the UK
United Kingdom

Abstract

Cognitive science suggests that periods of no practice in performing tasks may impact on the retention of the requisite Knowledge and Skills (K&S). This paper reports a study that predicted the retention of the K&S required for the effective design and delivery of e-learning content in *virtual learning environments* (VLEs). A predictive retention model was applied to VLE requisite K&S resulting in a series of indicative retention curves. Outputs from this research can inform the development of targeted training to mitigate skills fade and maintain institutional capability to sustain effective e-learning content organisation activities.

Introduction

The design and delivery of effective e-learning content within virtual learning environments requires staff with relevant knowledge and skills (K&S). The literature indicates that the more skilled personnel are, the more likely an organisation is to be successful in the provision of e-learning (Rogers, 2003). Past research has identified organisational processes and practices as being indicative of e-learning capability. The e-Learning Maturity Model (e-MM), for example, provides a means of benchmarking and comparing capabilities for the development, deployment and support of sustainable e-learning in higher education (Marshall, 2010). Whilst the e-MM addresses some of the people components of capability in terms of organisational practice, it focuses on processes and tools and does not provide sufficient information to support the development and maintenance of competence within the organisation. Competence analysis is an example of a process area aimed at directing the people component of capability. To demonstrate this process area has been achieved organisations need to document and maintain competence descriptions (Marshall, 2012). *Competence* can be defined as the knowledge, skills and underpinning attitudinal dispositions that must be acquired and maintained by individuals and teams in order to effectively perform tasks to a pre-defined standard of proficiency (Deighton, Wells, McGuiness, Page & Mills, 2011a). It follows that an individual who successfully performs a task is perceived as demonstrating competence in the application of the required knowledge or skill (Stothard & Nicholson, 2001). However, details regarding competence requirements are not addressed within the e-MM, and therefore the underpinning K&S required for competence management within the field of e-learning are not clearly identified.

When considering training and refresher training priorities for a task or job role, it is necessary to have an understanding of the type of knowledge and/or skills that must be retained to competently perform a task to the standard required. This is because cognitive science has shown that different types of K&S decay at different rates (e.g., Bryant & Angel, 2000; Deighton et al., 2011a; General Medical Council, 2014). Best practice within industry (Bonsall, 2012; Deighton, Wells, McGuiness, Page, & Mills, 2011b) and defence (JSP822, 2012) recommends a Knowledge, Skills and Attitudes (KSA) analysis be performed where a task is broken down into its constituent KSA, the acquisition and retention of which is required for successful performance. Without such a task analysis, the accurate consideration of the retention of knowledge and skills underpinning competence and the variables that determine how it can best be trained and maintained is constrained (MacLean & Cahillane, 2015). As KSA suggests, attitudes also play an important role in behaviour; however, they are arguably not subject to decay over time as are knowledge and skills. Rather, training can result in attitudinal shifts or change, and therefore the present study addresses the retention of VLE requisite K&S.

E-learning content design and delivery tasks encompass the effective organisation of e-learning content within a VLE. They involve a combination of the following activities: posting learning material, designing and generating learning activities, including summative and formative assessment (e.g., quizzes); accessing and commenting on submitted assignments. Execution of such activities is underpinned by the successful retrieval of procedures. Such tasks are therefore representative of procedural skills requiring memory for discrete sequences of steps. The application of procedural skills can involve the application of motor skill, although this element is typically minimal, such as moving a mouse to select items within a visual display (Goodwin, Leibrecht, Wampler, Livingston, & Dyer, 2007). Within VLEs, navigating through a series of menus and submenus to set parameters and execute commands provides an example. Unlike perceptual-psychomotor skills, for which greater retention is observed over extended periods of non-application (Swezey & Llaneras, 1997), memory for procedural skills is highly perishable over periods of non-use (Cahillane & Morin, 2012). The ability of an individual to retrieve the steps required in applying a procedural skill and more importantly, the order in which they must be performed, is a strong predictor of performance (Goodwin et al., 2007; Sanders, 2001; Wisher, Sabol & Ellis, 1999). Skills fade is particularly salient when individuals receive initial training in the requisite K&S, which they may not use for an extended period of time (Sabol & Wisher, 2001; Wisher et al., 1999). A meta-analysis performed on 189 independent data points derived from 53 research papers found a strong correlation between retention interval and skill fade (Arthur, Bennett, Stanush, & McNelly, 1998).

Predicting Skills Retention

The User Decision Aid (UDA) is a model developed by the United States (US) Army Research Institute (ARI) to predict skill retention and provide unit commanders and trainers with an evidence-base to inform the scheduling of refresher training (Rose, Radtke, Harris, Shettel, & Hagman, 1985). The UDA was developed with a focus on procedural tasks, since most military task involve some sort of procedural element from performing drills to following

Standard Operating Procedures. The model is theoretically-based and includes 10 of the most important *task-related* factors known to influence skill retention, according to the psychology literature (see Table 1, p.4).

As a survey-based task rating method, the UDA can be applied by Subject Matter Experts (SMEs) wishing to rate the characteristics of individual tasks in order to generate predicted retention curves. Whilst subsequent research has identified other moderating factors, such as frequency of application and the contextualisation of the training environment to the performance context, (see Cianciolo, Crabb, Schaefer, Jackson, & Grover, 2010), to date the UDA is the most developed scientific predictive model of skills retention; it has also received some validation (see Rose, Czarnolewski et al., 1985).

The UDA does not predict individual skill retention scores but instead predicts the percentage of personnel within a work force that are able to perform a task successfully (to criterion) after a period of time has elapsed since the requisite K&S were last applied. The skill retention curves generated by the UDA predict retention up to 12 months of no practice in applying the K&S. In addition, the retention curves generated are based on the assumption that 100% of personnel within a task force (sample) were competent at the end of their last training session. For 100% of personnel within a task force to remain competent, the UDA model assumes that all personnel are regularly and frequently applying the required knowledge and skills.

Aims and Objectives

To our knowledge, no empirical evidence exists regarding the retention of the K&S required by individuals within training and education institutions responsible for the effective organisation of e-learning content within VLEs. An evidence base would enable such institutions to understand and develop capability for sustainable and effective e-learning content organisation activities. To address this knowledge gap in the literature, the present study applied the UDA predictive skills retention model to a set of activities representative of the procedural skills required for effective organisation and delivery of e-learning content on a VLE.

Method

Participants

Two Cranfield University SMEs with approximately 25 years of collective experience in the administration and use of proprietary, bespoke, and open-source VLEs (all of which are underpinned by procedural skills) took part in this study.

Procedure

The e-learning SMEs conducted a task analysis to decompose content organisation within VLEs into its constituent subtasks, which represent the requisite procedural skills. A total of 15 subtasks, which describe key VLE management, use, and learning design activities, were identified along with the conditions under which each subtask is performed and the standards to be achieved by staff performing the task. Facilitated by the research team, the SMEs applied the UDA survey-based skills retention model to each subtask.

The model consists of 10 questions for which a number of prescribed responses are possible (see Table 1). Each response is associated with a weighting value which is lower for tasks that are harder to retain.

Table 1

The UDA Questions, Responses and Response Scale Values

UDA Questions	Response	Value
1. Are job or memory aids used by the individual in performing (and in the performance evaluation) this task?	Yes No	1 0
2. Are job or memory aids used by the individual in performing (and in the performance evaluation) this task?	Excellent Very good Marginally good Poor	56 25 2 1
3. Into how many steps has the task been divided?	1 step 2-5 steps 6-10 steps >10 steps	25 14 12 0
4. Are the steps required to be performed in a definite sequence?	None are All are Some are and some are not	10 5 0
5. Does each task provide built-in feedback so that you can tell if you are doing each step correctly?	For all steps For most steps For only a few steps No built-in feedback	22 19 11 0
6. Does the task or part of the task have a time limit for its completion?	No time limit Fairly easy to meet Difficult to meet	40 35 0
7. How difficult are the mental processing requirements of this task?	Almost none Simple Complex Very complex	37 28 3 0
8. How many facts, terms, names, rules, or ideas must an individual memorize in order to do the task?	None A few (1-3) Some (4-8) Very many (>8)	20 18 13 0
9. How hard are the facts, terms that must be remembered?	Not applicable Not hard at all Somewhat hard Very hard	34 31 12 0
10. What are the motor control demands of the task?	None Small Considerable Very large	2 0 16 3

Both SMEs were given an adapted copy of the UDA rating form, which provided examples defining and differentiating the prescribed responses. Since the UDA was developed to enable the prediction of skills retention for military tasks, some of these examples were specific to the military. These examples were tailored to the current context to aid in their interpretation and ultimately, the application of the model. Where military terms such as *soldier* were used we sometimes replaced them with i*ndividual* or *staff*. Where task examples were adjusted, the amendments were superficial and terminological and did not alter the intended meaning behind the prescribed responses. For example, assembling the M16 rifle (a multi-step task) is replaced by “creating a pop-up window for a book item.”

The research team talked through all the possible responses and their associated scale values. When all 10 questions were completed, the scale (weighting) values were totalled to produce an overall UDA score for each subtask. This overall score was then fed into a formula to predict skill retention at different time intervals (for full detail see Rose, Manning, Radtke, & Ford, 1984). The total time take to conduct the task analysis and apply the model was three hours. It was not possible to resolve differences in the UDA responses by calculating the arithmetic mean, since only the values provided in the UDA model are acceptable. Such differences could reflect factual matters (the presence or absence of a job aid) or differences in judgement (e.g., ‘how good is the job aid?’). Therefore, any differences in the responses selected by the SMEs, for each subtask, were resolved through discussion.

Results

The e-learning content organisation task analysis revealed 15 subtasks, all of which were deemed by the SMEs as representative of procedural skills. Differences in indicative refresher training intervals for the e-learning content organisation subtasks were defined by the point at which 50% of staff are predicted to no longer be able to perform an activity without practice. Application of the UDA to the 15 subtasks resulted in a series of indicative retention curves as shown in Figure 1. There is a clear distinction between those tasks which fade rapidly and those which fade to a much lesser extent, with 11 out of 15 activities predicted to be rapidly forgotten, in contrast to only four activities indicated to be retained at a better rate during periods of no practice or application of the skills. Figure 1 indicates the following refresher training intervals for the e-learning content organisation activities which are predicted to be rapidly forgotten:

- Setting up a quiz – 2 weeks
- Using completion tracking – 7 weeks
- Adding a book activity – 10 weeks
- Using conditional release and news forums for communications – 11 weeks
- Using Turnitin or Grademark - 15 weeks
- Using Quick Mail for communications, adding a URL and adding an HTML page – 16 weeks
- Managing a folder on a page – 17 weeks

For those activities predicted to decay at a much slower rate, the following refresher training intervals are indicated in Figure 1:

- Setting up a discussion forum – 47 weeks
- Managing page sections – 55 weeks
- Adding files to a page – 67 weeks
- Displaying and hiding individual items on a page; and making a page visible to students – 90 weeks

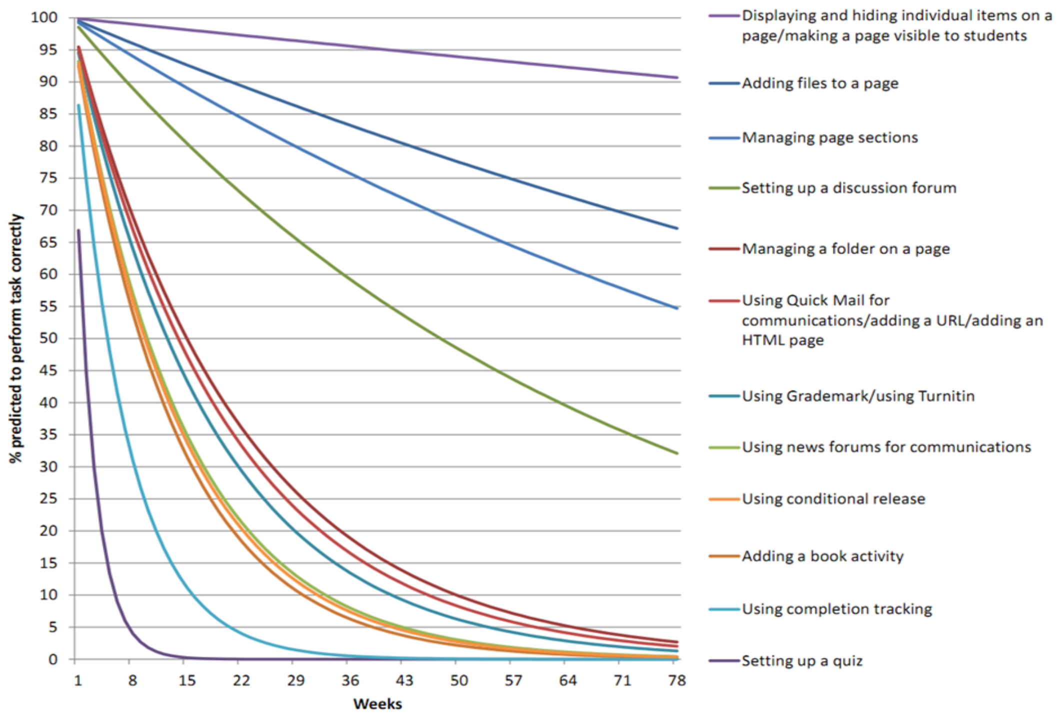


Figure 1. UDA indicative retention curves for e-learning content design and delivery procedural skills. (Note that three tasks are represented by a single curve; using Quick Mail, etc.)

Discussion

The findings of the present study indicate that it is feasible to use the UDA predictive skills retention model as a tool for differentiating and prioritising key e-learning content organisation activities. Application of the UDA demonstrated variability in retention rates for e-learning content organisation activities and their underpinning procedural skills. Two task characteristics: (a) the absence of a job aid; and (b) the complexity of mental processing requirements, account for the low subtask UDA ratings and thus differentiate those e-learning activities which are more susceptible to skills fade from those which are less susceptible. Job aids have been shown to reduce operator memory capacity load and help retention of information by externalising the steps that are required for successful task performance. Examples of job aids include quick reference guides, mnemonics, and technical manuals (Arthur, 1998; Bryant & Angel, 2000; Rose et al., 1985; Stothard & Nicholson, 2001). Less apparent forms of job aid are encountered in technology design where functions are set up such that the steps have to be performed in a particular order.

At the time of conducting this study, no job aid was available to assist staff in performing seven of the e-learning content organisation activities. These included: setting up a quiz, adding a URL or HTML page, using Quick Mail and news forums for communications, using completion tracking and conditional release. In addition to the absence of a job aid, *setting up a quiz and using completion tracking* were also rated as having complex mental processing requirements. *Mental processing requirement* complexity refers to the difficulty behind the thought processes an individual must apply during task performance. Such cognitive processes are often described as analysis, judgment, reasoning, decision making and problem solving. A task requires very complex mental processing requirements if it requires rapid decisions based on complex technical information under conditions of uncertainty and stress (Rose, Czarnolewski et al., 1985). The activities *setting up a quiz and using completion tracking* were predicted to fade the most. Excluding '*using Turnitin and Grademark* the activities most prone to skill fade also required memory for a definite sequence comprising up to five steps, because no job aid was available.

In contrast, the four activities which faded the least: *displaying and hiding individual items on a page; making a page visible to student; adding files to a page; managing page sections and setting up a discussion forum'* were characterised by simple mental processing requirements and the availability of a quality job aid which externalised memory for task procedures. Job aids are known to improve retention for procedural tasks requiring rote memory. However, they are generally found to be less helpful in optimising the retention of higher order cognitive processes such as decision-making. For example, managing information within a VLE requires the successful application of decision-making. In the case of this study, where activities such as *managing information on a pag*' were characterised by complex mental processing requirements, use of a job aid was not predicted to help retention. Conversely, use of a job aid was predicted to optimise skill retention where simple mental processing requirements underpinned information management tasks, for example *managing page sections*'.

The UDA model indicates that retention for those tasks predicted to fade the most could be improved by simply having a quality job aid made available for use while performing the task. Job aids not only externalise memory for tasks steps but also the facts and principles that need to be retained for successful task performance. Facts buried in multiple job aids are difficult to find let alone remember in context therefore, where tasks have eight or more facts to be memorised, these can be summarised in a condensed list which staff can more easily review. If the same facts are applicable to other activities, a list of these facts can be prepared to enable staff to see how the facts and principles generalise across e-learning content design and delivery.

The model also suggests that retention of tasks requiring the application of higher order cognitive processes can be optimised by reducing the complexity of mental processing requirements. This could be achieved by teaching staff how to reason and make decisions in situations so that the behaviours become internalised and more representative of gross mental comparisons characteristic of simple mental processing requirements (Kim, Ritter & Koubek, 2011). However, skills fade resulting from 'mental processing requirements' cannot be mitigated unless those requirements are accurately and operationally defined. The task analysis for e-learning content organisation used for the purposes of this study only provided a descriptive summary of the sequence of steps to be undertaken and the principles to be memorised; no distinctions in the action verbs used to describe the activities were observed. The targeted use of action verbs to describe activities would serve not only to better emphasise the process heavy procedural nature of these activities but also to articulate the level of mental processing required in their execution.

Limitations of the UDA

To our knowledge, only one study has compared UDA predicted scores to actual performance scores obtained by participants at multiple time intervals (i.e., 2, 5, and 7 months) (Rose, Czarnolewski, et al., 1985). Here the UDA was found to be effective at predicting retention across several field artillery tasks and the predicted skills retention curves were fairly consistent with actual performance data for these tasks. However, in comparison to the actual performance data, the UDA curves predicted on average that at a two month retention interval a smaller proportion of soldiers would able to perform the task to criterion, although across tasks this difference was only five percent. At other retention intervals the difference between predicted and actual performance was as great as 30 percent for some tasks, a difference which increased over longer retention intervals. This suggests that the UDA model may over predict skill fade across varying time intervals. The UDA has therefore been viewed as pessimistic in its projected predictions, such that the decay rate is potentially predicted to be somewhat worse than might be observed if actual performance data were collected. The potential over estimation of the level of skills retention has important implications for the application of the UDA to the organisation of e-learning content on VLEs when evaluating refresher training intervals. Although the UDA's forward projections of skill fade are potentially pessimistic, it can be argued that they indicate the 'worst case scenario', which, if considered along with other factors known to influence skills retention, can help inform refresher training decisions.

Additional moderators of skill retention that are not accounted for in the ARI UDA model include the effect of practice (Cianciolo et al., 2010) and the level at which individuals originally acquired knowledge and skills during initial training (Sabol & Wisher, 2001). Practice may occur with individuals having maintained knowledge and skills at a different level which is determined by the number of refresher training sessions they have completed in the past. Consequently, the predicted rate of skills decay would not be as pessimistic if the impact of practice was addressed. Where the level of original learning is concerned, research has shown that, at least in the short-term, skills that are acquired to a higher level tend to decay to a lesser extent compared to skills acquired after one demonstration of accurate performance (Driskell, Cooper & Moran, 1994; Sabol & Wisher, 2001). Moreover, individual differences in level of original learning have been found to predict skills retention to a higher degree than do individual differences in forgetting rates across skills such as perceptual motor and procedural skills (Swezey & Llaneras, 1997).

Conclusions

Application of the UDA predictive skills retention model identified e-learning content organisation activities that are most susceptible to skill fade. The results indicate approaches to training delivery that could increase skill retention for these activities. During training, having a quality job aid available for tasks characterised by definite sequences of steps would optimise their retention, since the memory requirement is situated in the job aid, and therefore knowledge for the job aid is not forgotten as long as it is used.

Furthermore, emphasis should be placed on encouraging staff to be able to locate and use existing job aids. Mental processing requirement complexity can be reduced by teaching staff how to reason and make decisions so that the underpinning cognitive processes become internalised and thus more representative of gross comparisons characteristic of simple mental processing requirements. The next step for future research will be to calculate how much retention would increase for those activities predicted to fade rapidly with the provision of quality job aids and a reduction in mental processing requirement complexity.

References

Arthur, W. Jr., & Bennett, W. Jr., Stanush, P.L., & McNelly, T.L. (1998). Factors that influence skill decay and retention: A quantitative review and analysis. *Human Performance, 11,* 57-101.

Bonsall, K. (2012*). Non-technical skills for rail: A list of skills and behavioural markers for drivers with guidance notes*. RSSB Report. Research Programme Operations and Management.

Bryant, D. & Angel, H. (2000). *Retention and fading of military Skills: Literature Review* Guelph, Ontario: Human systems Incorporated. (PWGSC Contract No W7711-9-7539/001/TOR).

Cahillane, M.A., & Morin, C. (2012). Skills Retention in a Complex Battlefield Management System. *Journal of Battlefield Technology, 15* (1), 65-72.

Cianciolo, A.T., Crabb, B.T., Schaefer, P., Jackson, S. & Grover, J. (2010). *Sustainment of individual and collective future combat skills: Modelling and research methods* (ARI Research Report 1918). US Army Research Institute for the Behavioral & Social Sciences. Arlington, VA.

Deighton, C., Wells, L., McGuiness, B., Page , H., & Mills, A. (2011a). Optimising competence retention in safety critical roles: influencing factors and management strategies. *Presented at the 1st World Congress on Rail Training*: Madrid, 6 – 8 April 2011.

Deighton, C., Wells, L., McGuiness, B., Page , H., & Mills, A. (2011b). *A model for optimising competence retention in the rail industry (skills fade)*. RSSB Report. Research Programme Operations & Management.

Driskell, J., Copper, C., & Moran, A. (1994). Does Mental Practice Enhance Performance? *Journal of Applied Psychology, 79* (4), 481-492.

General Medical Council. (2014). *Skills fade: a review of the evidence that clinical and professional skills fade during time out of practice, and of how skills fade may be measured or remediated*. Access at: http://www.gmc-uk.org/about/research/26013.asp

Goodwin, G., Leibrecht, B., Wampler, R.., Livingston, S., & Dyer, J. (2007). *Retention of selected FBCB2 operating skills among infantry captains career course (ICCC) students*. (1872). US Army Research Institute for the Behavioral & Social Sciences. Arlington, VA.

JSP822. (2012). *The Design and Delivery of Training*. Part 5: Chapter 1, DTSM 1. The Governance and Management of Defence Training & Education. Training Education Skills and Resettlement Division.

Kim, J., Ritter, R., & Koubek, R. (2011). An integrated theory for improved skill acquisition and retention in the three stages of learning. *Theoretical Issues in Ergonomics Science*, *14* (1), 22-37.

MacLean, P., & Cahillane, M. (2015). The human factor in learning design, research, policy, and practice. *International Journal of Information and Learning Technology. 32* (3).
Marshall, S. (2010) A quality framework for continuous improvement of e-learning: the e-learning maturity model. *Journal of Distance Education, 24,* 143–166.
Marshall, S. (2012). Improving the quality of e-learning: Lessons from the eMM. *Journal of Computer Assisted learning, 28*, 65-78.
Rogers, E. M. (2003). *Diffusion of innovations* (5th Ed.), New York, NY: Free.
Rose, A., Czarnolewski, M., Gragg, F., Austin, S., Ford, P., Doyle, J., & Hagman, J.D. (1985). *Acquisition and Retention of Soldiering Skills*. (671) US Army Research Institute for Behavioral & Social Science: Arlington, VA.
Rose, A., Manning, C., Radtke, P., & Ford, P. (1984). Acquisition and retention of soldiering skills: Report of Year 2 progress. DTIC Document.
Rose, A., Radtke, P., Shettel, H. & Hagman, J. (1985). *User manual for predicting military task retention*. (AIR FR 37800)U.S. Army Research Institute for Behavioral & Social Science: Alexandria, VA.
Sanders, W. (2001). *Cognitive psychology principles for digital systems training* (ARI Research Report 1773). U.S. Army Research Institute for the Behavioral and Social Sciences. Alexandria, VA.
Sabol, M., & Wisher, R. (2001). Retention and reaquisition of military skills. *Military Operations Research. 6*(1), 59 – 80.
Stothard, C., & Nicholson, R. (2001). *Skill acquisition and retention in training: DSTO Support to the Army ammunition study*. DSTO Electronics and Surveillance Research Laboratory DSTO-CR-0218.
Swezey, R., & Llaneras, R. (1997). Models in training and instruction. In G. Salvendy (Ed.), *Handbook of human factors and ergonomics* (pp. 514-577). New York: Wiley.
Wisher, R., Sabol, M., & Ellis. J. (1999). *Staying sharp: Retention of military knowledge and skills*. (Final Special Report 39). US Army Research Institute for Behavioural & Social Sciences. *Alexandria*, VA.

Author Details

Marie Cahillane
m.cahillane@cranfield.ac.uk
Piers MacLean
p.j.maclean@cranfield.ac.uk
Victoria Smy
v.smy@cranfield.ac.uk

Back to Contents page

EXTENSION OF A KNOWLEDGE AND SKILLS TAXONOMY TO INCLUDE A COMPLEX AND INTEGRATED SKILLS CATEGORY

Piers MacLean, Marie Cahillane, & Victoria Smy
Centre for Cyber Security and Information Systems
Cranfield University, Defence Academy of the UK
United Kingdom

Abstract

Understanding the nature of the tasks to be performed by learners in online and conventional contexts is essential in designing effective training and education programmes. Task analysis also determines the knowledge, skills, and attitudes (KSA) to be developed during learning programmes and subsequently expected of individuals for competent performance of a task to the standard required. A taxonomy developed by the researchers has, to date, proved appropriate for analysis of most tasks however, a requirement for an additional category has emerged. Theoretical analysis of complex skills provides a basis for a working definition of a proposed integrated skills category.

Introduction

MacLean and Cahillane (2015) describe an updated reclassification of knowledge and skills (K&S) developed to provide a finer-grained approach to analysis of the K&S required in the performance of trained tasks. Accurate task analysis is an essential first step in the design of effective online and conventional training and education and describes what learners do and how they should perform a task or apply a skill. It is used to determine the operational components of job roles, identify the skills required and the way in which they are applied as well as to develop training objectives. Thorough analysis also determines how the performer of the task thinks before, during and after learning and what knowledge states characterise the tasks being trained (Jonassen, Tessmer, & Hannum, 1999). The reclassification, which is consistent with the psychological literature on human cognition, is organised into psychological components (categories) and provides a generic taxonomy of psychological domains against which job-related K&S can be aligned. As such it provides a basis for more detailed task analysis during training design. The taxonomy may be used in conjunction with the User Decision Aid (UDA) (Rose, Radtke, Shettel, & Hagman, 1985). The UDA is a methodology developed for predicting how rapidly individuals forget certain types of military task. Combined, the taxonomy and UDA provide knowledge of task retention and task type which may be used by training managers to design training and indicate how long K&S will be retained if they are not applied or practiced. The following section summarises the psychological knowledge and skill domains of the current taxonomy. It is followed by a proposal to extend the taxonomy with a new category, a discussion about the nature of complex skills, what type of skill it will represent and how this should be defined.

The Knowledge Domain

Knowledge precedes all other skills, whether technical or non-technical in nature, and can be examined outside of its relationship with any other type of skill as a distinct category to be addressed in task analysis and the design of training interventions. In the taxonomy, the knowledge domain refers to the explicit knowledge required to conduct a task such as facts, concepts and theories. For the purpose of this paper two particular knowledge states are recognised; declarative knowledge and procedural (skill-based) knowledge. *Declarative knowledge* is developed during the first stage of learning, e.g., what things are and why things work, and it includes facts, rules or information about a task. As such, it represents *explicit knowledge*. As it is further refined, declarative knowledge is converted into procedural knowledge to produce skill-based behaviour. *Procedural knowledge* refers to knowing the actions required for the execution of a task and how to carry them out; hence the behaviour or task execution becomes more automatic (Ritter, Baxter, Kim, & Srinivasmurthy, 2011). Knowledge or information about a task is available in both declarative and procedural forms. As task execution becomes increasingly automatic, performance is driven predominantly by procedural knowledge. Unlike declarative knowledge, procedural knowledge does not require the active maintenance of each step of task execution in working memory.

The Skills Domain

Broadly, skills can be thought of in terms of mental processing and intentional physical movement, i.e., cognitive skills and motor skills. Within the taxonomy these broad skills areas are refined and organised into four categories of skill encountered in the literature: procedural skills, discrete psychomotor skills, continuous psychomotor skills, and decision-making skills. Drawing on MacLean & Cahillane (2015), these are summarised as follows:

Procedural skills. Procedural skills underpin the application of many military activities. Tasks requiring the application of procedural skills consist of a number of coherent steps. In turn, these steps include the application of both cognitive and motor skills. Within tasks which are considered as predominantly procedural the motor element is minimal. Where the motor element is more prevalent, a task falls into the discrete psychomotor skill category.

Discrete psychomotor skills. Discrete (closed loop) skills involve the application of physical movements to tasks with definite beginnings and endings executed in sequences of steps. Stripping and assembling a weapon is a good example of a task requiring the application of discrete psychomotor skill. In this example, an individual is required to remember a sequence of component steps within a *Skill at Arms* drill, whilst performing the physical/motor component, of manipulating the respective parts and characteristics of the rifle. They are dependent on procedural knowledge and memory for the order in which steps are performed and are also referred to as procedural skills.

Continuous psychomotor skills. Continuous (open loop) skills are characterised by repeated actions or steps with no distinct beginning or endings, such as flying an aircraft, driving a vehicle, typing, or keeping a weapon sight on a moving target. These types of activity are also referred to as perceptual-motor skills.

Decision-making skills. Skills in the decision-making category require the application of cognitive processes such as judgement, problem-solving and analysis in order for an individual to arrive at a decision. Two tasks representative of these skills are troubleshooting faulty equipment (which involves the use of reasoning skills in order to identify the problem) and the interpretation of topographical maps to identify symbols with terrain features on the ground.

Application of the Taxonomy

When applying the taxonomy in the analysis of tasks and job-roles, it is important to identify the sub-tasks which form the main task. Doing so identifies the category of skill that best reflects the task. For training managers, identification of this category is important when developing effective strategies for prioritising and sequencing training. Examples of military skills and tasks where the taxonomy has been used successfully to identify the main psychological skill categories include: map reading and navigation; tactical information and communications systems; driving; vehicle maintainer skills; operational law, and weapon handling.

In its current form, the taxonomy is primarily used to identify which psychological skill component is prevalent during successful execution of the task. In the case of certain types of task and sub-task, detecting the precise category of skill that best reflects the task is likely to be more problematic. Take, for example, analysis of a pilot taxiing an aircraft. This reveals that multiple procedural, discrete, and continuous psychomotor skills are being performed in parallel (Schoelles & Gray, 2012). Where a task requires this type of skill complexity, no single category can be said to reflect what psychological skill is being deployed during its execution.

Extending the Taxonomy

It is apparent that the complexity of some tasks presents an obstacle in applying the taxonomy for conducting fine-grained analysis of tasks. Nevertheless, it is an obstacle that has to be broken down, understood and addressed in the acquisition and retention of K&S (Farr, 1987; Sabol & Wisher, 2001). This is especially so in organisational training and education contexts such as that of defence where the overall successful performance of the organisation is dependent on the effective training of individuals. In order to deliver training and education to large numbers of learners defence organisations, as with higher education institutions, often opt to use information and communication technologies (ICTs) to support learning. As a result, defence has an increased need for learning technologies including simulators, virtual learning environments, mobile learning platforms, and virtual-part task trainers. Task analysis and the design of training and education, should ensure that there is successful alignment of the task to be trained with training methods, media, and appropriate learning technology, which in turn should support successful individual execution of trained tasks in the operational environment thus contributing to overall organisational performance.

This alignment and the fact that some skills are complex was taken into account when the taxonomy was developed. However, during application it emerged that for some tasks, not just complexity but also the notion of concurrent or parallel activity being addressed together in a distinct psychological skill category required attention in order to be able to make more accurate decisions regarding the most appropriate strategies, methods, media, and learning technologies to be used. Extending the taxonomy to address the problems raised by parallel processing or concurrency and related concepts during analysis will improve its utility and broaden its application. Next we discuss the nature of complex skills, task complexity, parallel performance, and their implications for the taxonomy. Finally, we tentatively propose a working definition for a new skill category within the taxonomy.

Complex Skills

Skill complexity is a recurrent theme in the psychological literature with varying descriptions and explanations. The term complex skill is often used without further qualification although more descriptive terms are also encountered such as *complex motor skill* and *complex cognitive-motor skill*. An overview of the results from a search of the literature using these terms suggests that these types of skill are mostly encountered within sports psychology research. This is possibly due to inclusion of the *motor* component. Complex skills (minus the motor component) are also found in the literature of training and education where the term *complex-cognitive skill* is used to categorise tasks such as complex decision making, information problem solving (Villado et al., 2013), computer programming, fault diagnosis, military air weapons control (Merriënboer, 1997), etc. Because of the range of terms used to describe skills, some thought has to be given to their precise nature in order to identify the most appropriate category to use.

Dimensions of Complexity

It follows that where tasks are complex, they are likely to require the application of complex skills. Gaining an overall measure of complexity is not only important for making decisions about training but also because it is *highly predictive* of whether a task, once acquired, will be forgotten (Sabol & Wisher, 2001, p.64). These authors describe the components of complexity that need to be understood in order to predict forgetting as: (a) the number of steps in a task, (b) whether the steps are to be performed in a sequence or not, (c) the presence of built-in feedback indicating correct performance of the task. Moreover, complexity and the need to remember a task are increased when a task involves procedures set among others which have no fixed organisation. Due to the relationship between these components and skill acquisition and retention, they were taken into account when the taxonomy was developed.

Within the taxonomy, complex motor and complex cognitive-motor skills are accounted for under the continuous and discrete psychomotor skill categories. Where the degree of cognitive processing required in performance of a complex cognitive-motor task increases to the extent that the motor aspect of the skill is secondary to the cognitive aspect, the skill becomes situated within the procedural skill category of the taxonomy. If there is little or no procedural knowledge required, the highest forms of cognitive-motor skill, once automatized, are placed in the continuous-psychomotor category, e.g., piano playing (Fitts & Posner, 1967). Identifying whether a skill has a greater or lesser cognitive component can present a challenge during task analysis using the taxonomy. The following example of speech production highlights the problem of how we might perceive a task requiring a high degree of cognition and motor movement and as a result, struggle to categorise it accurately.

Speech production requires very fine motor skills supported by complex cognitive processing. It involves a process of conceptual preparation, grammatical encoding, morpho-phonological encoding, and phonetic encoding before speech can be articulated. Articulation in itself is a fine motor skill requiring manipulation of intricate articulatory apparatus of which the tongue is just one part. The various physical components of the articulatory apparatus have to be controlled; breathing which gives the air supply needed for acoustic energy; the muscles of the laryngeal system which control voicing and loudness; and the vocal tract, for control of the timbre of vowels and the tongue, velum, and lips which control the way in which sounds are formed (see Indefrey & Levelt, 2000). Given these aspects, task analysis for training of a military linguist might identify articulation of speech as the dominant skill during certain tasks, and, therefore, it will rightly remain in the continuous psychomotor skill category. However, it is most probable that tasks requiring speech will act as an enabler to skills aligned with a more dominant category.

Performance of routine radio communications between the pilot of an aircraft and air-traffic controller would, therefore, be classed as a procedural skill even though it also requires speech production and involves physical operation of radio equipment; while still maintaining flight control of the aircraft. Thus, even a complex task such as in-flight radio communication might still be classified accurately because even the flight-control aspect, a continuous psychomotor skill, has been automatized to the extent where it is still secondary to the task of communication. Even apparently complex tasks can be successfully aligned with the taxonomy however, given that some tasks still do not appear to align with a single category, questions remain about the nature of apparently complex tasks and how we can determine the point at which a new category is required.

By examining the way in which tasks and tasks elements are organised and the relationships between them we can gain a better sense of a task's complexity. Elen & Clark (2006) acknowledge that as the number of elements in a task and the number and diversity of relationships between them increase along with change over time, tasks become more complex. Their discussion is presented in light of Dörner's (1996) view that task complexity cannot be calculated objectively and must take into account the subjective experience of the task performer or learner and the relationship between their characteristics and that of the task. This perspective differs from that of the taxonomy which considers the task objectively and independent of the subjective experience of the performer. However, the basic starting point for analysing the components of a task outlined above reflects two earlier theories of task complexity developed by Wood (1986) and Campbell (1988). Both take into consideration individual characteristics but set aside individual experiences while performing the task.

Although task analysis as such quite often relies on subjective perceptions of tasks, without a formal definition task characteristics become confounded by task and non-task elements "particularly interactions between task attributes and individual attributes" (Wood, 1986, p.61). If we are to establish which category in the taxonomy best reflects the task and objectively assess what is going on, Wood's theory is helpful. It identifies three constructs foundational to the definition of task complexity: products, acts, and information cues. *Products* are the specified and objectively measurable outputs resulting from the execution of a task. Acts are inputs in the form of behaviours or *components* required in creating a defined product. The direction of the act is implicit in the verb used in reference to it which indicates the level of the mental and physical activities within the act; verbs separate one act from another, e.g., walking, reading, identifying (p.65)Information cues are also inputs that must be consciously attended to and processed in judgment and inferential acts. Acts and information cues set the upper limits of knowledge and skill required for successful performance of a task. The relationships between the inputs determine the behavioural and processing demands placed on the individual. Within Wood's theory of task complexity three types of task complexity are defined.

Component complexity increases as the number of acts to be performed in a task and information cues requiring attention also increase thus placing greater demand on the K&S of the individual. Component complexity has a direct bearing on cognitive processing and memory requirements during performance. However, it may be moderated by component redundancy whereby the K&S required for one act generalise to another thereby reducing the level of cognitive processing and memory required.

Coordinative complexity refers to the nature of the relationships between task inputs and products. This type of complexity is of particular interest to the present study because as a concept it seeks to understand aspects of tasks relating to sequencing, timing, frequency, dependency, and location and is of particular importance in non-linear tasks which may require simultaneous performance of several acts and events. It is worth noting that this supports Sabol and Wisher's (2001) view of complexity as a task factor that severely impacts retention: "A complex task is the opposite of one with an inherent organisation that produces a 'simplicity' or unit where each task step follows logically from the one before" (p.64).

Dynamic complexity refers to the way in which change in the acts, information, or relationships between input and product vary over time. As a result, the knowledge or skills required for a task also change. For example, in multi-stage decision making, variations in the relationship between the values within information cues as inputs and the outputs of judgments and decisions lead to a corresponding adjustment in the magnitude of dynamic complexity. If there is a single change in one of the dimensions, its effects may diminish over time but when it is continuous, dynamic complexity of the task will increase. Although the dimensions are not completely independent of each other, any shift in the complexity in one does not necessarily affect the others. However, various combinations across the dimensions will have differing effects on overall task complexity. Wood (1986) implies that the predictability of the change is a significant factor in reducing, over time, the initially high level of dynamic complexity.

Using Wood's theory, task complexity can, to a certain extent, be analysed and understood. The increasing complexity of tasks, especially where the emphasis is on the coordinative relationships and requirement to be able to simultaneously perform several acts together, will require the ability to deploy skills from two or more of the taxonomy in a correspondingly coordinated and simultaneous way. As an example of coordinative complexity, Wood analyses the task of an air traffic controller landing a plane and the required acts and information cues. A point may be reached where complexity has increased to an extent where the individual's capacity to perform effectively becomes *overloaded.*

There is no single type of complex task but the three types of task complexity in Woods' theory provide an objective analytical approach to the overall complexity of a task and the K&S required to perform it. Echoes of Wood's (1986) dimensions of complexity occur throughout the literature and theories of cognition related to understanding the nature of complex tasks for example, the overloading of capacity is very clearly explored in research using Sweller's (1994) cognitive load theory. Understanding the nature of skill in the proposed category will likely entail a combining several theories and concepts. Some of these are briefly discussed below.

Simultaneously attending to multiple acts in a task with high dynamic complexity will require a type of 'multi-tasking' ability. Dzubak (2008) raises the idea that multi-tasking requires either task-switching or parallel processing of information. Whichever of these is considered, a higher degree of skill proficiency has to be acquired to reduce coordinative complexity through automatization of some aspects of the task. Several theories of skill acquisition have been put forward to explain the cognitive processes underpinning the acquisition of the type of internalisation and automaticity often associated with conceptions of expertise (e.g., Fitts & Posner, 1967). Although this model provides the foundation for all other models of skill acquisition, three stages remain common and consistent as an individual progresses from novice to skilled practitioner: the learning, associative, and internalisation stages. Progression through these stages of learning and development is characterised by an increase in the proceduralisation, durability and generalizability of K&S (Skinner, 2013).

How the stages of learning affect an individual's ability to cope with processing streams are also found in Campbell's (1988) theory where task complexity is directly related to the task attributes that increase information processing load. Differences in processing load at different stages of learning are illustrated by the example of flying an aircraft; it is easier for veteran flyers who have internalised the skills required and more difficult for novices who have to consciously recall and apply facts about a task to steer performance as they familiarise themselves with the basic rules and procedures underlying its execution and therefore find their processing capacity pushed to its limits. Campbell treats complexity as primarily a psychological experience which involves interaction between task and person characteristics and complex tasks are characterised by lack of structure, ambiguity, uncertainty, and difficulty. Complex tasks are by their nature difficult and the terms are sometimes used interchangeably. However, a task may be difficult because it requires more effort either physical or mental. The theory appears to suggest the presence of multiple *streams* of concurrent information processing and again appears to suggest multitasking.

For Loukopoulos, Dismukes, & Barshi (2009), multitasking is a loose term. Even when people appear to be performing two or more tasks at once, in all likelihood what is happening is

concurrent task management (p.11). Simultaneous task performance can only pertain to the types of situation described above where highly practiced tasks have become automated and do not require significant attentional resources. Tasks that have not been automated and are still in the early stages of skill acquisition (due to infrequent practice) require individual processing focused on one task at a time. What they propose is that pilots who appear to be multitasking or engaged in simultaneous execution of more than one task, are actually managing tasks concurrently. Thus, all but highly automated tasks are managed concurrently but executed sequentially - not simultaneously. Simultaneous execution is only possible with tasks that have been practiced to the point that they are automaticised and require minimal attentional resources.

Real-world tasks that pilots have to perform vary considerably from the ideal tasks described in flight operations manuals (Loukopoulos et al., 2009). The example of a cockpit crew at work is given to illustrate this situation and in which Wood's (1986) dimensions of complexity can be seen as the crew interact with other people both on the ground and in the air during the stages of flight. These people are continuously providing critical information to the crew and imposing demands that affect the timing and structure of the crew's other tasks. Furthermore, dynamic complexity increases significantly as a result of weather and other conditions. Closer analysis of pilot tasks in the example scenario would reveal high levels of component, coordinative and dynamic flexibility, and unpredictability. When several cognitive functions have to be managed concurrently during performance of a task, it becomes impossible to distinguish which category of the taxonomy is most appropriate to use. Therefore, when a combination of psychomotor and cognitive components such as declarative knowledge, a large number of steps in a procedural task, and decision-making are being attended to simultaneously, the task may be described as integrated (Skinner, 2013). As such, it requires coordination based on attentional processes and simultaneous processing of interacting knowledge elements (Kluge, 2014). Tasks with more skill components and a greater requirement for coordination are more likely to result in increased loading of intrinsic memory in multimedia learning tasks (Kirschner, Kester, & Corbalan, 2011). This is consistent with Wood's (1986) theory and the concept of coordinative complexity. It also illustrates the importance of taking into consideration Cognitive Load Theory (CLT) which differentiates between three distinct types of cognitive load: (a) intrinsic load essential to the topic or task being learned, (b) extraneous load imposed on the learner unnecessarily, and(c) germane load which results from cognitive processing required for learning (see, for example, Sweller, 1994; 2011).

Decomposition of tasks for analysis of the underlying skills required to perform them successfully is necessary if we are to understand how best to train individuals to proficiency in a wide range of contexts both online and conventional. However, if we are able to design effective online training and education such that it uses the results of fine-grained task analysis for optimised learning experiences, it becomes possible to consider the provision of ICT mediated training on a scale beyond the scope of conventional contexts. Consideration of the use of ICT in training solutions has become commonplace in training and education and as a result, online learning opportunities are encountered in a diversity of situations. However, as with conventional training and education there is always room for improvement in task analysis for the design of more effective learning, The taxonomy discussed throughout this paper has already proved useful in most contexts, however limitations have been encountered where concurrent application of several skills is required during performance of a complex task.

Proposed Definition for an Integrated Skill Category

Fine-grained analysis of most tasks under consideration for the design of training and educational interventions in organisational contexts will reveal the category of psychological skill that best reflects the task. It will also inform decisions about what, in any context, may be the most appropriate combination of methods, media, and learning technologies for training that task. However, from the preceding discussion it is clear that understanding and analysing certain types of task presents a greater than expected challenge since without a clear category, the consideration of how acquisition and retention of skills should be addressed is constrained. Further work is needed to explore and develop a new category. As a starting point, it would seem sensible to have a working definition for what that category might be, therefore, we tentatively propose the following on the understanding that, over time, it will be refined:

'Integrated skills are those where no single dominant category emerges during performance of a task with high levels of complexity and element interactivity whereby an individual has to coordinate the concurrent management of two or more skills for successful performance.'

Conclusion

This paper has presented a theoretical basis for extending an existing knowledge and skills taxonomy for task analysis, a critical step in the design of training. In its current form the taxonomy has been used for online and conventional training and education contexts. The taxonomy currently consists of five categories of psychological knowledge and skill domains. Ongoing research in aligning the taxonomy of psychological domains indicated a possible need to include a further category for considering complex integrated skills, which involve multiple components within an integrated task. The nature of complex skills has been discussed and a range of related theories and concepts briefly described. The discussion concluded with a proposed working definition for a new skills category. This is a tentative first step towards developing deeper insight into the nature of integrated skills.

References

Campbell, D. J. (1988). Task Complexity: A Review and Analysis. *The Academy of Management Review*, *13*(1), 40–52.

Dörner, D. (1996). *The logic of failure; why things go wrong and what we can do to make them right*. New York: Henry Holt & Co.

Dzubak, C. M. (2008). Multitasking: The good, the bad, and the unknown. *The Journal of the Association for the Tutoring Profession*, *1*(2), 1–12.

Elen, J., & Clark, R. E. (Eds.). (2006). *Handling complexity in learning environments: theory and research*. Amsterdam: Elsevier.

Farr, M. J. (1987). *The Long-Term Retention of Knowledge and Skills: A Cognitive and Instructional Perspective*. New York: Springer.

Fitts, P. , & Posner, M. (1967). *Human performance*. Oxford, England: Brooks/Cole.

Indefrey, P., & Levelt, W. J. (2000). The neural correlates of language production. In M. S. Gazzaniga (Ed.), *The new cognitive neurosciences; 2nd ed.* (pp. 845–865). Cambridge, Mass.:MIT Press.

Jonassen, D., Tessmer, M., & Hannum, W. H. (1999). *Task analysis methods for instructional design*. Mahwah, NJ: Erlbaum Associates.

Kirschner, F., Kester, L., & Corbalan, G. (2011). Cognitive load theory and multimedia learning, task characteristics and learning engagement: The Current State of the Art. *Computers in Human Behavior*, *27*(1), 1–4.

Kluge, A. (2014). *The acquisition of knowledge and skills for taskwork and teamwork to control complex technical systems: a cognitive and macroergonomics perspective*. New York: Springer.

Loukopoulos, L., Dismukes, K., & Barshi, I. (2009). *The multitasking myth: handling complexity in real-world operations*. Farnham, UK; Ashgate.

MacLean, P., & Cahillane, M. (2015). The human factor in learning design, research, policy, and practice. *International Journal of Information and Learning Technology. 32*(3), 182-196.

Merriënboer, J. J. G. van. (1997). *Training complex cognitive skills: a Four-Component Instructional Design model for technical training*. Englewood Cliffs, NJ: Educational Technology Publications.

Ritter, F., Baxter, G. , Kim, J., & Srinivasmurthy, S. (2013). Learning and retention. In Lee, J., & Kirlik, A (Eds). *The Oxford Handbook of Cognitive Engineering* (pp. 126-142). New York: OUP USA.

Rose, A., Radtke, P., Shettel, H., & Hagman, J. (1985). *User's manual for predicting military task retention* (No. AIR RP 88600). Washington, DC: American Institutes for Research.

Sabol, M., & Wisher, R. (2001). Retention and reacquisition of military skills. *Military Operations Research*, *6*(1), 59–80.

Schoelles, M., & Gray, W. (2012). SimPilot: An exploration of modelling a highly interactive task with delayed feedback in a multitasking environment. In U. Drewitz & H. van Rijn (Eds.), *Proceedings of the 11th ICCM* (pp.66-71). Berlin: Universitätsverlag der TU Berlin.

Skinner, A. (2013). *Retention and Retraining of Independent and Integrated Cognitive and Psychomotor Skills Related to Laparoscopic Surgery* (Unpublished doctoral dissertation). The Catholic University of America, Washington D.C.

Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction*, *4*(4), 295–312.

Sweller, J. (2011). Cognitive load theory. *The Psychology of Learning and Motivation: Cognition in Education*, *55*, 37–76.

Villado, A., Day, E., Arthur, W., Boatman, P., Kowollik, V., Bhupatkar, A., & Bennett, W. (2013). Complex command-and-control simulation task performance following periods of nonuse. In W. Arthur, E. A. Day, W. Bennett, & A. M. Portrey (Eds.), *Individual and team skill decay: The science and implications for practice* (pp. 53–67). New York, NY: Routledge.

Wood, R. (1986). Task complexity: Definition of the construct. *Organizational Behavior and Human Decision Processes*, *37*(1), 60–82.

Author Details

Piers MacLean
p.j.maclean@cranfield.ac.uk
Marie Cahillane
m.cahillane@cranfield.ac.uk
Victoria Smy
v.smy@cranfield.ac.uk

Back to Contents page

THE ROLE OF INSTANT MESSAGING DURING PRACTICUM: LESSONS LEARNED FROM A CASE STUDY

Apostolos Kostas, Alivisos Sofos, and
Kostas Tsolakidis
University of the Aegean
Greece

Abstract

The use of technological infrastructure in academic departments for teacher preparation can provide support for student teachers during practicum, since school placement can be a particularly intense and emotional experience. Using a Web 2.0 social network as a collaborative space, students were encouraged to share their experiences in order to establish a supportive learning environment. In this article, we present the results of a content analysis research based on electronic messages of the Instant Messaging (IM) mechanism. Content analysis revealed that synchronous communication via instant messaging served as a Query and Answer (Q&A), support and self-expression mechanism within a social context.

Introduction

Current research on teachers' preparation, as summarized by Zagami (2010), describes school placement during practicum as a stressful component of teachers' preparation program. Curriculum mainly focuses on methodology and less on preparing students to cope with real-life situations in classrooms and schools.

Practicum is a baseline for teachers' preparation, because during classroom placement students start to build their *self-perception* about the profession, mainly by associating theory and practice, reflecting on practice and gaining a better understanding of *what is to be a teacher* (Geijsel & Meijers, 2005; Korthagen & Vasalos, 2005; Carrington, Kervin, & Ferry, 2009).

Gold (1996) identified two broad concepts of support that students need during this phase, as they have to overcome issues like time management, teaching preparation, personal beliefs and expectations: (a) *instructional support*, i.e., class administration, student motivation, instructional design, diversities among students, etc. and (b) *psychological support*, i.e., emotional support, positive feedback, stress handling, increase self-esteem and self-efficacy, etc.

Moreover, it has been acknowledged that teachers' preparation programs must be adopted in order to cope with the new demanding requirements of 21st century skills (AACTE, & P21, 2010), whereas future teachers must be able to act in a student-centric, personalized, flexible and ICT-oriented educational environment (Zygouris-Coe, 2013).

Scholars and policy makers have advocated for and argued about the potential benefits of using and embedding ICT within pre-service teachers' preparation programs (Russell, Bebell, O'Dwyer, & O'Conner, 2003; Tsoulis, Tsolakidis, & Vratsalis 2012). Academic institutions are already pacing the latest integration phase where pervasive technologies enable *intra/inter/trans-institutional* social arrangements, supporting one of the main missions of pre-service institutions, i.e., to create a social fabric for teacher education and later professional practice based on relationships (Gomez, Sherin, Griesdom, & Fin, 2008).

In this broad context, resent studies have examined the use of *computer mediated communication* (CMC) technologies in order to provide instructional and emotional support for student teachers during practicum, where various asynchronous and synchronous technologies have been utilized.

Among other researchers, Chu, Chan, & Tiwari (2012) reported that blogs enhance professional learning of student teachers during placement; English and Howell (2011) used Facebook as a communication means, associating the social, cultural and digital capital of students. Reich, Levinson, & Johnston (2011) used the Ning platform to facilitate an educational social network among students, and Cameron, Campbell, & Sheridan, (2011) used mobile phones among students during school placement and found that such an initiative requires structural changes of practicum settings. Davie and Berlach (2010) used wikis to facilitate collaboration among students placed in rural schools; Zagami (2010) used iPhones+Twitter in order to facilitate communication among students. Paulus and Scherff (2008) used asynchronous forums as peer support mechanism, and Rideout et al. (2007) used the Moodle Learning Management System (LMS) in order to maintain a virtual community and empower the sense of belonging in this community.

Results showed various positive outcomes in terms of using communities' formation on the Web in order to provide support to students during practicum but with some important limitations: (a) lack of a holistic approach between practicum, pedagogical and technological design, (b) focus only on one CMC tool and (c) small range of participants.

Taking into account these limitations, our exploratory case study followed a holistic approach utilizing a social network (S/N) environment in order to facilitate a community of practice between students, using various synchronous and asynchronous communication tools and integrating this initiative into the pedagogic/didactic design of the practicum (Kostas, Sofos, & Tsolakidis, 2013).

In this article, we focus mainly on synchronous communication via the instant messaging mechanism of the S/N environment and present results from a content analysis conducted over all messages exchanged between members of the community. In this way we could trace conversation patterns and themes over this communication channel throughout an entire semester.

Pedagogical and Technological Context

The concept of a holistic approach in this research refers to the design of a sound pedagogical and technological framework integrated into the practicum process.

Research settings for the *pedagogical* domain focus on student teachers' reflection on action (Schön 1983) and "emerging" professional identity in a social context, such as a community of practice (Wenger, 1998), and follow the evidence of educational affordance of Web 2.0 tools (Kostas et al., 2013).

An inquiry and reflective approach for the incorporation of new media in the educational process (Sofos, 2013) formulated a theoretical model with six dimensions (Figure 1), and served as the basis for the practicum of the lesson entitled "Design and Creation of Digital Content for Online Distance Learning" during the 7th academic semester in the Department of Education, University of the Aegean.

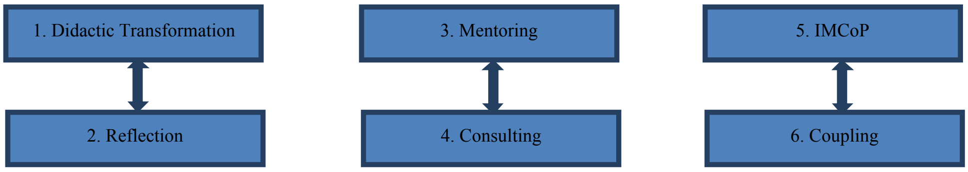


Figure 1. Basics of the holistic model for the reflective practicum.

Research settings for the ***technological*** domain focus on ICT as a facilitation means between a student teacher and his/her pedagogical aims and follow the concept of *communities of practice* as a social network and a non-formal learning and collaborative space among students.

It was set up as an electronic *Community of Teachers Practicum* (eCTP) (Kostas et al., 2013) in order to support and facilitate teaching practice by establishing a network of communicating peers among students, fostering reflection on action by sharing individuals' or collegial experiences, problems, personal stories from the classroom, peer assessment of didactic plans, perceptions about the profession, etc. Based on literature review, members of eCTP had access to a set of tools within a common technological platform, in contrast to communities mediated by a single technology (forum-oriented, blog-oriented, etc.), and also the community was organized as an inter-institutional educational network.

Those requirements led to the adoption of a Software-as-a-Service (SaaS, or *Cloud Services*) SaaS solution for the community's infrastructure. SaaS is a new computation paradigm with five basic characteristics: *on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service* (Bora & Ahmed, 2013). So, SaaS Grou.ps (http://grou.ps) was chosen as the technological solution. It is a "a do-it-yourself" social networking platform that allows people to come together and form interactive communities around a shared interest or affiliation with built-in apps enabling easy collaboration and communication with 12M+ members and 300K+ active groups, based on open source technologies.

Research Context

The process of students' online instant messaging analysis was part of a qualitative case study, which was the overall research design. According to Yin (2003) *case study* is a research strategy rather than a method, i.e., an empirical enquiry that investigates a contemporary phenomenon within its real-life context. In this context, rather than just investigating isolated variables that may impact CMC in the community, it was more appropriate to describe and interpret students' participation on synchronous communication as part of an educational phenomenon.

Although a qualitative case study design builds rather than tests theory (Merriam, 1988), researchers do not endeavor investigation without any kind of theoretical propositions to guide the study. Therefore relevant literature is used as theoretical background. Based of Paulus and Scherff's (2008) work on asynchronous CMC for students, this study focuses on synchronous communication via chat tools to explore patterns and themes on communication between student teachers during practicum.

Research design was reinforced by Grou.ps' communication and collaboration tools, aligned with the pedagogical context, which allowed student teachers to actively participate in a set of *open* and *closed a*ctivities guided by three main research issues:

- Reflective dialogue of student teachers while participating to eCTP.
- Student teachers' perceptions of professional identity during school placement.
- eCTP as a mean to facilitate and foster practicum.

Based on the literature review and the above research context, an exploratory single case study research was set up during practicum in the Primary Education Dept., University of Aegean, and case was defined as the support and facilitation of the practicum via a virtual Community of Practice (CoP).

Data Sources and Analysis

Study participants were a cohort of 165 student teachers (28 males and 137 females) placed in 16 different K-6 schools for internships, spanning over 13 weeks, organized into three distinct phases: (a) *Classroom Observation* (weeks: 2-4), (b) *Micro-Teachings* (weeks: 5-7) and (c) *Classroom Teachings* (weeks: 9-11).

These students were members of eCTP as well, having produced more than 4.500+ artifacts in the community, such as forum messages, blog posts, chat messages, files sharing (text, images, and video), private messaging, etc., throughout semester as part of the educational process.

Even though chat messages IM) were not part of the original educational design,, users exchanged a large amount of messages (800+) -- a fact that influenced us to include synchronous communication as part of our research sources (with forum and blog messages) (see Figure 2).

An average of 53 messages were posted per week and 4.6 messages per user (0.36 messages per user per week) for the duration of the course, where the most active week was 13 with a total of 333 messages, because ever though the semester ended January 13th, communication continued till February.

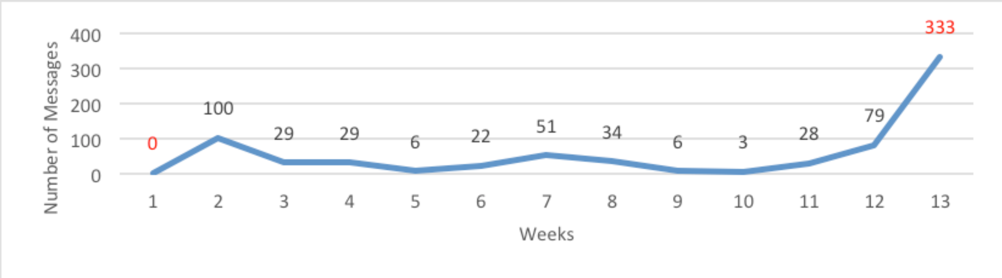


Figure 2. Chat messages per week.

Qualitative data includes a detailed description of the context, direct quotations from participants and excerpts from documents (Merriam, 1988), and participant observation is a common source of data for qualitative case studies. Instant messaging took place within the eCTP chat tool and observing these conversations and reading their transcripts is a type of participant observation (Paulus & Scherff, 2008).

The chat transcripts were analyzed to explore emergent themes and patterns related to what students talked about and how they made sense of their experience. They were copied into a word processing document at the end of the semester, sorted by date and then imported into Atlas.ti 6.2 as a Primary Document of the Hermeneutic Unit (Atlas.ti is a well-known computer assisted qualitative data analysis software).

The end result was a list of themes (Table 1) describing the chat's communication pattern within the virtual community.

Table 1

Themes of Messages' Content Analysis

	Themes *"What the students were discussing about, or what the content of the message was…"*	**Messages**	
1	Answer to questions / Responses to an issue	276	32,43%
2	Questions	211	24,79%
3	Acknowledges	113	13,28%
4	Opinions/Ideas/Points of View	67	7,87%
5	Emotions/Impressions/Humor	50	5,88%
6	Clarifications of an issue	36	4,23%
7	Agreement/Convergence of opinions	30	3,53%
8	Narration	21	2,47%
9	Support/Encouragement	20	2,35%
10	Ascertainment/Declaration	14	1,65%
11	Contradiction on an issue	13	1,53%
		851	100%

In order to perform Open/Initial Coding (Saldana, 2009) to the data, the electronic message was chosen as the unit of analysis. Using this model of content analysis, qualitative data were broken into discrete parts and the researcher closely examined and compared them for similarities and differences (Strauss & Corbin, 1998). Moreover, we counted frequency of themes and categories within messages in order to quantify results of the analysis.

Analysis revealed that a synchronous communication (IM) pattern was dominated by eleven themes corresponding to the content of the messages. Answering the central question "what the students were discussing about," it was evident that their dialogue was centered on the **questions** that student teachers were asking to their peers as members of eCTP. So, a second level analysis was performed on those messages so that the researchers might understand the type and content of those questions and clarify what kind of help users were seeking among peers in the community (see Table 2).

Table 2

Categories of Questions' Content Analysis

	Categories of *Theme 2* **"***What the students were questioning about…"*	**Messages**	
1	Course deliverables: *general questions*	37	17,54%
2	Technical issues/Use of eCTP	35	16,59%
3	Information about other courses	35	16,59%
4	Course deliverables: *self-assessment*	23	10,90%
6	Organizational issues	21	9,95%
7	Course deliverables: *teaching*	18	8,53%
7	Micro-Teaching	16	7,58%
8	Course deliverables: *description of an educational dimension*	14	6,64%
9	Course deliverables: *classroom observation datasheet*	12	5,69%
		211	100%

By performing content analysis on the messages of the theme "Questions," we found that student teachers' peer questions centered around five major categories: (a) deliverables of the course/practicum at the end of the semester, (b) technical issues, (c) organizational issues, (d) micro-teaching issues and (e) general information about other courses.

It was evident that chat was used mainly as a Query and Answer mechanism within the community of peer students and this outcome is in accordance with Paulus and Scherff's (2008) research, who found that CMC - as a support mechanism for interns - was used as a forum for university and curriculum concerns among students.

Besides questions as the dominating theme, chat served as a means for students' emotional relief, having given them a forum to express emotions, humor, anxieties and through this process to offer each other support and encouragement for the successful completion of the internship, as can be seen to the following messages excerpts:

- Just a few days left for the end! Don't worry and be patient.
- Be positive! Good luck with the exams.
- Be positive above all…course is ending and I believe with a good final grade because all of us had work very hard during this practicum!
- Don't get nervous A… we shall find a solution to this problem together.

Also, instant messaging helped individuals in the process of socialization, offering a forum for narration, dialogue, exchange of ideas/opinions and contradiction on an issue within the community, as can be seen to the following messages excerpts:

- Professor X… said that eventually she will give us the email to send the material, but I learned from other colleagues that in the end she only assesses just a few of the exercises.
- Dear M, we all have to follow the same procedure on this. I can't see where the problem is…
- The point is that you can't give a questionnaire to K-1 pupils!
- You are wrong! Micro-teaching refers to student teachers, not to pupils in school.

Finally, examining how the students talked with each other, it was found that messages were characterized by: (a) a strong *sense of emotional engagement* created through several discourse strategies, (b) *responsiveness* to each other's messages - even though this was not an obligation of the course design – thus enhancing their social presence in the online environment of eCTP, and (c) *storytelling* as an important element of the dialogue, an impetus for further engagement by triggering new messages of doubt, ideas, or requests (Paulus & Scherff, 2008).

Discussion

Research on eCTP based on a holistic pedagogical and technological context focuses on the creation of a community of practice among peers during internship, thus promoting greater levels of critical reflection and cognitive engagement.

As Paulus and Scherff (2008) suggested, while scaffolding this type of CMC environments is of great importance, it is not the only action needed in teachers' preparation departments. Student teachers need also emotional support, clarifications on organizational and academic issues, and answers on course and practicum design, assessment procedures, etc.

The results of this study indicate that synchronous communication with the instant messaging mechanism is an effective means of providing peer support among student teachers during practicum, with evidence of social presence, emotional engagement and responsiveness.

Technology allowed students to stay connected with their peer group. They are already deeply engaged in socializing via technologies like Facebook©. Therefore capitalizing on their digital behavior and habits, supportive tools may be developed that can be used during practicum and may prove valuable in teachers' preparation programs, as English and Duncan (2008) and English and Howell (2011) have suggested.

References

American Association of Colleges of Teacher Education (AACTE) & the Partnership for 21st Century Skills (P21) (2010). *21st century knowledge and skills in educator preparation* [White paper]. Retrieved from http://www.p21.org/storage/documents/aacte_p21_whitepaper2010.pdf

Bora, U., J., & Ahmed, M. (2013). E-learning using cloud computing. *International Journal of Science and Modern Engineering*, *1*(2), 9-13.

Cameron, L., Campbell, C., & Sheridan, L. (2011). Using mobile technology to develop the pre-service teacher practicum: Education and technology: innovation and research. In K. Fernstrom & K. Tsolakidis (Eds.), *Education and Technology: Innovation and Research, Proceedings of ICICTE 2011* (pp. 535-544). Fraser Valley, Canada: University of the Fraser Valley Press.

Carrington, L., Kervin, L., Ferry, B. (2009). Enhancing the development of pre-service teacher professional identity through the use of a virtual learning environment. In I. Gibson et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2009* (pp. 1402-1409). Chesapeake, VA: AACE.

Chu, S., Chan, C., & Tiwari, A. (2012). Using blogs to support learning during internship. *Computers & Education*, *58*, 989-1000.

Davie, S., Berlach, R. (2010) Using wikis to facilitate communication for rural, remote and at-risk practicum students. *MERLOT Journal of Online Learning and Teaching*, *6*(1), 78-88.

English, R., & Howell, J. (2011). Virtual communities as tools to support teaching practicum: Putting Bourdieu on Facebook. In B. Daniel (Ed.), *Handbook of research on methods and techniques for studying virtual communities: Paradigms and phenomena* (Volume 2) (pp. 233-247). Hershey, PA: Information Science Reference.

Geijsel, F., & Meijers, F. (2005). Identity learning: The core process of educational change. *Educational Studies*, *31*(4), 419-430.

Gomez, L., M., Sherin, M., G., Griesdom, J., Fin, L-E. (2008). Creating social relationships: The role of technology in preservice teacher preparation. *Journal of Teacher Education, 59*, 117-131.

Korthagen, F., & Vasalos, A. (2005). Levels in reflection: Core reflection as a means to enhance professional growth. *Teachers and Teaching: Theory and Practice*, *11*(1), 47-71.

Kostas, A., Sofos, A., & Tsolakidis, C. (2013). Facilitating student teachers during practicum: A case study using a web 2.0 online community. In L. Morris, & C. Tsolakidis, (Eds.), *Proceedings: International Conference on Information Communication Technologies in Education (ICICTE) 2013* (pp. 343-353), Chania, Greece.

Merriam, S., B. (1988). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.

Paulus, T., & Scherff, L. (2008). Can anyone offer any words of encouragement? Online dialogue as a support mechanism for preservice teachers. *Journal of Technology and Teacher Education*, *16*(1), 113-136.

Reich, J., Levinson, M., & Johnston, W. (2011). Using online social networks to foster preservice teachers' membership in a networked community of praxis. *Contemporary Issues in Technology and Teacher Education*, *11*(4), 382-397.

Rideout, G., Briunsma, R., Hull, J., & Modayil, J. (2007). Online learning management systems (LMS) and sense of community: A pre-service practicum perspective. *Canadian Journal of Learning and Technology*, *33*(3).

Russell, M., Bebell, D., O'Dwyer, L., & O'Conner, K. (2003). Examining teacher technology use: Implications for pre-service and in-service teacher preparation. *Journal of Teacher Education*, *54,* 297-310.

Schön, D., A. (1983). *The reflective practitioner. How professionals think in action*. London: Tample Smith.

Sofos, A. (2013). Mentoring in a holistic framework of inquiry and reflection-based practicum for the incorporation of new media in education. In G. Kokkinos & M. Chionidou (Eds.), *Educational Sciences: From a weak classification of pedagogy to an interdisciplinary and scientific hybridism* (pp. 192-220). Athens: Traveler Pubs.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, CA: SAGE.

Tsoulis M., Tsolakidis C., Vratsalis C. (2012). Second level teacher's training in the use of ICT: The Day After, European and e-Learning Network, 7th Research Workshop, 22-23 October 2012, Leuven.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York: Cambridge University Press.

Zagami, J. (2010). *Twittering to survive practicum.* Paper presented at ACEC2010: Digital Diversity Conference, 6-9 April, Melbourne, Australia.

Zygouris-Coe, V. (2013). 21st Century learning preparation spaces for teacher preparation. In L. Morris, & C. Tsolakidis, (Eds.), *Proceedings: International Conference on Information Communication Technologies in Education (ICICTE) 2013*, (pp. 20-26), Chania, Greece.

Yin, R., K. (2003). *Case study research design and methods*. Thousand Oaks: SAGE Publications.

Author Details

Apostolos Kostas
apkostas@aegean.gr

Alivisos Sofos
lsofos@aegean.gr

Kostas Tsolakidis
tsolak@aegean.gr

Back to Contents page

EFFECTIVENESS OF AN E-LEARNING SYSTEM AND STUDENTS' PERCEIVED SATISFACTION IN A PUBLIC ADMINISTRATION PROGRAMME USING THE MOODLE E-LEARNING PLATFORM

Lan Umek, Damijana Keržič,
Aleksander Aristovnik, and Nina Tomaževič
University of Ljubljana
Ljubljana, Slovenia

Abstract

The use of e-learning techniques in higher education is becoming ever more frequent. In some institutions, e-learning has completely replaced the traditional teaching methods, while in others it supplements classical courses. The paper presents a study, conducted in a member institution of the University of Ljubljana, providing public administration programmes. We analysed the relationship between proportion of the course implemented in Moodle e-learning platform and students' effectiveness and satisfaction. The empirical findings reveal positive correlation for both elements. The results can help the decision makers to learn more about how to enhance students' success and satisfaction using an e-learning platform.

Introduction

E-learning is becoming increasingly interesting for society and educational institutions because it supports the concept of lifelong learning and because knowledge is becoming more and more important. This increases the demand for various educational forms and means. Different education programs worldwide cater to the increased demand and offer new forms of education that are frequently supported by information-communication technology (ICT) (Sulčič & Lesjak, 2009). Moreover, technological advances have revolutionized teaching and learning processes (Aristovnik, 2013). Fry (2001), for instance, notes that the emergence of new technologies, the rapid expiration of knowledge and training, the necessity of just-in-time information delivery, and the need for more cost-effective teaching methods have transformed the teaching-learning practices.

Since e-learning has been an important and ever more frequently used teaching technique in the past decades, there are also many opinions as well as studies on its impact on students' performance. Delivering instructions that can produce equal or even better outcomes than face-to-face learning systems is one of the main goals of introducing ICT into study process (Carr, 2000; Saba, 2012). But besides many advantages of this type of the study (e.g., in Cole, 2000, Novo-Corti, Varela-Candamio, & Ramil-Diaz, 2013), there are also many disadvantages, which can decrease the positive impact of modern ICT tools on students' performance (e.g., in Wang et al., 2003). Moreover, in the e-learning process there are also many specific factors involved (Chien, 2012; Frydrychova Klimova & Poulova, 2013; Haverila & Barkhi, 2009; Kim & Kim, 2013; Ozkan & Koseler, 2009; Park & Choi, 2009; Saba, 2012;

Upadhyaya & Mallik, 2013) that are not directly connected with the ICT but importantly influence the students' effectiveness (Lopez-Perez, Perez-Lopez, & Rodriguez-Ariza, 2011), sometimes also in a negative way (Berge & Huang, 2004; Frankola, 2001; Willging & Johnson, 2004).

When making the decisions regarding the introduction of blended learning (Friesen, 2012) and on the use of a specific e-learning platform, it is important to analyse the opinions of different stakeholders, involved in e-learning process, i.e., teachers (Boling, Hough, Krinsky, Saleem. & Stevens, 2012) and students (Ozkan & Koseler, 2009; Paechter, Maier, & Macher, 2010; Wu, Tennyson, & Hsia, 2010). The same is important also when making the improvements and deciding about any changes in the concept of e-learning.

The purpose of the paper, is firstly, to provide the answer to the question whether the introduction of e-learning system Moodle as a part of a teaching process in the public administration programs had an impact on students' effectiveness, measured as the average grade and the average number of admissions to the exams for each course. Secondly, we tried to find out how the introduction of e-learning system Moodle influenced the students' satisfaction with the specific aspects of course conduction (prompt study, the availability of relevant information). The two research questions were formulated as hypotheses:

H1: Higher proportion of implementation of a course in Moodle increases students' effectiveness.

H2: Higher proportion of implementation of a course in Moodle has a positive impact on students' satisfaction.

The paper continues with the presentation of the sample and of the data collected, followed by the description of the methodology and empirical results. The conclusion offers the findings, implications for research and practice, limitations and avenues for future research.

Data

Faculty of Administration (FA) is a part of the University of Ljubljana, Slovenia. FA educates students in the field of administrative science and develops this field through a variety of research. Study at the FA is interdisciplinary and includes administrative, legal, economic, as well as organizational and ICT courses. FA offers undergraduate study programs (1st cycle) − University Study Program in Public sector governance and Higher Education Professional Study Program in Administration, which last 3 years (six semesters). Both undergraduate study programs of the FA meet the requirements defined by the European Association for Public Administration Accreditation (EAPAA) high quality standards.

e-Learning at FA

The beginnings of e-learning at the FA are dating back to 2005, when we implemented a payable platform for e-learning, i.e., eCampus. After three years, the learning platform was replaced with open-source Moodle platform, mainly due to user-friendly environment and cost benefits. FA runs blended learning, where traditional face-to-face teaching is combined with e-courses in Moodle.

In the beginning, implementation of e-course was based on a voluntary decision of teachers themselves. In the academic year 2010/11 an e-course in Moodle became mandatory for all courses of the first year of undergraduate study, namely 20 to 30 percent of traditional face-to-face learning process was implemented in Moodle. Next year blended learning was implemented on second year of study and in academic year 2012/13 all courses of the undergraduate study had their own e-classroom in Moodle. At the same time, the rules that control the quality performance of the educational process in e-course (e-learning policies) were set. In accordance with these rules, any e-course has to include at least:

- an introductory section with basic information about the course,
- two forums: news forum and discussion forum - enabled communication between teachers and students,
- e-content - additional learning resources for independent study,
- self-evaluation activities for students (e.g. quizzes), and
- assignments for students, where teachers' feedbacks about the correctness are mandatory.

At the end of each semester the coordinator for e-learning reviews the adequacy of e-courses according to the rules. So the quality of the pedagogical work in e-courses is regularly monitored and the necessary improvements are made for the next academic year.

Participants (Students Included in the Research)
Due to the heterogeneity of the courses at our faculty we focussed on the obligatory courses at the first year of study and excluded outliers with too high and too low average grades. The final study included 13 courses and five of their properties (the proportion of time the course was held in Moodle, the average grade and the number of admissions to the exams, the level of prompt study and the availability of relevant information). The total number of students from which the aggregation averages were computed, was 205. The data were collected in the academic year 2012/13.

Survey
Students' satisfaction surveys are common to all faculty members of the University of Ljubljana and are a part of the regular annual monitoring of the quality of the FA. In the survey students express their individual opinions regarding the quality of execution of specific subjects and of pedagogical work of participating lecturers. Filling in the survey through web-based information system is anonymous and is secured by a specific IT solution. The results of the surveys are used as a basis for carrying out the habilitation procedures and give a feedback to teachers about their lectures and teaching methods during the year.

Answers to the question range from minus 3 (very bad) and minus 1 (negative) to 1 (good) and 3 (very good). Students can also choose N ("do not know") or even do not respond since the participation in the survey is not obligatory. Missing responses and the value of N in the analysis of the survey are considered as missing values.

From the students' survey we selected the following two questions about the execution of the course that are related to our study.

Q1: The knowledge, gained in each lesson is checked regularly during the semester.

Q2: Timely relevant information about the course and related duties are available.

In the first question students are asked whether the course enables prompt study in any form. Besides the possibility of partial exams there are different assignments and quizzes, all available in Moodle platform. The second question asked students how well-informed are they about the relevant news related to the course. The Moodle platform offers simple communication between teachers and students via several forums from which students receive instant notifications about the relevant topics directly to their e-mail addresses.

Methodology

In the empirical study we analysed the statistical relationship between the proportion of the course implemented in Moodle e-learning platform and the two aspects of students' effectiveness and satisfaction. We measured the effectiveness with average grades and average number of admissions to exams. Satisfaction was measured with students' opinion on possibilities for a prompt study (Q1) and availability of the course-relevant information (Q2). Graphical estimation of the statistical relationship was made with four scatter plots. We presented two variables which measure effectiveness in one figure, and two variables which measure satisfaction in another as a function of the proportion of the course implemented in Moodle.

We also computed the weighted Pearson's correlation coefficient between the proportion of the course implemented in Moodle and all other analysed variables. Like the traditional coefficient its weighted version ranges from −1 to 1 where 1 corresponds to perfect positive correlation, −1 to perfect negative correlation and values around 0 indicate no linear relationship. We used weighted coefficient to incorporate different number of students who attended different courses. Besides the weighted Pearson's coefficient of correlation, we computed its standard error, t-statistics and corresponding p-value that helped us to test our research hypotheses.

Empirical Results

In order to graphically estimate the statistical relationship we plotted four scatter plots: the x-axis represents the proportion of the course implemented in Moodle in all four plots. The y-axis represents a different variable at each scatter plot. For descriptive purposes we coloured the points with two colours: the black dots represent the courses from the University study programme, the grey dots represent the courses from the Professional study programme. The size of the dot is proportional to the number of students who attended the course (see Scatter plots in Figure 1 represent the relationship between the proportion of the course implemented in Moodle and the two aspects of students' effectiveness - the average grade (measured from 1 to 10, students pass an exam with grade 6 or higher) and the average number of admissions to the exams. The scatter plots show that the implementation of Moodle has a positive impact on students' effectiveness: in courses with lower proportion of the implementation in Moodle (16 % or less) students got on average lower average grades (below 7 on 1−10 scale) and those courses require on average more admissions (around 1.4) to pass an exam. At the courses with a higher proportion of Moodle (around 30 %) students on average got better grades (around 7.3) and required only a little more than one admission to pass an exam (around 1.05). The relationship is stronger for the courses from the University study programme (black dots).

and Figure 2).

Scatter plots in Figure 1 represent the relationship between the proportion of the course implemented in Moodle and the two aspects of students' effectiveness - the average grade (measured from 1 to 10, students pass an exam with grade 6 or higher) and the average number of admissions to the exams. The scatter plots show that the implementation of Moodle has a positive impact on students' effectiveness: in courses with lower proportion of the implementation in Moodle (16 % or less) students got on average lower average grades (below 7 on 1−10 scale) and those courses require on average more admissions (around 1.4) to pass an exam. At the courses with a higher proportion of Moodle (around 30 %) students on average got better grades (around 7.3) and required only a little more than one admission to pass an exam (around 1.05). The relationship is stronger for the courses from the University study programme (black dots).

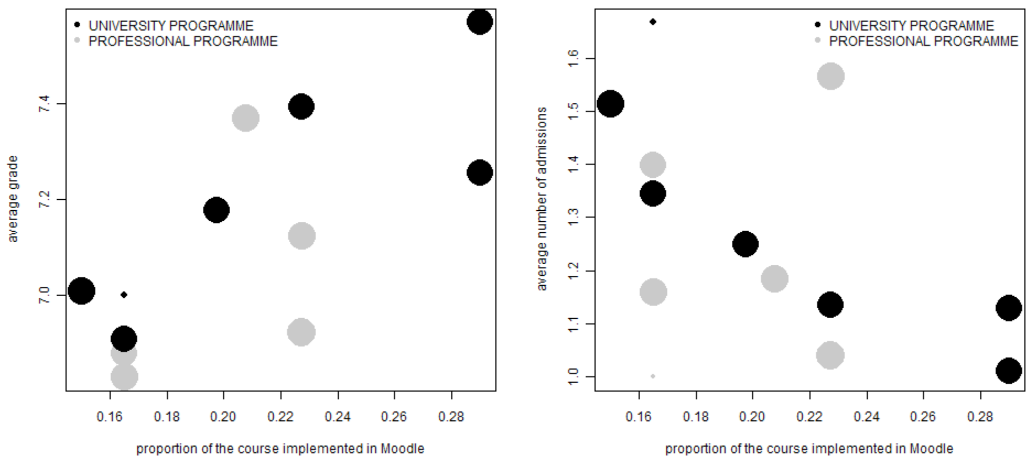


Figure 1. Relationship between the proportion of the course implemented in Moodle and the average grade (left plot) and the number of admissions to exams (right plot).

The scatter plots in **Error! Reference source not found.** show that the proportion of the course implementation of Moodle has a weaker impact on students' satisfaction. In the courses with a lower proportion of implementation in Moodle (16 % or less) students study less promptly (students' average opinion is below 1 on −3 to 3 scale) than in the courses with a higher proportion (average above 1). But on the other hand, there seems to be no such relationship for the availability of relevant information. Perhaps the main reason is that the students' opinion regarding this question (Q2) shows that the general availability of important information at the faculty level is pretty high (average around 1.7 on scale from −3 to 3).

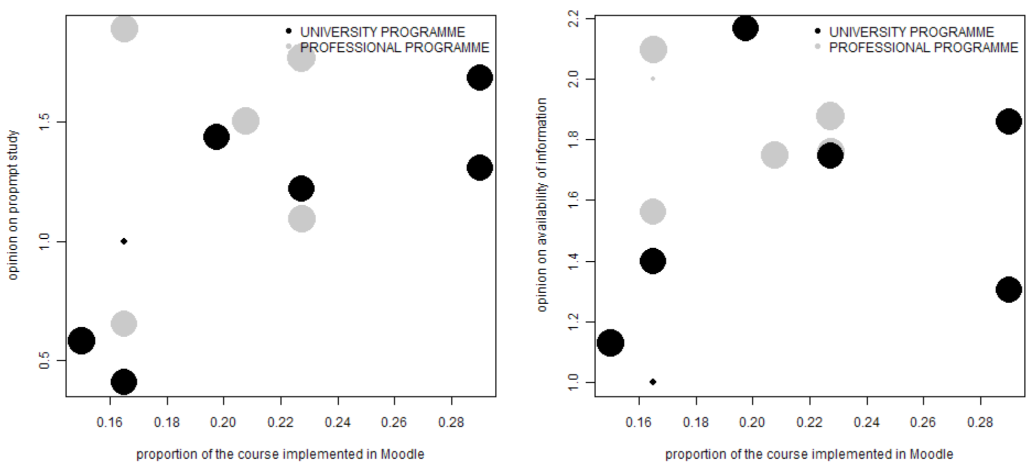


Figure 2.. Relationship between the proportion of the course implemented in Moodle and prompt study (left plot) and availability of information (right plot).

To test our hypotheses H1 and H2 we computed a weighted Pearson's correlation coefficient and estimated the 1-sided p-values between the proportions of the course implemented in Moodle e-learning platform and the two aspects of students' effectiveness (average grade and average number of admissions) and the two aspects of students' satisfaction (Q1, Q2).s Table 1 shows the results of our empirical study.

Table 1

Weighted Pearson's Correlation Coefficient And Related Statistics

Variable	Correlation	Std. errs.	t-value	p-value (1-tailed)	
Average grade	0.70	0.22	3.22	0.004	***
Average number of admissions	−0.56	0.25	−2.23	0.024	**
Q1	0.48	0.26	1.81	0.049	**
Q2	0.14	0.30	0.47	0.323	

Correlation is significant at level: 0.1 (*), 0.05 (**), 0.01 (***).
Source: Survey, 2015.

The empirical study showed that proportion of the course implemented in Moodle e-learning platform is strongly and positively correlated ($r = 0.70$) to the average grade - the weighted Pearson's correlation is highly significant (p-value: 0.004, see Table 1). This means that in the courses with a higher proportion of workload in Moodle students tend to get higher average grades compared to the courses with lower proportion. On the contrary, the correlation with the average number of admissions to the exams is moderate and negative (−0.56) and still significant (p-value: 0.024). This means that students in the courses with a higher proportion in Moodle require on average less admissions to the exams compared to the courses where the same proportion is lower. The empirical results thus support our first hypotheses (H1) and show that the higher proportion of implementation of a course in Moodle increases students' effectiveness, i.e., increases average grades and decreases the required number of admissions to the exams.

The weighted Pearson's correlation coefficient shows a weaker relationship between the proportion of the course implemented in Moodle e-learning platform and the two aspects of students' satisfaction although the correlations are still positive and one of them significant at 5 % level (see Table 1). We found a modest positive correlation between the proportion of a course in Moodle and the students' prompt study ($r = 0.48$), which is significant (p-value 0.049). This means that the Moodle environment forces students to study promptly. Although the correlation between the proportions of the course implemented in Moodle e-learning platform and the availability of information regarding the course is positive ($r = 0.14$), the value is too low to be significantly greater than 0 (p-value 0.323).

The empirical results thus just partially support our second hypothesis (H2). They show that the courses with a higher proportion of their implementation in Moodle require more prompt study but do not provide enough statistical evidence to prove the same relationship with the availability of course-relevant information.

Conclusion

The results of our study indicate that the implementation of blended learning with a LMS platform Moodle at the Faculty of Administration, University of Ljubljana, resulted in a statistically significant increase of students' effectiveness, measured with the average grade and the average number of admissions to the exams. We confirmed our first research hypothesis (H1) that a higher proportion of implementation of a course in Moodle increases students' effectiveness, i.e., students get on average better grades and require less admissions to pass the exam. We have partially confirmed our second research hypothesis (H2) that a higher proportion of implementation of a course in Moodle has a positive impact on students' satisfaction: we showed its positive impact on satisfaction with more prompt study but did not find enough statistical evidence to show its impact on the satisfaction with the availability of relevant information.

Main limitation of the research was a limited data set. Due to the anonymity of the students' survey we could not link students' answer to their grades.

Therefore we had to aggregate the data and analysed courses as units of observation. Such aggregation reduced the sample size and blurred possible relevant relationships. Besides that, the courses at FA are very diverse, therefore we had to limit our survey to just the first year of study with the highest number of students and the most homogeneous subgroup of courses in terms of Moodle's usage. The other limitation is hidden in the students' survey where the focus is on the evaluation of teachers and courses while no questions in the survey are directly measuring the satisfaction with blended learning and its implementation with e-learning system Moodle.

To conclude, the obtained results of the study can, however, serve as an important background when deciding on the future development of e-learning at the Faculty of Administration. Our future work will concentrate on introduction of another survey in 2015, which will be specialized in evaluating the Moodle environment by students and teachers and will link the students' answers to their effectiveness. The results of our future surveys will provide more insight into the relationships we studied in this paper.

References

Aristovnik, A. (2013). ICT expenditures and education outputs/outcomes in selected developed countries: An assessment of relative efficiency. *Campus-wide information systems*, *30*(3), 222–230.

Berge, Z., & Huang, Y. (2004). A model for sustainable student retention: A holistic perspective on the student dropout problem with special attention to e-learning. *DEOSNEWS*, *13*(5). Retrieved from http://learningdesign.psu.edu/deos/deosnews13_5.pdf

Boling, E. C., Hough, M., Krinsky, H., Saleem, H., & Stevens, M. (2012). Cutting the distance in distance education: Perspectives on what promotes positive, online learning experiences. *Internet in Higher Education*, *15*(2), 118–126.

Carr, S. (2000). As distance education comes of age, the challenge is keeping the students. *The Chronicle of Higher Education*, *23*. Retrieved from http://chronicle.com/free/v46/i23/23a00101.htm

Chien, T. C. (2012). Computer self-efficacy and factors influencing e-learning effectiveness. *European Journal of Training and Development*, *36*(7), 670–686.

Cole, R.A. (2000). *Issues in web-based pedagogy: A critical primer.* Westport, CT: Greenwood Press.

Frankola, K. (2001). Why online learners drop out. *Workforce*, 53–63. Retrieved from http://www.workforce.com/articles/why-online-learners-drop-out

Friesen, N. (2012). Report: Defining blended learning. Retrieved from http://learningspaces.org/papers/Defining_Blended_Learning_NF.pdf

Fry, K. (2001). E-learning markets and providers: some issues and prospects. *Education + Training*, *43*(4/5), 233–239.

Frydrychova Klimova, B., & Poulova, P. (2013). Impact of a form of online materials on the quality of education – A case study. *International Journal of Digital Information and Wireless Communications, 3*(1), 43–49.

Haverila, M., & Barkhi, R. (2009). The influence of experience, ability and interest on e-learning effectiveness. *European Journal of Open, Distance and e-Learning, 1*, 1–13. Retrieved from http://files.eric.ed.gov/fulltext/EJ911761.pdf

Kim, J. K., & Kim, D. J. (2013). Meta-analysis on relations between e-learning research trends and effectiveness of learning. *International Journal of Smart Home*, *7*(6), 35–48.

Lopez-Perez, M.V., Perez-Lopez, M.C., & Rodriguez-Ariza, L. (2011). Blended learning in higher education: Students' perceptions and their relation to outcomes. *Computers & Education*, *56*(3), 818–826.

Novo-Corti, I. ,Varela-Candamio, L., & Ramil-Diaz, M. (2013). E-learning and face to face mixed methodology: Evaluating effectiveness of e-learning and perceived satisfaction for a microeconomic course using the Moodle platform. *Computers in Human Behavior*, *29*, 410–415.

Ozkan, S., & Koseler, R. (2009). Multi-dimensional students' evaluation of e-learning systems in the higher education context: An empirical investigation. *Computers & Education*, *53*(4), 1285–1296.

Paechter, M., Maier, B., & Macher, D. (2010). Students' expectations of, and experiences in e-learning: Their relation to learning achievements and course satisfaction. *Computers & Education, 54*(1), 222–229.

Park, J. -H., & Choi, H. J. (2009). Factors influencing adult learners' decision to drop out or persist in online learning. *Educational Technology & Society*, *12*(4), 207–217.

Saba, T. (2012). Implications of E-learning systems and self-efficiency on students' outcomes: A model approach. *Human-centric Computing and Information Sciences*, *2*(6), 1–11.

Sulčič, V., & Lesjak, D. (2009). E-learning and study effectiveness. *Journal of Computer information Systems*, *49*(3), 40–47.

Upadhyaya, K.T., & Mallik, D. (2013). E-learning as a socio-technical system: an insight into factors influencing its effectiveness. *Business Perspectives and Research*, *2*(1), 1–12.

Wang, G. et al. (2003). *Departure, abandonment, and dropout of e-learning: Dilemma and solutions*. James Madison University.

Willging, P. A., & Johnson, S. D. (2004). Factors that influence students' decision to drop out of online courses. *Journal of Asynchronous Learning Network*, *8*(4), 105–118.

Wu, J. H., Tennyson, R. D., & Hsia T.L. (2010). A study of student satisfaction in a blended e-learning system environment. *Computers & Education*, *55*(1), A155–164.

Author Details

Lan Umek
lan.umek@fu.uni-lj.si

Damijana Keržič
damijana.kerzic@fu.uni-lj.si

Aleksander Aristovnik
aleksander.aristovnik@fu.uni-lj.si

Nina Tomaževič
nina.tomazevic@fu.uni-lj.si

Back to Contents page

THE INTERDISCIPLINARY USE OF BLOGS AND ONLINE COMMUNITIES IN HIGHER EDUCATION

Helen Caldwell and Rebecca Heaton
The University of Northampton
United Kingdom

Abstract

With online learning developing rapidly in higher education we have experimented with methods to embed blogs and online communities into our courses to enhance learning for staff and students. In this paper we provide a critical analysis of the approach used to analyse multi-sensory content on blogs and communities whilst demonstrating how they have been utilised across the Initial Teacher Education Division at The University of Northampton in the United Kingdom. We show how blogs and communities have enhanced interdisciplinary subject teaching, staff development and student engagement. By sharing a series of case studies we model the strengths and limitations of the practices adopted and demonstrate how reflexivity, communities of practice and the adoption of 21st century teaching and learning strategies fuel learning. We demonstrate how learning models can be applied and analysed within higher education institutions to enhance provision in progressive digital learning, and we draw conclusions about how tools can be used in combination to support learning.

The Digital Journey Towards the Use of Blogs and Communities

As an Initial Teacher Education (ITE) division we experiment with the digital tools we embed in our courses. This desire to be innovative began by replacing assessed e-portfolios with the use of online blogfolios in a primary computing module and went on to explore the use of blogs and Google+ communities, both singly and in combination. Research suggests blogging can provide participants with an opportunity to respond to their digital world (Collins & Ogier, 2012), allowing them to build content to share socially (Deng & Yuen, 2013; Farmer, 2006) and enabling them to develop through engagement with each other's work (Churchill, 2009). Research also exists to demonstrate how blogs enhance learning in higher education (Williams & Jacobs, 2004; Wheeler, 2010). Blogs have been found to help build learning communities (Yang, 2009), promote active collaboration (Ruepert & Dalgarno, 2011) and increase learning ownership (Farmer, Yeu & Brooks, 2007). Within ITE, blogs can function as reflective devices for students (Deng & Yuen, 2011). We sought to question how this occurred in our setting, and the five cases presented in this article demonstrate how this approach to learning has been explored at our institution.

We carried out a preliminary thematic analysis of five case studies, which used blogs and communities singularly and in combination, and we suggest a theoretical framework, which might be adopted to analyse their multi-modal content (see Tables 1 and 2). We became interested in how multi-modal content might be analysed to acknowledge the visual culture in which we all teach and learn (Heaton, 2014). This drove our trial to identify how learning occurred through blogs and communities across disciplines but also made us consider the most effective way of analysing multi-modal content in research. We share our experimentation, but acknowledge that our model is developmental and that multiple approaches exist to analyse multi-modal content (Banks, 2007; Pink 2012).

Blogs and Communities Within ITE

The following five cases demonstrate the diverse ways blogs have been implemented within our ITE division. Together, our case studies model the different ways participants' accessed learning and demonstrate how they developed to become change-makers in their digital realm (Hood, 2008; Martinez, 2012). Case 2 provides a deeper insight into our methodological structure for blog analysis, in an attempt to share how our conclusions have been drawn. By conducting research into our online practice we hoped to find out what common threads enhanced or impeded learning when blogs or communities were embedded within education modules and continuing professional development (CPD) projects. We looked at how our case study blogs and communities enhanced teaching and learning by analysing them against five coding themes, identified by analysis of the case study samples by two researchers. Our key coding themes looked at how blogs and communities demonstrated *reflective learning* (Schon, 1983), facilitated the creation of *socially shared content* and *learning communities* (Deng & Yuen, 2013; Yang 2009), encouraged *self-directed learning* (Farmer et al., 2007), and provided evidence of the participants immersing themselves in *21st century learning practices* beyond the original tool (Sharples et al., 2014).

Case 1: A Module Blog in Art Education

Through our first case we model how a whole group blog was implemented as a non-assessed course component on our ITE art specialism course (see Case 1 overview). In this case it was evident that student learning was influenced by the participants' ability to become co-producers of content (Deng & Yuen, 2013), as the blog enabled them to express their artistic and educational license. Although the participants did not write all of the blog posts, as the course tutor created some, participants did provide the visual content and made comment on session posts, showing reflective engagement. By engaging with the blog they became aware of what it meant to share their practice as an artist teacher in a public domain (Parker, 2009; Stanhope, 2011). And as their familiarity with the blog developed, they began to generate discussion surrounding their content, demonstrating creative design cognition through their digital narratives (Tillander, 2011).

Case 1: A module blog for students in art education

Learning intentions:

· To use a blog to support communication and criticality between the students.

· To create a space where students could showcase their art practice identifying how learning events contributed to idea development.

Case Overview: This blog belongs to our first year BA ITE 2014 art specialist students. Its main uses have been to document learning events such as exhibitions, school and gallery visits. Students have mainly engaged through contributions of visual work, commentaries on posts and by accessing session materials.

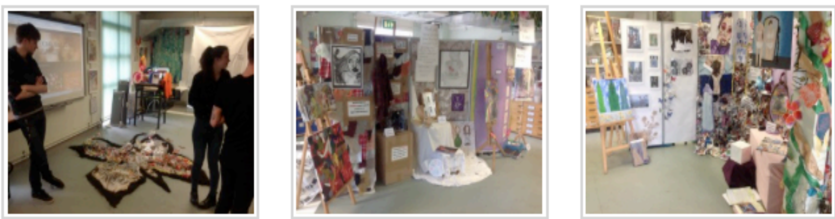
Social Issues Exhibition 2015

Published on March 27, 2015 | 1 Response

On Tuesday evening the year 1 art specialist students hosted their first exhibition at The University of Northampton to showcase their work surrounding social issues.

The event was a great success! Guests thought the experience was thought provoking, challenged the notions of art and demonstrated the talents of our future artist teachers.

Here is a gallery of the students practice:



Butterfly inspired by Art and Ecology at Nottingham Contemporary Gallery | Students explore homelessness and body image | Urbanisation meets social challenge

Figure 1. A sample post from the art specialism 2014 blog.
Blog url: http://mypad.northampton.ac.uk/artspecialism2014/

Learning Outcomes:

- Students were given a multi-sensory voice; they began to generate an identity as an artist teacher. The blog demonstrated how they drew parallels between different aspects of their identities.
- Research, resources and artists practice was shared in a central space where discussion could be generated beyond the learning events planned.

An initial barrier to learning in this case was the disparity in student confidence to engage with the blog, but as Muncy (2014) stated, this developed when the students' familiarity with the blogging process grew.

When the blog was used as a tool for discussion and content sharing in taught sessions, a model of interaction was provided by the tutor, who also provided a safer scaffolded environment for students before independent engagement with the blog occurred. This blog highlights the importance of analysing visual or multi-modal contributions, wherein the visual content represents the voice of the learner. This finding sets the stage for the analytical approach we adopted in Case 2.

Case 2: Student Group Blogs to Explore Learning Outside the Classroom Pedagogy

Through this case we provide a second example of group blogs supporting learning in ITE, in this instance as an assessed piece of work, entirely produced by groups of four students. This case was developed into a fuller analysis, which has informed our review of all five cases shown here. We share this to showcase the complexities of blog analysis and demonstrate our emerging methodology.

In this case, blogs were used as an assessment tool to demonstrate how PGCE students applied learning outside the classroom (LOC) approach to study foundation subjects in the UK National Curriculum (DfE, 2013). The students created blogs in groups of four over the course of an academic year documenting reflection on their own learning experiences of LOC practices. The LOC practices shared included generation of short and long term plans, and examples of their application of ideas to practice. Over time, the students' reflection occurred both in action, on action and for action (Schon, 1983; Cowan, 2006) as they refined ideas through site visits, on campus and during school placements. They documented this ongoing development through regular journal postings on their blogs and used the page options on the blogs to present summaries of their learning in the form of a theoretical rationale and group presentation.

Case 2: Student group blogs to explore learning outside the classroom pedagogy

Learning intentions:

- To use a blog as an assessment tool to demonstrate learning across the foundation curriculum.
- To use blogs as a reflective tool to unite theory, pedagogy and practice.

Case Overview: The group blog provided here demonstrates an example of student practice. The blog has acted as a tool for the students to communicate their knowledge and understanding of creative approaches to learning. The students have been able to add and reflect on each other's contributions whilst creating innovative learning opportunities that they can now take forward into their professional practice.

Figure 2. Sample page from a learning outside the classroom blog.
Blog url: http://mypad.northampton.ac.uk/parkrangers/

Learning Outcomes:

- Peer to peer learning has occurred and evidence has been provided that student learning has been developmental throughout the year spanning pedagogy and practice.
- The use of the blog as an assessment tool has been effective to demonstrate group contributions and critique of practice; the students have also been able to produce a variety of media within the assessment.
- Learning has spread across multiple institutions. The students have been able to draw on pedagogy in different school settings and have shared this collaboratively to alter practice in different learning domains.

In this case study, we took a triangulated approach to the blog analysis. Our curriculum team conducted pre- and post- learning questionnaires and pre- and post- focus groups with our students and analysed these to generate key themes. Open coding was used to determine the focus group themes. We then analysed the findings from these against their blog contributions to determine how their learning developed. When analysed against their blog contributions, a sequential three-stage process was used. Table 1 documents the coding phases used and the key learning themes generated as a result of the questionnaires and focus groups. It provides a small number of examples to model how this evidence was identified on the student blogs.

Table 1

Example Framework for Blog Analysis to Include Multi-Sensory Content

Coding Phases	**Coding themes identified**					
Phase 1: Theoretical Coding	**Reflective learning (Schon, 1983)**	**Socially shared content (Deng and Yuen, 2013)**	**Learning communities (Yang, 2009)**	**Self-directed learning (Farmer, Yeu and Brooks, 2007)**	**21st century learning practices. (Sharples et al. 2014)**	
Evidence on blog	Updates of information Transfer of learning to a new setting or scenario	Creation of resources/ lesson plans for other students Presentation software used	Students reviewing information Delegating roles within a group Working in partnership with museums	Application of LOC principles to teaching Relating practice to theory	Use of external e-tools e.g. thinglink, QR codes Uploading and manipulating own digital content	
Phase 2: Blog content compared with the themes of the questionnaire findings	**1.Articulating understanding of the foundation subjects**	**2.Sharing confidence to develop children's skills**	**3.Sharing beliefs**	**4.Articulating the value of LOC principles**	**5. Discussion of progress towards the blog assignment and awareness of digital literacy**	**6. Shared different learning strategies**
Questionnaire findings	Confidence increase	Increase in all subject areas	Foundation subjects should be taught separately and together	Increased, less guidance now required	Student acknowledgement of the blog impacting learning has decreased	Confidence to use these has increased
Evidence on the blog that correlated with the theme.	Updates of subject knowledge Adapting their own teaching Learning transfer	Maps of skill progression Application of principles to teaching	Narration in posts Imagery selected	Reiterated throughout all content: narrative, visuals, multi-modal content	Blog reveals students adopting LOC principles and digital literacy in their teaching but students' acknowledgement of the blog assisting this has decreased.	Range of learning strategies modeled through blog content, e.g. socio constructivist
Phase 3: Blog content compared with the open coded themes of the focus group	**1. Learning through the foundation curriculum shared**	**2. Learning outside the classroom principles articulated**	**3.Technology enhanced learning discussed**	**4.Organisation of learning articulated**		
Focus group findings	Shift from learning about the principles to modeling in practice	Students identify LOC practices enhancing pupil learning	Student value of technology increased	Students share value of blogging		
Evidence on the blog that correlated with the theme.	Principles modeled in practice: digital content/ plans	Visuals Plans/ Evaluations	Use of in own teaching/ blog content	Evidence in narrative		

To reflect on the blog analysis process shown in Table 1, we now think that theoretical coding should have been utilised as an approach throughout all data forms to maintain consistency instead of open coding. The strength of the approach was that blog analysis revealed additional findings to the questionnaire and focus group, as it was able to take account of the multi-sensory content. The blog content also helped to substantiate students' comments increasing data validity.

The reflective process used by the students in the blogs enabled a cyclical process of learning to occur (Kolb, 1994). The students were able to use the blog to reform their thinking around LOC practices and implement new actions as a result. As academics we also engaged in reflective learning, maintaining empathy with the students' growing integration of theory and practice. As a result, the blogs documented the growth of students' confidence and understanding of LOC practices and digital media over time, and enabled students to review and adapt their learning in response to influences from scholarly material (Brown, 2004).

As with the blog in Case 1, the research revealed an initial reluctance to engage in blogging. However, by the end of the assessment process students could see how their blogs had enhanced their understanding of LOC practices and identified that blogging would be valuable to their learners. And as academic practitioners we recognised that the learning process might be enhanced if students were taught how reflexive dialogue could enhance learning. Reflexive dialogue can create fluidity in articulations (Scott & Morrison, 2005) and aid expression of cause and effect experiences (Spry, 2001). Academic staff also took account of how blogs gave a more central role to student voice, positioning the students as educational change-makers (Hood, 2008). By extending our use of blogs as a HE assessment tool, staff and students have been able to enrich their teaching and learning.

Case 3: Northampton Inspire: A Teacher CPD Blog and Google + (G+) Community Spanning Geographical Locations

The combination of a blog and a G+ community in Case 3 provides an example of how school pupils, university students, teachers and academics can engage in collective knowledge-building around a common purpose: in this case, the creative exploration of technology and the arts across subjects. This blog extends the learning practice shown in Case 2, as it demonstrates the use of blogs and communities in tandem to support a dispersed group of teachers who are engaged in developing and evaluating their practice. The blog and community were formed as a response to the need for an online space for a network group of teachers to develop and exchange successful strategies for using digital technology to enhance learning. The blog provided a connected environment in which the emergent professional development community could build an evidence base of best practice in teaching with technology by archiving their learning experiences. This was complemented by the community space as a fertile ground for ongoing discussion and quick ideas sharing. An advantage of using two online spaces in this way was the facility for educators to build upon each other's ideas and strategies. To look at one example, the idea of using a *light trails* app was picked up from a network meeting, applied in one primary school to support science, in another as an art project, and in a special school to promote multisensory learning. Teachers' reflections on this approach were recorded at a TeachMeet and on Twitter, and subsequently shared on the blog as a video recording and a Storify.

Case 3: Northampton Inspire: A CPD blog and G+ community spanning geographical locations

Learning intentions:

· To use a blog and G+ community to support a dispersed network of teachers, academics and student digital leaders

· To create a space where technology and the arts projects and events could be archived

Case Overview: This blog and G+ community reflects the work of the *Northampton Inspire* network group, which is looking at the interdisciplinary coming together of technology and the arts in schools and university settings. Posts on the blog and community pages document face-to-face meetings, projects in schools supported by volunteer student digital leaders and the sharing of practice at TeachMeet events.

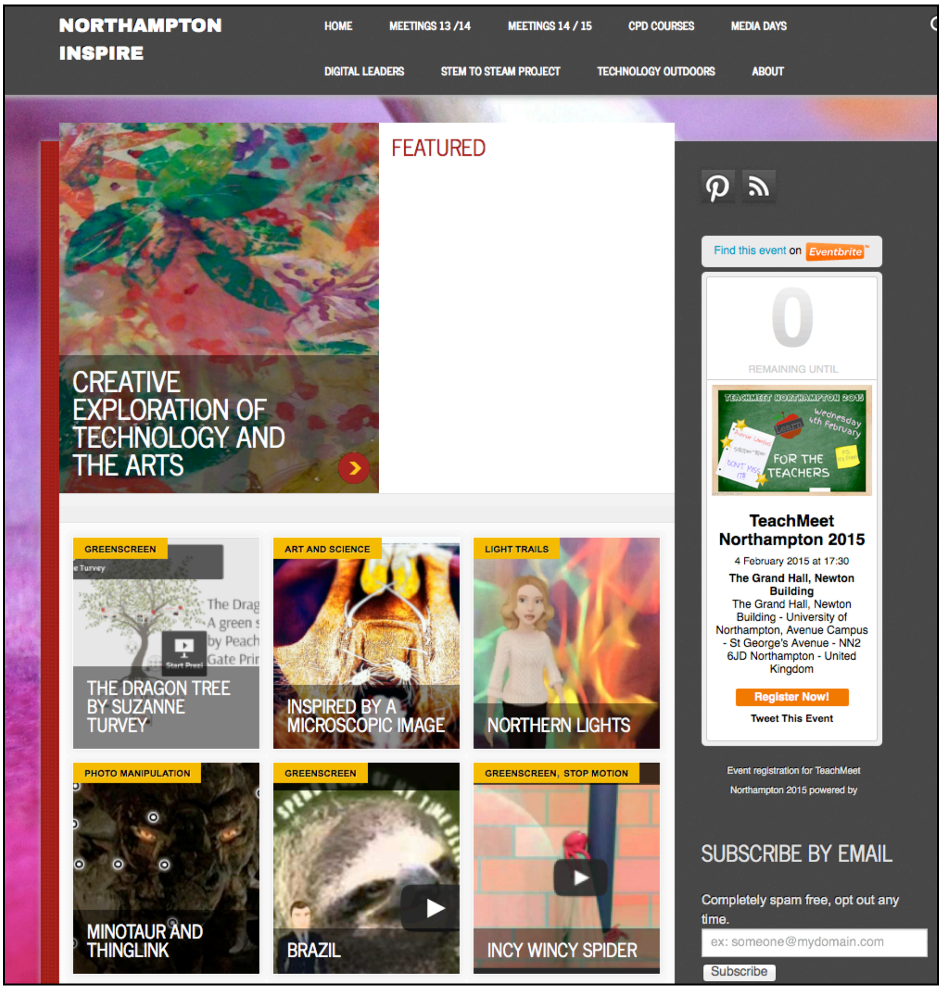


Figure 3. Sample page from the Northampton Inspire case study.
Blog url: http://mypad.northampton.ac.uk/inspire/
G+ community:
https://plus.google.com/u/0/communities/116085017840955911437

Learning Outcomes:

- The online spaces create a community of practice hub that is external to a particular educational institution and allow for peer-to-peer learning across the phase boundaries of schools and university, and between university students, academics and teachers.
- The blog creates an accessible interdisciplinary reservoir of resources and strategies representing collective knowledge building as the group applies themes in their learning contexts.
- The online spaces emphasise the application of knowledge to practice by drawing together three types of activities: presentations on recent classroom practice from students, academics and teachers at Teachmeet events; themed network meetings exploring practical applications; and projects in schools supported by student digital leaders.

Used together, the blog and community enabled teachers from a wide range of settings to discover common ground as they applied ideas to practice across varied contexts, a benefit suggested by Wick (2000), which is also modelled in the students' practices in Case 1 and 2. Researchers have noted a difference between the physical and virtual communities in the absence of *traditional group norms* and the levelling of social hierarchies (Palloff & Pratt, 1999). In Cases 1 and 3, contributions from students sit side by side with posts and comments by academics, cutting across formal structures and forging new understandings across educational sectors of the ways in which technologies can transform learning (Wenger, 2011).

Communities of Practice

As the concept of *communities of practice* is central to our findings, we will discuss it here. According to Lave and Wenger's definition, "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger, 2011, p.1). Other definitions place a similar emphasis on applying knowledge to practice, viewing communities as "individuals united in action" (Liedka, 1999, p. 5) or as groups with similar aims purposefully solving authentic problems within a real world context (Wick, 2000; Johnson, 2001) as seen in Case 3. Since Wenger's original work on communities of practice in 1991 there has been a widespread increase in online learning, which has resulted in the adoption of the term *online communities of practice (OCoPs)* to describe "socio-technological learning environments" that facilitate knowledge construction (Ozturk & Ozcinar, 2013).

As well as helping to remove geographical and social boundaries, all three case studies outlined so far have enabled participants to belong to communities of practice with a shared common purpose. Within these communities they have co-constructed knowledge by documenting learning that took place in a number of different contexts: at teacher sharing events, at network meetings, in classrooms, and via hands-on activities. This makes a case for *multimodal learning,* which mixes physical interaction with asynchronous learning (Hammond, 1998). Contemporary communities of practice, such as we describe, can combine physical and virtual spaces enabling the participants' learning journeys to move in and out of a number of *digital habitats*, a process which increases the opportunities for learning (Wenger, White, & Smith, 2009).

For example, by bringing together students, pupils, teachers and academics through a digital leaders programme in Case 3 and capturing their activities on the blog, we were able to add their different perspectives to curriculum development. Media projects using green screen equipment were developed by teachers who were supported by academics, then carried out in schools with pupils supported by digital leaders and later shared at TeachMeets from where they were captured on the blog as sources of ideas for future projects. This illustrates the way in which the *bottom up* and *top down* approaches to effective learning interact when expertise is shared informally through social online spaces and practitioner-led events (Sharples et al., 2014).

A Learning Extension: Combining Blogs With Communities

Through our first three cases we have shown that technology can facilitate situated learning by providing an environment in which learners can interact and share ideas using collaborative technologies. In Case 3 we have shown how a G+ community can enhance the use of blogs by providing a more immediate and responsive environment for exchanging ideas. Our online spaces can be seen as an example of situated learning taking place within a virtual community of practice or OCoP (Oliver & Herrington, 2000; Coppola, 1999), allowing for both synchronous and asynchronous communication. This gives learners control over the pace and place of their learning and engagement (Wenger et al., 2002; Gannon-Leary & Fonainha, 2007). In the next two cases we demonstrate the application of these ideas to a higher education context.

Case 4: The Ipad Project- A Blog and Community to Enhance Research and CPD in Higher Education

In Case 4 below, you can see that our growing community of practice involving academic and support staff across our university division has developed shared metacognition as outlined by Gunwardena (Gunawardena et al., 2009) around the use of apps for learning in a higher education context. Their metacognitive learning has been documented via a G+ community allowing them to quickly exchange ideas as well as a blog to archive their applications to practice as mini case studies. Mason and Rennie describe this type of learning shift as *group mediated cognition* in which "knowledge is created, shared, remixed, repurposed, and passed along" (2008, p.10). Our community demonstrates this as it documents the evolution of participants' use of a core set of apps for content creation over the course of a year with tools such as Thinglink, Skitch, Padlet, Rollworld, Explain Everything and Visual Poet being reused to meet a range of learning objectives across different subject areas within the group. A shared consensus has emerged that apps such as these can help make students' learning more visible. As the group solved problems together, sought help from each other, reused solutions and evaluated new apps, they developed a "collective competence" and a shared repertoire of resources and strategies (Wenger, 2011, pp1-6).

Case 4: The ipad project- A Higher Education (HE) blog and G+ community to enhance research and CPD in Higher Education

Learning intentions:

· To document and support the use of iPads by academic staff within the School of Education over the course of an academic year and provide a platform for sharing expertise more widely.

· To provide a Google+ (G+) space for academic staff to ask questions, share resources and ideas, and reflect on their practice during the implementation of the iPads project.

Case Overview: The G+ community and blog aimed to document the rollout of the use of iPads by academic staff in their teaching and learning. The project provided support for novice users who were able to seek advice from their peers, who shared what worked for them, until they gained sufficient confidence to experiment for themselves. New skills developed, supported by a collaborative team with a common purpose that tested and shared strategies and resources.

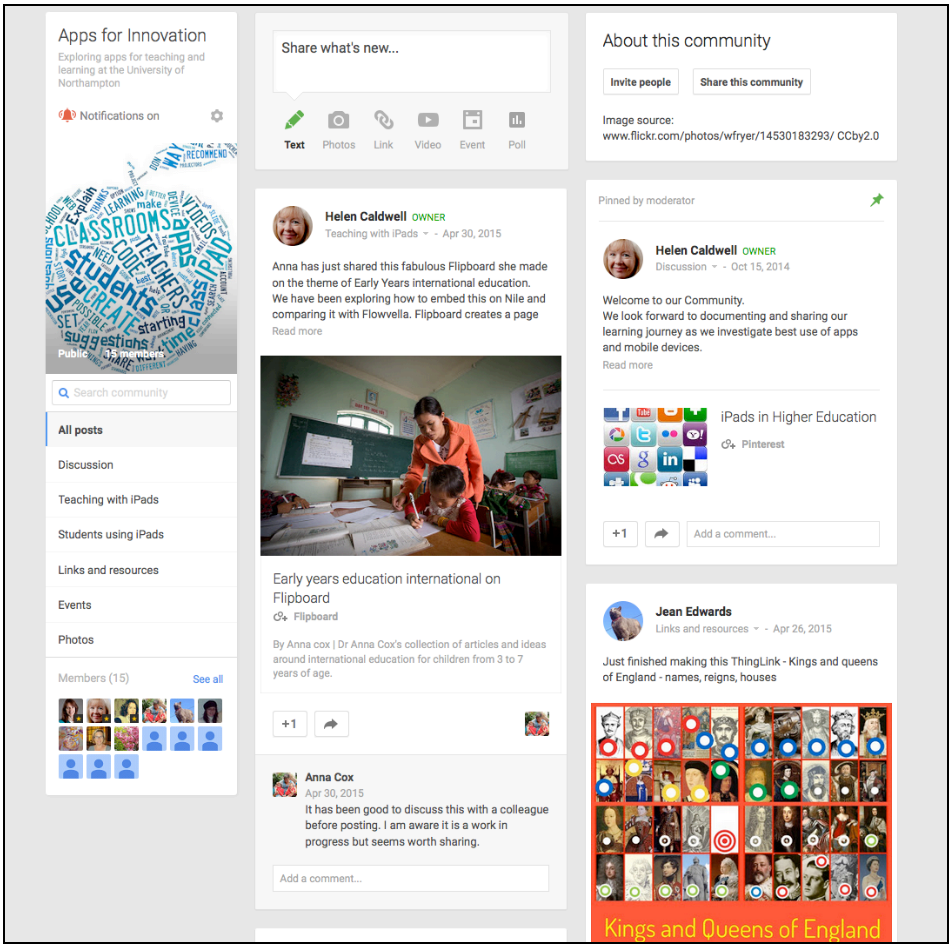


Figure 4. A sample of a Google+ page for the iPad case study.
Community URL:
https://plus.google.com/u/0/communities/110218249780833007111
Blog URL: http://mypad.northampton.ac.uk/appsforinnovation/

Learning Outcomes:

- Knowledge continued to be transferred between novices and experts within the group outside of face-to-face meetings via the G+ community discussions.
- Over time, a core set of open-ended content-creation apps emerged as users trialled them for different purposes and recorded successes as mini case studies on the blog.
- Close links were made with other communities using social network tools, and between research and practice as people shared ideas from different perspectives and discovered common ground.

As in Case 3, we have combined remote and physical collaboration by mixing occasional face-to-face contact with connected conversations through social media. The blog and online community together provided a structured framework in which social learning could take place (Wenger, 2011). Our cases can thus be seen as *connectivist* learning environments in which participants make connections with people and resources, co-create ideas and make choices within an environment mediated by technology (Saadatmand & Kumpulainen, 2014; Downes, 2010; Siemens, 2005); "Connectivist models explicitly rely on the ubiquity of networked connections between people, digital artefacts, and content" (Anderson & Dron, 2011, p. 87).

Unlike face-to-face learning events where a cohort learns the same content at the same pace, an online community may have different types of participation and differing degrees of expertise. Knowledge transfer can occur at any time between experts and novices or from peer to peer (Bielaczyc & Collins, 1999) as the community generates "a common history" and its own "artefacts" (Lave & Wenger, 1998). And, as Johnson (2001) points out, individuals may move from the edges of the community to the centre as their expertise increases. Indeed, individuals may belong to a network of communities at any one time (Ozturk & Ozcinar, 2013) bringing a *new fluidity* to learning. Wick (2000) notes that collaborative teams might form and dissolve resulting in cross-pollination of ideas. In the community of Case 4, this can be seen around the apps for art activities bringing together the *app smashing* combination of Rollworld, Fragment and BeFunky, which has been independently explored by three academics and has resulted in several related posts and a series of comments on the blog and community.

A benefit of online learning is identified here; learning opportunities are multiplied as the collective learning potential of the group exceeds that of individuals working on their own and can thus lead to accelerated learning (Richardson, 2010; Hung, 2002). Johnson highlights this as a key idea when saying, "The learning that evolved from these communities is collaborative, in which the collaborative knowledge of the community is greater than any individual knowledge" (Johnson, 2001, p34). We would echo that this has been the major learning potential of the use of blogs and communities in our higher education courses.

Case 5: A Digital Community to Support SEN Education
Case 5 focuses on the use of a G+ community to support a student module in Assistive Technology. A key finding was that the presence of a commenting audience facilitates peer-to-peer learning. Case 5 illustrates how students contributed to the online community before, during and after our face-to-face sessions. Luckin et al. (2010) noted that this self-directed involvement by the participants is crucial to the success of the community and suggest that it can integrate formal and non-formal modes of learning by motivating learners to take a self-directed approach to managing their digital learning as they curate resources, reflect upon achievements and offer contributions to others.

Case 5: A G+ community to support a student module in SEN education

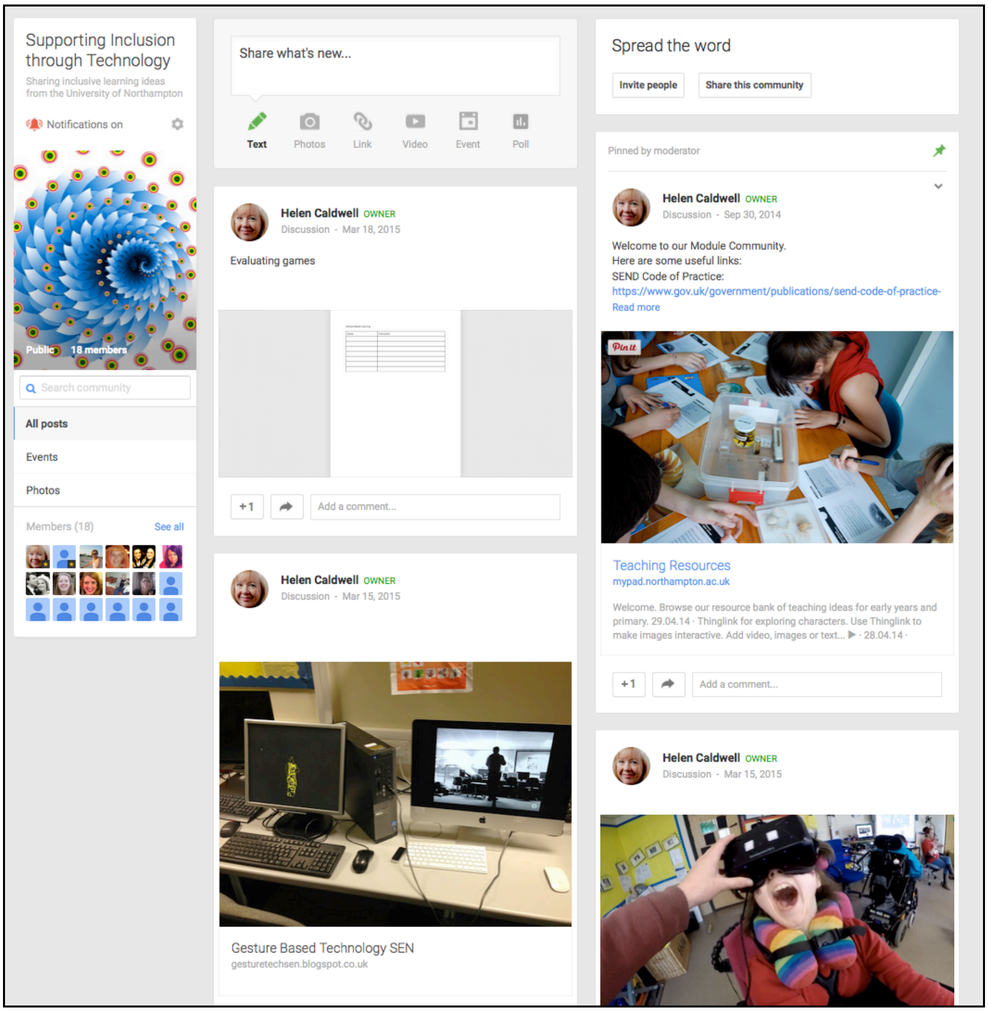


Figure 5. Sample Google+ webpage supporting the assistive technology case study.

Community URL:
https://plus.google.com/u/0/communities/105048363469375309187

Learning intentions:
· To help students explore the complex theme of assistive technology across all areas of need and all ages of users throughout a 24-week module.

· To capture students’ developing ideas and understanding before, during and after sessions.
· To provide a space for reflection and review following a varied range of activities including visits, visiting speakers, practical application of skills and consideration of theory.

Case Overview: This G+ community was designed to provide a hub for students, visiting speakers and course tutors to share their ideas as they explored the theoretical and practical aspects of the complex topic of assistive technology and its application to a diverse range of needs and age groups over the course of a 24 week module.

Learning Outcomes:

- The online environment allowed interactions to occur outside of face-to-face sessions and so increased opportunity for student collaboration.
- The availability of content in different media increased students’ choice over their learning pathways, facilitating self-directed learning, supporting visual and auditory access methods and alternative ways of expressing ideas.
- Student control over the time, pace, place and learning pathways was increased, blurring the boundaries between formal and informal learning.
- The use of the G+ community as a presentation tool and to capture learning during face to face sessions made for a more seamless connection between online and offline learning.

In Case 5, we aimed to create an online classroom where interactions occurred beyond the face-to-face sessions. We were keen to increase the availability of content in different media so that students had choice over their learning pathways and an option to make a more seamless connection between online and offline learning. We sought to capture ideas during sessions using collaborative tools such as Google Docs and Padlet so that there was a strong connection with students’ face-to-face learning. We wanted to support students in trying to express their understanding in different ways by creating media-rich digital artefacts, as well as to offer visual and auditory access to topics. This was so that our students gained first hand experience of how these approaches might benefit the SEN/D users they would need to support in their future practice. We looked to increase student collaboration so that they approached each other for feedback rather than just their tutors. We hoped students would see the value in belonging to a community of practice in their field, in the same way as our higher education staff had identified through our iPads in HE project in Case 4.

Analysing Learning Themes Across Blogs and Communities

Over the course of our five case studies we sought to compare how they represented our five key coding themes, and how this differed across the blogs and G+ communities. Table 2 shows some examples drawn from both tools, colour coded to show examples from blogs and G+ communities.

Table 2

Examples of Analysis of Themes Across Blogs and Communities

Overview of examples across blogs and communities	**Coding themes** **Communities** **Blogs**				
Theoretical coding themes	**Reflective learning (Schon, 1983)**	**Socially shared content (Deng and Yuen, 2013)**	**Learning communities (Yang, 2009)**	**Self-directed learning (Farmer, Yeu and Brooks, 2007)**	**21st century learning practices. (Sharples et al. 2014)**
Case Study 1: A module blog for students in art education http://mypad.northampton.ac.uk/artspecialism2014/	Reflecting on school/ gallery visits	Using blog tags, blogroll and categories to improve navigation Hosting an exhibition	Documenting a social issues exhibition Responding to discussion topics	Making connections between own practice and other artists' work during gallery visits	Pre-session readings and tasks: blended learning Digital making
Case Study 2: Student group blogs to explore learning outside the classroom http://mypad.northampton.ac.uk/parkrangers/	Updates of information Transfer of learning to a new setting or scenario	Creation of resources/ lesson plans for other students Presentation software used	Students reviewing information Delegating roles within a group Working in partnership with museums	Application of LOC principles to teaching Relating practice to theory	Use of external e-tools e.g. thinglink, QR codes Uploading and manipulating own digital content
Case Study 3: A teacher CPD blog and G+ Community http://mypad.northampton.ac.uk/inspire/ https://plus.google.com/u/0/communities/116085017840955911437	Reflecting on the creation of collaborative visual minutes of an event	Posting details of events Sharing Pinterest boards of ideas on session themes	Posting videos of event presentations Suggesting further applications of techniques	Posting digital artefacts created during CPD days Sharing personal explorations of programming techniques after CPD events	Crowd based learning at a TeachMeet event: event-based learning Documenting network meetings and providing pre and post meeting resources: flipped learning Creating animated gifs to demonstrate techniques
Case Study 4: A HE CPD blog and G+ community https://plus.google.com/u/0/communities/110218249780833007111 http://mypad.northampton.ac.uk/appsforinnovation/	Using the blog to write reflective posts after application to practice and identifying improvements and extensions	Making suggestions for extending participants posts on uses of apps across other subjects Suggesting questions to investigate and avenues for further research as part of blog posts	Responding to queries on the community Building shared strategies for re-using recommended apps in different learning contexts Posting in pairs to record discussions Creating screencasts to enable others to replicate app uses	Posting reviews comparing apps Taking recommended apps and applying them to own teaching Writing a blogpost that documents personal exploration of iPad accessibility options and generalising from the experience	Collaborating on a shared Prezi conference presentation Developing app flows combining tools to enhance app capabilities
Case Study 5: A G+ community to support a student module in SEN education https://plus.google.com/u/0/communities/105048363469375309187	Group evaluations of games based learning experiences, Group app reviews Posting reflections and images after visits to settings and visits from practitioners Capturing student debate	Sharing slideshows evaluating acoustic environments around the university Sharing images and evaluations of assistive technologies for the visually impaired	Posting and commenting on personal browsing on session themes Commenting on posts Sharing tips for exploring multisensory equipment with darkrooms	Creating applications for symbol-based learning Uploading reflections on wider browsing Sharing personal reviews of accessibility options across devices	Using collaborative Google Docs to record group discussions Making multimedia digital artefacts Using QR codes

Looking at Table 2, we would suggest that blogs and G+ communities are both useful tools for demonstrating reflective and self-directed learning, generating socially shared content within learning communities, and promoting the use of 21st century practices. When used in combination, as in Cases 3 and 4, they can encourage reflection before, during and after the application of theory to practice, and when further supported by face-to-face events, they can promote continuous learning through active experimentation and sharing within the online community (Kolb, 1984; Schon, 1983).

Looking Forward

Online communities of practice in the form of blogs and communities, such as G+, can provide a fertile ground for social learning. Through our cases we have shown that social network tools such as blogs, Google communities and Twitter allow learners to join an online community where interaction, cooperation, and social engagement continue to prompt learning away from the classroom. Learning in these domains occurs naturally, arising out of social behaviour. Like their physical counterparts, our virtual communities of practice are characterised by a shared common purpose and by the application of ideas to practice. Our belief, supported by our findings to date, suggests that learning can be amplified and accelerated due to the number of opportunities learners have to engage with others who are exploring the same topics in different contexts, bringing together different perspectives and experiences.

We have taken some first steps towards developing a framework for analysing our multimodal blog and community posts. Our next step is to apply this methodology across cases in order to match learning themes and digital tools.

Our use of blogs and communities goes some way towards aligning educational practice with ways in which digital technology is changing disciplines outside schools. This practice has resulted in changing social interactions and online collaborations within the workplace (ETAG, 2015). We acknowledge the need to embed the use of technology in educational contexts through interdisciplinary approaches mixing physical, digital and social learning spaces. We see the need to link the use of technology with authentic real world contexts. And we recognise the potential to use digital technology to support individual learners in a personalised way, amplifying effects by seeking input from the community. The emphasis of our cases has been on active knowledge building using collaborative technologies, moving away from teacher-directed pedagogy to generate a flexible learner-directed approach (Hung, 2002; Markham, 2003). The Pedagogy-Andragogy-Heutagogy (PAH) continuum suggested by Luckin et al. (2010) offers a useful way of considering the redefinition of teacher-learner roles in this context.

Our longer term aim is to document fluid and continuous learning journeys across a combination of locations, times, technologies and social settings in higher education to identify their effect on student learning in an attempt to add further justification to the practices we model. We seek to identify ways in which research on technological learning communities could focus on life transitions, such as school to university or university to workplace, or on personal inquiries to demonstrate the impact of such practices on a learner's development beyond academia. Such a journey might start by using digital tools in a formal setting, continue at home or outdoors and then return to the formal setting to present results in a space that cuts across boundaries and formal structures.

As the ETAG group suggests:
"Digital technology can and should bring joy and engagement: a delight in stellar progress, the exhilaration of unexpected challenges, some playfulness and the reaffirmation of a global audience" (ETAG, 2015, p. 3).

References

Anderson, T., & Dron, J. (2011). Three generations of distance education pedagogy. *The International Review of Research in Open and Distance Learning, 12* (3), 81-97. Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/890/1663

Banks, M. (2007). *Using visual data in qualitative research.* London: Sage.

Bielaczyc, K., & Collins, A. (1999). Learning communities in classrooms: A reconceptualization of educational practice. In C. Reigeluth (Ed.) (2013). *Instructional-design theories and models: A new paradigm of instructional theory* (pp.289-292). Mahwah, NJ: Lawrence Erlbaum Associates.

Brown, S. (2004). Assessment for learning. *Learning and Teaching in Higher Education 1*, 81-89.

Churchill, D. (2009). Educational applications of Web 2.0: Using blogs to support teaching and learning. *British Journal of Educational Technology*, *40*(1), 179–183.

Coppola, N. (1999). Setting the discourse community: tasks and assessment for the new technical communication service course. *Technical Communication Quarterly*, *8* (3), 249–267.

Cowan, J. (2006). *On becoming an innovative university teacher: Reflection in action* (2nd ed.). Berkshire: Open University Press.

Deng, L., & Yuen, A. H. (2011). Towards a framework for educational affordances of blogs. *Computers and Education*, *56*(2), 441-451.

DfE. (2013). *National curriculum in England.* Department for Education. Retrieved from https://www.gov.uk/government/publications/national-curriculum-in-england-primary-curriculum

Downes, S. (2010). What is democracy in education? [Web blog post]. Retrieved from http://halfanhour.blogspot.com/2010/10/what-is-democracy-in-education.html

ETAG. (2015, March). *Education Technology Action Group Report: Our reflections* [pdf]: Available at: http://etag.report [Accessed 27.03.2015].

Farmer, B., Yue, A., & Brooks, C. (2008). Using blogging for higher order learning in large cohort university teaching: A case study. *Australasian Journal of Educational Technology*, *24*(2), 123-136.

Gannon-Leary, P., & Fontainha, E. (2007). Communities of practice and virtual learning communities: Benefits, barriers and success factors. *Barriers and Success Factors. eLearning Papers*, 5.

Gunawardena, C. Hermans, M. Sanchez, D. Richmond, C. Bohley, M., & Tuttle, R. (2009). A theoretical framework for building online communities of practice with social networking tools. *Educational Media International*, *46*.1, 3-16.

Hammond, M. (1998). Learning through online discussion. *Journal of Information Technology for Teacher Education*, *7*(3), 331–346.

Heaton, R. (2014). Moving mindsets: Re-conceptualising the place of visual culture as multi-sensory culture in primary art education. *Canadian Review of Art Education*, *41.1,* 77-96.
Hung, D. (2002). Situated cognition and problem-based learning: Implications for learning and instruction with technology. *Journal of Interactive Learning Research, 13*(4), 393-415.
Johnson, C. M. (2001). A survey of current research on online communities of practice. *The Internet and Higher Education, 4* (1), 45-60.
Kolb, D. (1984). *Experimental learning: Experience as the source of learning and development.* London: Englewood Cliffs.
Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.
Liedka, J. (1999). Linking competitive advantage with communities of practice. *Journal of Management Inquiry*, *8* (1), 5–16.
Luckin, R. Clark, W. Garnett, F. Whitworth, A. Akass, J. Cook, J., ... & Robertson, J. (2010). Learner-generated contexts: A framework to support the effective. *Web 2.0-based e-learning: Applying social informatics for tertiary teaching,* 70.
Markham, T. (2003). *Project based learning handbook: A guide to standards-focused project based learning for middle and high school teachers.* California: Buck Institute for Education.
Mason, R., & Rennie, F. (2008). Social networking as an educational tool. *E-learning and social networking handbook: Resources for higher education*, 1-24.
Oliver, R., & Herrington, J. (2000). Using situated learning as a design strategy for Web-based learning. *Instructional and cognitive impacts of web-based education*, 178-191.
Ozturk, H., & Ozcinar, H. (2013). Learning in multiple communities from the perspective of knowledge capital. *The International Review of Research in Open and Distributed Learning*, *14* (1), 204-221.
Palloff, R., & Pratt, K. (1999). Building learning communities in cyberspace: Effective strategies for the online classroom. San Francisco: Jossey-Bass.
Pink, S. (2012). *Advances in visual methodology.* London: SAGE.
Reupert, A., & Dalgarno, B. (2011). Using online blogs to develop student teachers' behaviour management approaches. *Australian Journal of Teacher Education*, *36*(5), 5.
Richardson, W. (2010). *Blogs, wikis, podcasts and other powerful web tools for classrooms.* Thousand Oaks, CA: Corwin.
Saadatmand, M., & Kumpulainen, K. (2014). Participants' perceptions of learning and networking in connectivist MOOCs. *MERLOT Journal of Online Learning and Teaching*, *10*(1), 16-30.
Schon, D. (1983) *The reflective practitioner.* New York: Basic Books.
Scott, D., & Morrison, M. (2006). *Key ideas in educational research.* London: Continuum.
Sharples, M., Adams, A., Ferguson, R. Gaved, M. McAndrew, P. Rienties, B., & Whitelock, D. (2014). Innovating pedagogy. *Open University Innovation Report, 3*, 1-35.
Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning,*

2(1), 3-10. Retrieved from http://www.itdl.org/Journal/Jan_05/article01.htm

Spry, T. (2001). Performing auto-ethnography: An embodied methodological praxis. *Qualitative Inquiry, 7,*706-732. Retrieved from http://qix.sagepub.com/cgi/content/abstract/7/6/706

Wenger, E. (1998). *Communities of practice.* New York: Cambridge University Press.

Wenger, E. (2011). Communities of practice: A brief introduction. Retrieved from https://scholarsbank.uoregon.edu/xmlui/handle/1794/11736

Wenger, E. McDermott, R. & Snyder, W. (2002). *Cultivating communities of practice*. Boston: Harvard Business School Press.

Wenger, E. White, N. & Smith, J. D. (2009). *Digital habitats: Stewarding technology for communities*. Portland: CPsquare.

Wheeler, S. (2010). Open content, open learning 2.0: Using wikis and blogs in Higher Education. *Changing cultures in higher education*, 103-114.

Wick, C. (2000). Knowledge management and leadership opportunities for technical communicators. *Technical Communication, 47*(4*),* 515–529.

Williams, J. B., & Jacobs, J. (2004). Exploring the use of blogs as learning spaces in the higher education sector. *Australasian Journal of Educational Technology*, *20*(2), 232-247.

Yang, S. H. (2009). Using blogs to enhance critical reflection and community of practice. *Educational Technology and Society*, *12*(2), 11-21.

Author Details

Helen Caldwell
helen.caldwell@northampton.ac.uk

Rebecca Heaton
rebecca.heaton@northampton.ac.uk

Back to Contents page

SOCIAL NETWORKS SUPPORTING HIGHER EDUCATION IN IT AND MANAGEMENT

Petra Poulova, Ivana Simonova
University of Hradec Kralove
Czech Republic

Abstract

The paper presents results of survey focused on social networking; particularly on the role social networks play in higher education. The research question is what social networks are preferred and who their users are. Data were collected from the research sample of 203 students of the University of Hradec Kralove. Three social networks were detected as the most frequently accessed (Facebook, Google+ and LinkedIn) by both male and female users. The collected data resulted in several didactic recommendations on how the potential of social networks can be used towards independent learning on the higher education level in selected subjects.

Introduction

Aristotle characterized man as a "zoon politikon," i.e., a "warm being" in English, as discussed by Elenchuskb (2010). Currently, in the time of i-society and e-society, social networks are one of numerous means of socializing. They join and build relations/connections among people of the same interests and activities; they share them and make connections. Social networks are frequently and widely used mainly for entertainment, business purposes, employment, and for various other areas, including professional ones. In the field of education the social networking principle is reflected in theories of collaborative and cooperative learning (“What are Cooperative and Collaborative Learning?” 2004), connectivism – the learning theory for the digital age (Siemens, 2010) and others.

Currently, hardly any sphere of human activity can do without ICT support. This fact is also reflected in the educational process. Most of higher education institution teaching in the Czech Republic is now online (Simonova, 2010), usually in the form of various e-learning courses. The Faculty of Informatics and Management (FIM) of the University of Hradec Kralove, Czech Republic, runs more than 250 e-courses, which enhance face-to-face or distance education as blended courses or serve as an additional support for students after their regular, face-to-face classes. The question is what their contribution to the field of education is. In other words what social networks are preferred by higher education students and to what purposes so that those frequently accessed ones could be used for educational purposes?

Research Design and Methodology

In May 2014 research was conducted at the Faculty of Informatics and Management, University of Hradec Kralove, Czech Republic, to answer the above questions. Data were collected via online questionnaire within e-learning courses for the subjects Database Systems 2, Management 2, and

English for Specific Purposes 2 and 4 in the Learning Management System (LMS) Blackboard. The questionnaire contained 12 items focusing on the use and preferences of (a) mobile devices (items 1 – 8) and (b) social networks (items 9 – 12).

The use of mobile devices, social networks and other sources was detected in fields listed below:

1. Communication with friends/family
2. Communication relating to study/work
3. Devices used for respondent´s entertainment
4. Sources of information for respondent´s university study
5. Devices used for respondent´s university study
6. Sources of information for further education (reflecting both respondent´s interests and profession)
7. Devices used for further education (relating to both your interests and profession)
8. Devices the respondent owns
9. How often the respondent accesses Facebook
10. How often the respondent accesses LinkedIn
11. How often the respondent accesses Google+
12. Whether/how often the respondent accesses any other social network and which one it is

Respondents provided answers of the multiple-choice type; four choices could have been made in items 1 and 2, all choices could be marked in items 3 – 8, one choice was in items 9 – 12. In this paper data of items 9 – 12 were processed by the method of frequency analysis.

The collected data were processed by the NCSS2007 statistic software and analyzed. In this paper data reflecting the state in social networking were analyzed (items 9 – 12).

Research Sample

The research sample included 203 students (male 60 %; female 40 %) matriculated in the 2013/14 academic year at the University of Hradec Kralove, Faculty of informatics and Management (FIM). This institution offers three-year bachelor study programmes to 2,000 students in several study programmes:

- Applied Informatics (AI3), Financial Management (FM), Tourism Management (MCR), Information Management (IM3).
- Follow-up two-year master study programmes: Applied Informatics (AI2) and Information Management (IM2).

- Doctoral study programme in Knowledge Management (KM) and Applied Informatics (AI).

The research sample was structured as follows (see Figure 1):

- Applied Informatics (AI3+AI2; 83 + 1 students)
- Information Management (IM3+IM2; 44 + 2)
- Financial Management (FM, 21)
- Tourism Management (TM 54)

From the total amount 60 % of respondents attended the full-time study programmes, 40 % part-time programmes.

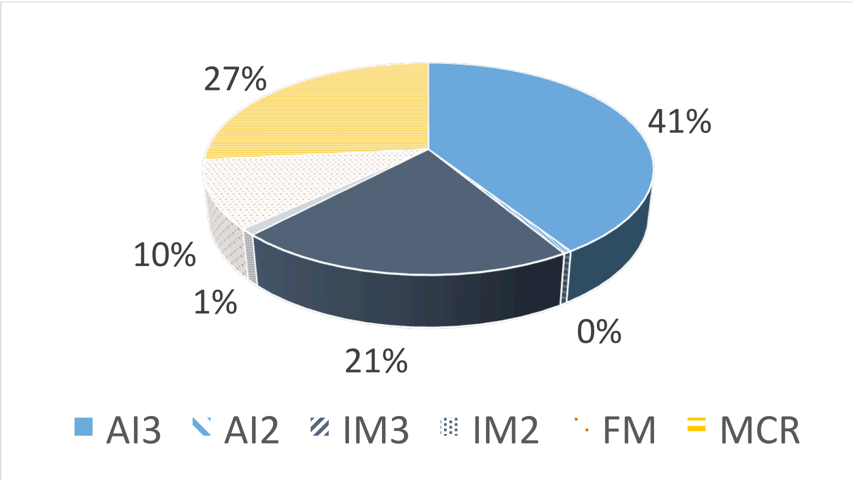


Figure 1. Respondents' fields of study.

Most respondents (70 %) were 20 – 24 years old; one quarter (24 %) of them were older (25 – 29 years old: 13 %; 30 – 39 years old: 11 %). Four respondents were younger than 20 years, 4 % of respondents were above 40 years and 2 % below 20 years.

Research Results

The use of social networks was analyzed on the basis of two criteria:

- Social networks used by respondents
- Visit rate to three most frequently used social networks

The data clearly show that three social networks were most frequently used:

- Facebook, originally Harvard university students' website for communication, data sharing and entertainment, joining common-interest user groups
- Google+, currently the second-largest social networking site in the world after Facebook, serving the same purposes
- LinkedIn, connecting the world's professionals to make them more productive and successful

Table 1

Visit Rate to Selected Social Networks (n)

	Facebook	**Google+**	**Linkedin**
Never	17	84	161
Less frequently	4	50	21
Once per week	2	18	10
2-6 times per week	22	13	9
Every day	86	28	2
All days long	72	9	0

Table 1 clearly shows the Facebook, Google+ and LinkedIn were the most frequently used social networks by the FIM respondents, which reflects results collected by numerous authors around the world. See “Top 15 most popular social networking sites” (2014), Gomes, (2013), and Skyrms and Pemantle, (2004).

Reflecting the Facebook visit rate, more than one third of respondents (36%) stated they were logged into Facebook all day long, and another group of 42% accessed Facebook every day. In total, Facebook was used daily by four fifths of respondents, mainly for communication with friends as respondents stated in comments to this item. This high communication potential of Facebook could be used for education purposes within higher education.

Of the three most frequently used social networks LinkedIn was the least accessed by FIM students. Professionals of all fields and interests, personnel managers, and administrative staff frequently use this social network, but it is fully ignored by IT students within their study (see Figure 3). Nearly four fifths of respondents (79 %) did not use LinkedIn at all; another group of 10% used this social network rarely – they accessed it a maximum of several times per month; 5 % of FIM students stated they seldom visited (once per week as a maximum); and only 6 % of students declared they used LinkedIn more frequently. These data clearly show the position of LinkedIn for education is not strong, i.e., the network will not be implemented into the designed system of instruction until the position of LinkedIn changes – the access frequency (access rate) rises.

A similar situation was detected with Google+. The respondents have not been used to accessing this social network very frequently, which means currently it is not efficient to take advantage of it and explore it for the purpose/support of higher education. More than two fifths of FIM students (42 %) did not use Google+ at all (see Figure 6), one quarter of them (25 %) declared access several times per month, and 9 % used it once per week. Only less than one quarter of respondents (24 %) accessed Google+ more frequently than once per week.

But, despite the fact that the access rate was very low, FIM students have had accounts, both in Google+ and LinkedIn. The reason might be that as IT professionals they are interested in new software, so they created accounts, but in practice the Facebook environment satisfies their social requirements, and they do not feel like accessing other networks frequently and regularly.

These data were also analyzed from the view of gender (Figure 2) and study programmes (Figure 3). While on Facebook and Google+ the structure of users (male/female) is rather similar, LinkedIn differs substantially – nearly 80 % of male “users” had never visited this social network.

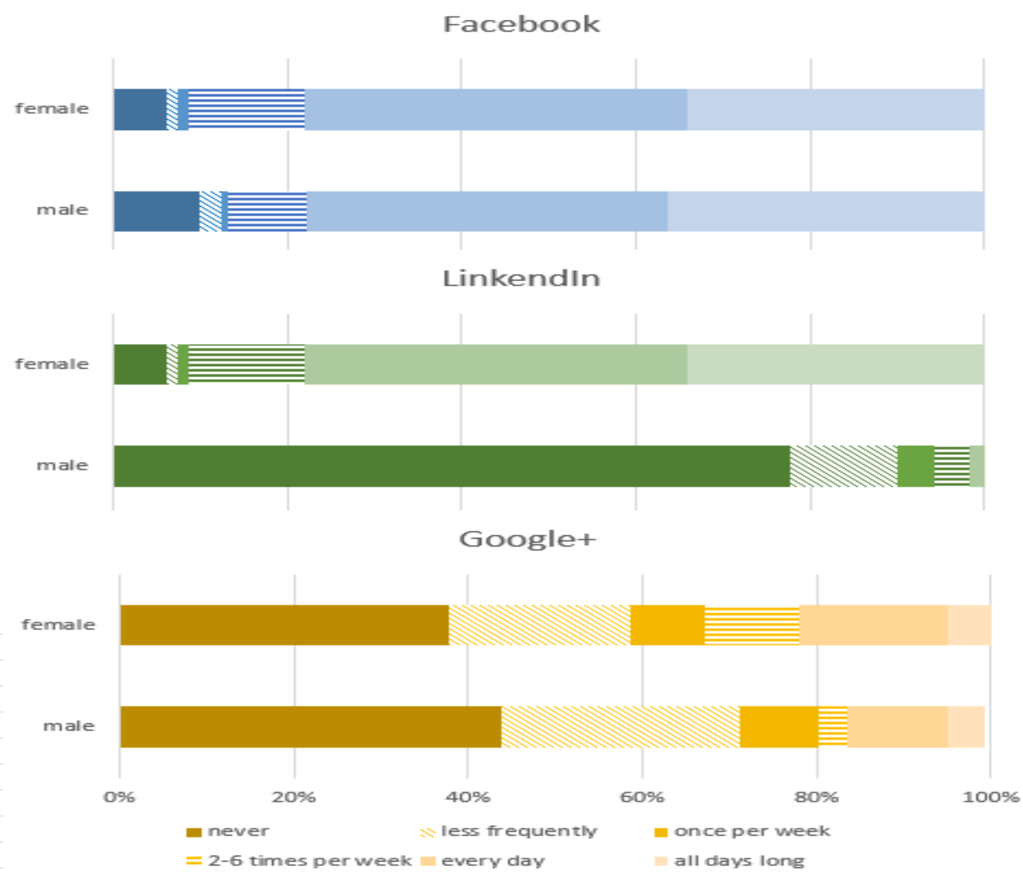


Figure 2. Structure of male/female users of selected social networks.

Taking the criterion of main study programmes taught at FIM into consideration, Facebook is the leader with students in all three study programmes; the visit rate of Google+ is of medium extent; and, as expected, LinkedIn is rarely visited, as displayed in Figure 3.

Respondents also declared the use of other social networks (Figure 4). The access rate is very low, except that Twitter (free microblogging service) reached approximately 9 % (19 respondents).

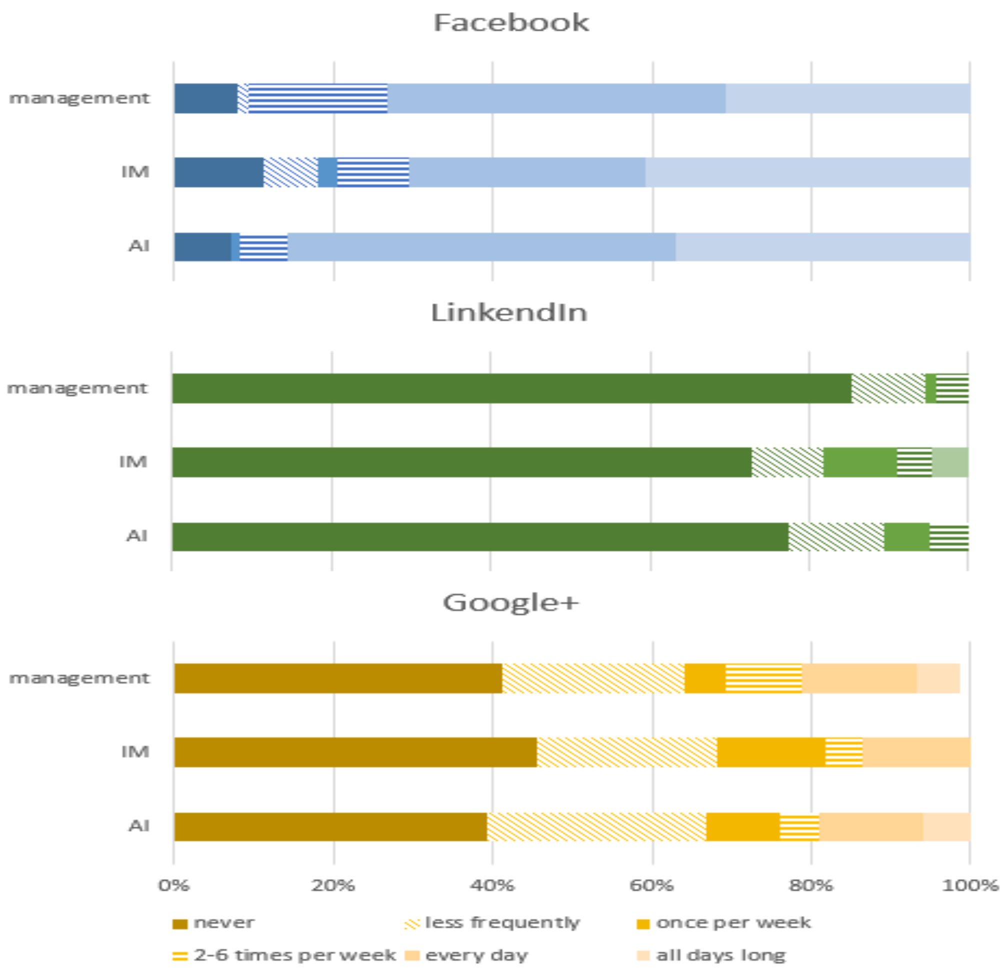


Figure 3. Structure of various study programmes of users on selected social networks.

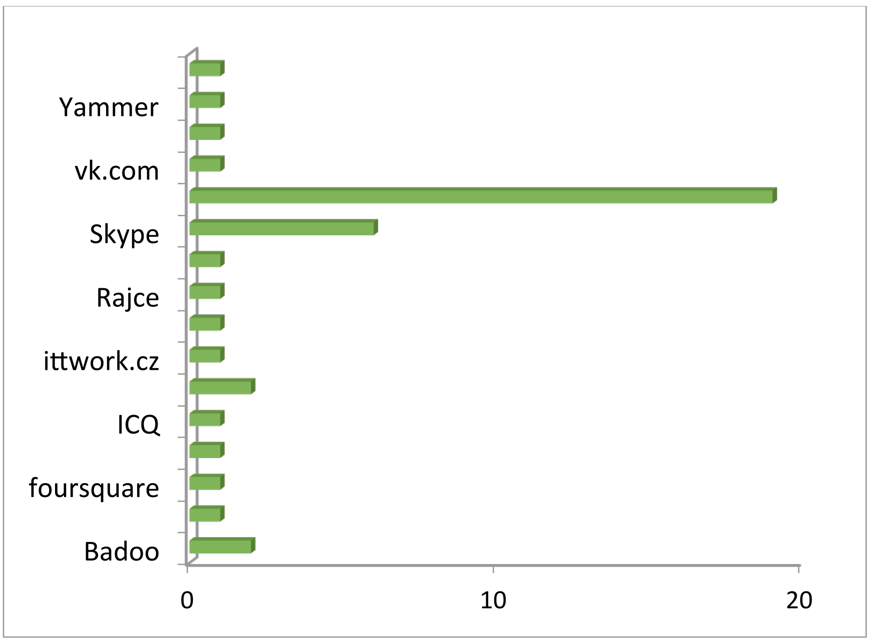


Figure 4. The exploitation of other social networks by FIM students (n).

The social network services are run on the latest mobile devices (tablets, smartphones, PDAs, etc.), which most respondents own and widely use for private purposes, i.e., communication with friends/family and entertainment (see above – criteria 1, 3) and slightly for university study and relating communication (see above – criteria 4, 2).

Discussion and Conclusions

It is widely accepted that the access rate to social networks for private purposes (communication with friends, family members, interest-related topics) is rather high. To take advantage of this fact for education, strong didactic efforts targeting learners´ motivation and support should be applied to increase the real use of social networks for education purposes. Moreover, in practice access is made through mobile devices, which provide different advantages (low weight, small size) and disadvantages (small screen) to present the educational content. This fact means study materials, tests, communication and other tools enhancing the process of instruction must be provided to the social networks' users in such formats that are clearly displayed on these small devices, e.g., long full-text materials to be shortened, animations and video-sequences to be considered from the point of technical, technological and size features, and simple presentations with bulleted texts preferred, as well as tests in multiple-choice, true/false, yes/no formats, etc. The social networking phenomenon thus reflects *m-learning* didactic principles, being considered an inseparable part of it.

The technical and technological development being very fast in recent years, the field of education should benefit from the learners' interest in the latest mobile devices, and incorporate this phenomenon into the process of instruction. As with e-learning a decade ago, when *e-learning didactics* was strongly required for efficient use of PC and the Internet in education, *m-learning didactics* is necessary in this phase of the social networks/mobile devices implementation process.

Acknowledgement

This paper is supported by the SPEV project N. 2108.

References

What are cooperative and collaborative learning? (2004). *Concept to Classroom*. Retrieved from http://www.thirteen.org/edonline/concept2class/coopcollab

Top 15 most popular social networking sites. (2015, June), *eBizMBA.* Retrieved June 4, 2015 from http://www.ebizmba.com/articles/social-networking-websites.

Elenchuskb. (2010). Please.. someone define "zoon politikon" for me?!? Retrieved April 2, 2015 from https://answers.yahoo.com/question/index?qid=20110303065506AANdmFI.

Frydrychova Klimova, B., & Poulova, P. (2012, July). Reflection on the development of eLearning in the Czech Republic. *Proceedings of the 16th WSEAS International Conference on Recent Researches in Communications and Computers* (pp. 433-437). Corfu, Greece.

Gomes, W. [William Gomes] (2013, May 29). *Website metrics within Google analytics 2013* (video file). Retrieved from https://www.youtube.com/watch?v=-m7ZPgOB8Y8.

Siemens, G. (2010). Description of connectivism. *Connectivism*. Retrieved April, 20, 2015 from http://www.connectivism.ca/about.html

Simonova, I. (2010). On the process of ICT implementation in the tertiary education reflected in the eLearning conferences and competitions at the FIM UHK. In I. Semradova (Ed.), *Reflections on the exploitation of a virtual study environment* (pp. 26-62). Hradec Kralove, Czech Republic: MILOS VOGNAR Publishing House.

Skyrms, B,. & Pemantle, R. (2004). A dynamic model of social network formation. Retrieved March 3, 2015 from http://arxiv.org/pdf/math.PR/0404101.pdf

Author Details

Petra Poulova,
petra.poulova@uhk.cz

Ivana Simonova
ivana.simonova@uhk.cz

Back to Contents page

CREATING ENVIRONMENTALLY ORIENTED ONLINE LEARNING COMMUNITIES: THE CASE OF ELEMENTARY SCHOOLS IN GREECE

Konstantinos Karampelas
2nd Model Experimental Primary School of Rhodes

Sarantis Karvounidis
1st Model Experimental Primary School of Rhodes

Greece

Abstract

This study examines the possibility of an Online Learning Community (OLC) of primary school classes to promote environmental literacy. The community was composed of four primary school classes in Greece, on the E-twinning platform. The community members would carry out common activities focusing on constructing knowledge on environmental concepts and issues and developing skills required to approach problem solving on environmental challenges. Through a qualitative approach, based on the activity theory, it was concluded that to an extent environmental literacy was promoted, learners respected the potential of the OLC. However barriers emerged.

Introduction

The expansion of the Internet and Information and Communication Technologies (ICT) has caused drastic changes in foundational aspects, functions and concepts of current societies. Communication, ideas exchange, socialization and learning have been exposed to new norms. A concept that is being renegotiated is the community. The definition of a community nowadays emphasizes mostly in common identity, characteristics, shared values and practices of its members. The region factor has less significance now. Online communities are gaining grounds, as groups of people with common believes, who work together towards common aims in the context of the World Wide Web and the opportunities it offers for communication and cooperation (Pallof & Pratt, 2007).

Education is under reform too. Modern technology has introduced new concepts, new practices and new fields in learning. An example is the development distant education forms, through which people and schools from different regions work together in order to fulfill learning purposes. Information can now be disseminated across different regions, opening new opportunities as well as demands in learning, in terms of subject, approach and pedagogy. Pupils have access to new kinds of resources. They are both assisted and expected to learn through new ways unknown before.

Thanks to the rapid development of ICT, wide range of new possibilities has emerged in education and other kinds of services. Within the context of the new learning environments, a new kind of communities emerges. This is the

Online Learning Communities. Thanks to OLC there is room for cooperation among schools, exchange of practices and ideas. If this is to be achieved though, community members, including pupils, need to adopt new roles and understand the benefits OLC offer in contrast to traditional classroom restricted practices (Pallof & Pratt, 2007).

However, research shows that this is not easily applied in classrooms. There are challenges that emerge generally when implementing new practice as well as particularly in learning communities (Fullan, 2007; Pallof & Pratt, 2007).

Within this context, this study was planned. Its' main purpose is to examine the benefits and risks of developing OLC in order to promote learning. More specifically, the subject of the OLC was environmental education.

Online Learning Communities

Many theories have been developed concerning about OLCs (Lock, 2002).

Developing Online Learning Communities

When establishing an online community, it is important to identify its' basic mission and goal. These values have to be shared by all members. These are guidelines for all activities that will be completed within it. They have to be nurtured, justified and spread, so that all members acknowledge, understand, appreciate and respect the role of this OLC, which may otherwise lack sustainability (Lock, 2002; Fullan, 2007). OLC survival depends on communication, collaboration, interaction, participation, instructional delivery and instructional context. For that reason, it is necessary to focus on student-centered practices (Lock, 2002).

OLC gives room for new practices that can familiarize pupils with modern means of communication, as current society demands. Moreover, pupils can meet new people, new places, new cultures and new ideas. Through this, pupils engage in learning contexts outside classrooms, which helps broadening conceptual knowledge and skills. Therefore, pupils and teachers need to be open to new ideas, collaborate and share information. They should be familiar with means of online communication and interaction. They should be self-motivated and self-disciplined. They should understand that learning could take place outside traditional classrooms and teaching schemes. Finally, they should have access to Internet and means of ICT (Pallof & Pratt, 2007).

OLC in Environmental Education

The growing concern about environmental issues over the last decades has had a great impact on education. Environmental Education emphasizes on investigating the environment holistically through cross-disciplinary and problem-solving approaches. Primary schools pupils need to understand the holistic view of the environment, develop critical thinking skills to identify environmental risks and concerns, look for resources, express ideas, plan and evaluate plans. The ultimate goal of environmental education is environmental literacy, which Roth (1992, p. 17) has defined as 'the capacity to perceive and interpret the relative health of environmental systems and take the appropriate actions to maintain, restore and improve the health of those systems'. This definition emphasizes on problem solving (Roth, 1992, UNESCO, 2014).

An OLC can provide a social context for environmental learning. This way, learning moves beyond traditional teaching and addresses to environmental topics that call for action. Learners will be members of a large group, aiming to work out real-life environmental problems. This assists knowledge construction and helps learners adopt environmentally friendly attitudes. So, OLC can be very useful in Environmental Education (Robelia, Greenhow, & Burton,, 2011). Environmental Education can assist OLC creation too. According to Heimrich and Ardoin (2008), it can be a context for knowledge, attitudes, skills that form behaviors and behavioral change expected. These help the establishment and function of and OLC (Pallof & Pratt, 2007; Robelia et al., 2011).

Challenges of implementing OLC

As with any new learning practice, when implementing OLC in schools, success is not guaranteed. The school context works under certain rules, functions, ideas and structures, which form the school culture. If the new practice does not fit in this culture, it may not be effective (Fullan, 2007).

In terms of ideas, as already mentioned, teachers and learners need to share the belief and vision that the OLC helps learning. They should also have the needed knowledge to participate. This knowledge could be about computers and the World Wide Web, or it may be linked other kinds of skills, such as interpersonal (Shrivastava, 1999).

The school context should assist too. Innovative learning practices may face challenges deriving from the structures of the school or the education system. These could be legal or bureaucratic. Another challenge could be the lack of the necessary equipment and tools in schools. Time can also be restricting, since usually, the new duties that teachers undertake when applying learning practices, such as management of OLC, are being added to previous ones.

All these issues are likely to prevent an OLC from working effectively and achieving learning goals (Shrivastava, 1999; Fullan, 2007)

Evaluating OLC

The OLC serves as context to learn, change by acting, use means and transform aims into outcomes. Within it people engage in learning activities. An approach to evaluating OLC is activity theory (Hew & Chueng, 2003). Activity theory was introduced by Engestrom (1987), as a cross-disciplinary framework to examine learning processes, through the interaction of their components: tools, subject, rules, community, roles, object or outcome. Activity theory helps teachers evaluate an OLC holistically. The subject would be a community member, such as a learner or educator. The subject will use tools, follow rules set by a context -community, which has charged the subject with roles, in order to construct knowledge, develop skills, which are the desired object or the outcome. The relationships between these processes can be complicated. Evaluation through the activity theory focuses on selecting an appropriate triad of processes (Engestrom, 1987; Hew & Cheung, 2003).

In the light of the aim of this study, the most appropriate triad is the subject-object-community, which according to research can give insights about participants, the way they interact, the knowledge and skills they gain, as well as the compatibility of the OLC functions with the community-school context.

Collaboration and interaction is evaluated through the messages that participants exchange or upload and their content (Henri, 1992).

Knowledge construction is approached through different stages. The first stage includes exchange of information and ideas. The second includes evaluation of this information and testing for inconsistencies. The third includes negotiation of meanings. The fourth includes proposition for modification and re-statement of information. The fifth and final stage includes the construction of knowledge (Kannuka & Anderson, 1998; Hew & Cheung, 2003).

Figure 1: The processes of an activity

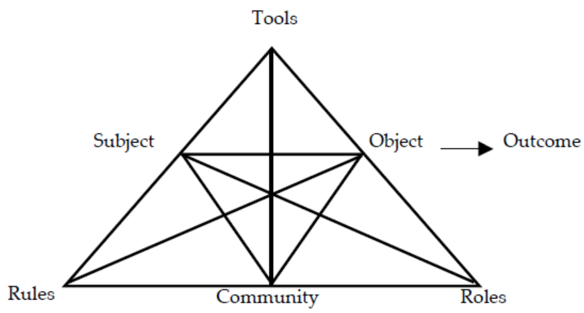


Figure 1. The processes of an activity.
(Source: Engestrom, 1987, p. 78).

Skills are also approached in five different stages. The first includes simple exchange of information. The second includes analysis and connection to or identification of a greater problem, issue or challenge. The third includes interference, deduction and reduction. The fourth includes judgments and opinions about comments and any interference made to them. Finally the fifth stage includes suggestion of solutions or action plans (Hew & Cheung, 2003).

The Project

There are many portals to build OLC focused on environmental education in primary schools. Selection requires attention (Pallof & Pratt, 2007).

Selecting the Appropriate Platform to Form the OLC: E-twinning

For the particular research, the E-twinning platform, also known as the *community for schools in Europe* was selected (E-Twinning, 2014). It aims to bring different schools and pupils together. Since its establishment in 2005, the portal has accommodated more than 230.000 projects from more than 5.400 schools, across Europe. E twinning was selected due to its popularity and in European Primary Schools, which make it accessible and attractive.

Establishing a community in e-twinning follows a specific procedure. Teachers, first have to register. Afterwards, they have to fill in a form with the aims of the project, its' rational, indicative timetable, the activities it involves. After the approval by the portal managing group, it is published in the portal, inviting other teachers and schools to express interest. As soon as teachers are found, the project starts. The teachers along with the pupils form the OLC, which is managed by the teachers who founded it. During the project, all groups carry out common activities and upload to the platform evidence, projects, comments and findings (E-Twinning, 2014).

The OLC of the Project

The project of the OLC, called 'Planet sending SOS', aimed to promote environmental literacy. It was designed by one school. Three other teachers responded. The OLC included four primary school classes, of totally 82 pupils, aged 10-12, and four teachers from schools of different islands of Greece. All teachers had access to the Internet in their classroom. All schools had a computer lab. Schools followed the legal requirements of the School Management and Function Act (1998) to justify the projects' importance, pedagogical potential and assurance of no risk for children. Overall, all teachers and schools had the same basic means to participate in the OLC.

These activities were common for all schools. All activities were done during school hours. It was thought to be more convenient that way. Usually, teachers and pupils would devote three to five hours every week for the OLC projects. Interaction was mostly asynchronous. However, there were some synchronous activities, through videoconferencing.

Pupils would first introduce themselves. Afterwards, groups of members would gather information on the environmental wealth of their region, and upload it in the platform. Through projects pupils should learn about concepts such as 'ecosystem', 'flora', 'fauna', 'diversity', 'pollution', 'food chains', 'food webs' and 'recycling'. They would be asked to include them in comments and messages. Later on, they would carry out and upload new projects about environmental challenges and issues of each region. This would include description, identification of causes, impacts and suggested solutions. Comments and ideas about these would follow, in order to construct clear understanding about these problems, the uniqueness of each environmental region, the necessity of its' preservation and actions needed. Through these activities, learners would approach environmental literacy (Henri, 1992; Heimrich & Ardoin, 2008; Robelia et al., 2011; UNESCO, 2014).

Forming Research Questions

The study aims to evaluate the effectiveness of an OLC focusing on promoting environmental literacy in primary school pupils. To define effectiveness, it is important to identify if learners became more familiar with concepts relevant to the environment, environmental risks and challenges (Roth, 1992; Robelia et al., 2011; UNESCO, 2014). Learners must also demonstrate they have developed skills, as critical thinking and problem-solving (Hew & Cheung, 2003). There are five stage scales, which precise acquisition of knowledge (Heimirich & Ardoin, 2008) and skills (Henri, 1992).

Additionally, it should be identified, if learners engaged themselves in the roles that an OLC requires. Learners should be motivated and disciplined to the activities carried out within the OLC and realize its benefits and learning goal. Learners may not understand the pedagogical role of the OLC and treat it as an amusement activity. This may end in no discipline and commitment. Through their work they have to prove that they know that they are members of a group, with a specific goal, which in this case is to identify and negotiate environmental issues (Henri, 1992; Pallof & Pratt, 2007).

Research has shown that such interventions might face challenges. Challenges may arise because the school equipment may not be sufficient, or because generally the school climate and context may not be assistive. In this case, the benefits of the OLC may be jeopardized (Lock, 2002; Pallof & Pratt, 2007).

The activity theory approach was selected to give insights to the activity of the OLC emphasizing on three processes-factors: object-goals, subject learners and the community-school context (Engestrom, 1987; Hew & Cheung, 2003).

The evaluation is negotiated through the following three research questions:

1. Did the learners become environmentally literate? (Objects factor)
2. Did the learners understand the importance of OLC? (Subject factor)
3. Did challenges arise? (Community-context factor)

Methodology

Selection of the appropriate methodology depends highly on its focus and the aims. This study is of qualitative nature. It aims to examine human behaviors in relation to a specific context and not to use data to test a specific hypothesis, as the quantitative research does (Bell, 2001; Cohen, Manion, & Morrison, 2011).

Data for research may come from interviews, questionnaires, observation, biographies or any kind of notes. For the particular project, data may derive from interviews, observations and pieces of work, projects, texts or messages produced by the pupils (Bell, 2001).

Observations focused on teaching interventions and videoconferencing that took place, paying attention on pupils' comments on environmental concepts, ideas, messages, their ideas about the OLC and its' benefits.

Data to answer the first research question came from observations, pupils projects and from interviews in replies to questions such as: *What kind of environmental problems are there? What kind of solutions do you suggest?*, which reflect knowledge, skills and environmental literacy achieved

(Heimrich & Ardoin, 2008; Hew & Cheung, 2003; UNESCO, 2014). Through these it is possible to identify the level of knowledge and skills construction achieved, which reveal significant evidence about environmental literacy (Kannuka & Anderson, 1998; Hew & Cheung, 2003).

Data to answer the second research question, came from observation, from pupils projects or messages, which will reveal about communication (Henri, 1992) and from interviews in replies to questions, such as: W*hat would you like to do more in an e-twinning program? What do you think pupils should do when they participate in such a program?*, which reflect *learners' perception* about OLC (Shirastava, 1999; Lock, 2002; Pallof & Pratt, 2007).

To answer the third research question, data came mostly from observations, which give insights about the progress of OLC in relation to school functions and structure (School Management and Function Act, 1998; Fullan, 2007).

Findings

Findings were overall encouraging. However, there were concerning points.

1st Question: "Did the Learners Become Environmentally Literate?"

As far as the first research question is concerned, data that came from interviews, observations and pupils' projects, can justify that pupils actually learnt more about the environment, its' characteristics, and issues.

Firstly, pupils showed that they have enriched their vocabulary of concepts about environmental topics. By the end of the course they have well learned to use terms, unknown or unclear to them before, such as *ecosystem, diversity, pollution,* and *recycling.* These new terms were existent in pupils' messages and projects. Secondly, they were able to search for resources about a particular environment, or a specific problem. However, learners struggled analyzing these resources and linking them to the concepts they learned. For example, some learners when reading about *risks of the environmental wealth*, they did not easily understand the exact meaning. This prevented partly modification of information and construction of further complex environmental knowledge (Henri, 1992; Roth, 1992; Heimrich & Ardoin, 2008; Robelia et al., 2011; UNESCO, 2014).

Apart from knowledge, learners showed that they improved their skills. There was improvement in exchanging information and ideas, as well as locating to a greater problem. Improvement was not so impressive though in deduction. As a result, judgments, comments and suggestions for plans frequently needed revision, as they were losing focus (Henri, 1992; Hew & Cheung, 2003).

So learners became more environmentally literate, as they learnt new concepts and developed skills but there is room for improvement (UNESCO, 2014). With regards to the activity theory, approach the object factor of the activity seems to be satisfied to an extent (Engestrom, 1987).

2nd Question: "Did the Learners Understand the Importance Of OLC?"
Findings have showed that learners understood the importance and significance of the OLC they were involved, to a large extent.

Firstly, learners disciplined to the tasks that had to be done. Any duties and assignments set to them were completed satisfactorily and in time. Messages were uploaded frequently, which shows healthy communication (Henry, 1992). It was very common for learners to show enthusiasm when any kind of assignment was set for them. This kind of commitment is important for the proper function of the OLC (Kannuka & Anderson, 1998; Shirastava, 1999; Lock, 2002; Hew & Cheung, 2003).

Secondly, learners showed that they understood that the OLC can help them socialize with other learners of different places. Many of them expressed, '"In it [the e-twining program] ,we met other children and learnt about the place where they live",justifying that they can see benefits (Pallof & Pratt, 2007).

However, it is unclear from the learners' sayings that all of them had understood the learning goals. Approximately half of the learners mentioned that the program can help them learn about environment and environmental concerns. The rest did not seem to have understood that, and when answering what the role of the community was, there were replies such as "amusing." This shows lack of understanding of the learning potential of the OLC and of the fact that learning can happen outside the traditional class (Lock, 2002; Fullan, 2007).

So the importance of the OLC and participation in it was understood by the learners, even partly. With regards to the activity theory approach, the subject of the activity seems to be work properly to an extent too (Engestrom, 1987).

3rd Question: "Did Challenges Arise?"
As observations and interviews of the pupils have shown, even though the study was planned and carried out effectively, challenges were not missing.

The first, and perhaps the most important, challenge was relevant to the technical infrastructure of the schools. Each school had a computer lab with a reasonable number of units able to accommodate the students. However, in all schools, frequently there were plenty of activities that depended on the lab. Therefore, many times, the tasks for the community had to be carried out in the classroom, where there was only one computer. This reduced the participation of learners in the online processes and the interaction (Lock, 2002).

There were also bureaucratic barriers to overcome. Since learners were young, there was a series of procedures done to justify the pedagogical role of this community and the fact that there is no risk for the children. This had to be done for the project generally, and for individual teaching interventions too, such as those involving teleconferencing. Certainly, many of these issues were dealt through careful planning, which took into consideration the legal context in which the schools work. Still this was demanding and time consuming.

Lastly, there were time restraints, as teachers and pupils had other duties too. The legal and functional context, of the School Function and Management Act (1998) may allow the function of OLCs but do not fully support them.

In short, the school climate caused challenges. It is encouraging that there was no problem from the side of the teachers to respond to the needs of the OLC and motivate learners to participate (Shirastava, 1999; Fullan, 2007).

Overall, with regards to the activity theory approach, the community-context factor of the activity seems to be partially assisting (Engestrom, 1987).

Conclusions

This research aimed to evaluate the potential of an OLC to promote environmental literacy to primary school learners. It composed of Greek primary school classes, which carried out common projects aiming to construct knowledge about the environment and develop skills towards environmental problem solving. These are basic dimensions of environmental literacy (UNESCO, 2014). OLC are known to assist in these aims (Pallof & Pratt, 2007). The e-Twinning network was selected as the most appropriate platform for that purpose (E-twinning, 2014).

Research, though, has shown that implementation of new learning patterns does not automatically guarantee positive results. In relation to that, the OLCs are effective under specific conditions. Learners' reactions, as well as the school climate may bring on challenges (Lock, 1992; Fullan, 2007).

On the basis of the above, this qualitative research was planned. Through the approach of the activity theory (Engestrom, 1987), three research questions were formed: (a) Did the learners become environmentally literate? (b)) Did the learners understand the importance of OLC? (c)) Did challenges arise?

Data were gathered through interviews, observations and pupils' messages and projects. The findings, with regards to the activity theory approach, show that the goals-objects were attained to an extent. The learners-subjects have responded effectively in general. However, the assistance offered by wider school context-community, was limited in some cases (Engestrom, 1987; Hew & Cheung, 2003). In conclusion, the OLC was able to promote environmental literacy to primary school pupils. Certainly, there is room for improvement.

These findings agree with the ones of relevant literature (Robelia et al., 2011). Before generalizing these conclusions though, it is important to point out specific limitations. This study focused on one case of an OLC, composed by four classes of Greek schools, for one year. Generalizing would require comparison with the findings of other similar studies (Cohen, Manion, & Morrison, 2011).

References

Bell, J. (2001). *Doing your research project* (3rd ed.). Buckingham, Philadelphia: Open University.

Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th ed.). London: Routledge / Falmer.

E-Twinning, (January 2014). *The community of teachers for Europe. General Guidelines*. Retrieved 2 February 2015 from http://www.etwinning.net/

Engestrom, Y. (1987). *Learning by understanding: An activity theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.

Henri, F. (1992). Computer conferencing and content analysis. In A.R. Kaye (Ed.), *Collaborative learning through computer conferencing: The Najaden papers* (pp.117-136). Berlin: Springer-Verlag.

Hew, K. F., & Cheung, W. S., (2003). Models to evaluate online learning communities in asynchronous discussion forums. *Australian Journal of Educational Technology*, *19*(3), 241-259.

Kanuka, H., & Anderson, T. (1998). On-line social interchange, discord and knowledge construction. *Journal of Distance Education*, *13*(1), 57-74.

Lock, J., (2002). Laying the groundwork for the development of learning communities within online courses. *Quarterly Review of Distance Education*, *3*(4), 295-308.

Pallof, R., & Pratt, K. (2007). *Building online learning communities: Effective strategies for the virtual classroom*. San Francisco: Jossey Bass.

Robelia, B. A., Greenhow, C., & Burton, L., (2011) Environmental learning in online social networks: Adopting environmentally responsible behaviors, *Environmental Education Research*, *17*(4), 553-575.

Roth, C. E. (1992). *Environmental literacy: Its roots, evolution, and directions in the 1990s*. Columbus, OH: ERIC Clearinghouse on Science, Mathematics and Environmental Education.

Shrivastava, P., (1999). Management classes as online learning communities. *Journal of Management Education*, *23*(6), 691-702.

School Management and Function Act (1998), Presidential Charter 201/1998. Greek Ministry of Education and Religious Affairs.

UNESCO, (2014). *Shaping the future we want. UN Decade of Education for Sustainable Development* (2005-2014). Paris: United Nations Educational, Scientific and Cultural Organization.

Konstantinos Karampelas,
kkarmpelas@aegean.gr

Sarantis Karvounidis,
skavrvounidis@gmail.com

Back to Contents page

CHILDREN'S LITERATURE AND READING IN AN ERA OF DEVELOPING TECHNOLOGY

Roseland Da'eem
The Arab Academic College for Education in Israel- Haifa
Israel

Abstract

This paper explores the children's literature in an era of developing technology. The research relies on several studies of children's literature and reading development since 2005. Four main dilemmas are addressed: the language of literature, the contents of the literature, the production of the books, and the act of reading. Creating good literature for print or for the media is a great responsibility. Our aspiration as authors, parents, educators, and change agents is to present the child with an artistic story that includes rich language, connotations and style, worldly knowledge, art, an aesthetic experience, and an emotional and pleasurable experience.

Introduction

This paper relies on my many years of experience in teaching children's literature to the future educators and teachers, who work with early childhood through to those working with adolescents in high schools. This experience is supplemented by my academic knowledge, my experience concerning the development of literature for children in Israel and other countries in recent decades, including works in Arabic from Israel and from the Arab world, and practical guidance of the publication of children's books in Arabic, both the original source literature and also translated works.

The paper also relies on several research studies in which I participated over the last decade, in the field of children's literature and development of reading. The presentation describes these studies and their themes, in an attempt to trace the more positive and less positive aspects of influence of computerization and technology on the reading of literature among school students. In this presentation, I will relate to four main dilemmas:

- The language of the literature and the Arabic language
- The contents
- The production of the books
- The act of reading.

I would like to ignite sparks in the minds of researchers, authors and educators in an era challenged by 21st century technology and many dilemmas. And so, as I present the dilemmas, I shall also discuss the challenges posed by this rapid technological development.

My presentation will integrate consideration of literature (Da'eem, 2004) with the consideration of technology in general (Mansour, 2000; Mansour, 2001), because materials that were once presented with audiovisual means now use computerization and sophisticated communications, whose development seems unlimited or infinite.

Many reviews (The Galilee Society, 2004, 2007, 2010) of the use of communication technology have shown that there has been a significant increase in the amount of use and type of means, from traditional means such as radio and television through to smartphones and post-modernist communications and including all that lies between, among different populations, including school students. Each technology is characterized by its own advantages and disadvantages. This phenomenon is on the upsurge and will only continue to rise.

Two examples that I have experienced as a teacher and educator highlight changes in my instruction methods as a result of developing technologies. In 1990, I taught Arabic language and literature in a vocational high school. One of the compositions that I asked my students to write then was “The world in the year 2000.” The subjects and ideas that emerged then – when the technology that we spoke about had only reached television, video and the inception of the era of the computer - swept the students forwards to worlds that seemed different and strange. Today, if I had to ask my students to write a composition, I would not approach such a subject.

This also happened when I taught different courses in teaching and education at a college. At the beginning of the 1990s I was developing a course that would relate to the question: who is the 21st century teacher? Or, what is the teacher’s role in the technological era? These are questions that I would not raise today, because changes occur from one group to another and from one day to another, which the students know about before I do.

Before I begin to discuss my topic, I think it appropriate to note that the use of the male pronoun throughout this presentation refers here to both sexes.

The presentation will relate to children’s literature and its reading in an age of technological development, so before presenting the dilemmas I think it fitting to clarify: why children’s literature?

Literature is an art form that stimulates an aesthetic experience. Its medium is the spoken and literary word, both illustrated and written. Children’s literature is literature that is appropriate in its substance, contents, language style, and external format to the world perception and intellectual and linguistic abilities of children (Abu-Alsa'd, 1994).

Literature transmits culture and social messages; it constitutes a way of attaining knowledge. Literature is also a tool to broaden vocabulary, to respond to mental needs, and to present a small world before the child. Literature fosters the child’s expressive ability, broadens horizons to understand things in a different way, allows recognition of other people’s cultures, improves the child’s ability to read literature critically, helps to develop imagination, steers the child onto the path to creativity and contributes to personality shaping and the acquisition of values.

First Dilemma: Language –The Medium of Literature

In addition to acting as a tool for communication, expression and thinking, language sustains cultures and values. It is therefore an important element in the shaping of a child's personal, social and national identity.

I would like to adopt the definition proposed by the British poet, philosopher, and critic Samuel Taylor Coleridge (1772-1834) (Coleridge, 1984, p. 7-8) [1], who claimed that literature consists of "the best words in the best order." This definition is rooted in Arab culture in the work of the critic Abd al-Qahir al-Jurjani (1009-1078), a philosopher of Persian origin who lived during the golden period of Arab culture, and was considered the founder of the theory of rhetoric in the Arabic language in his book *The Secrets of Rhetoric*. [2] Al-Jurjani (1991) did not consider the single isolated word in poetic creation. Instead he related to the choice of the word and its positioning within a context. His rhetorical principle is based on the fact that the beauty of a metaphor stems from a proper order of the words. A single word has no meaning in poetical creation without its context. He enlisted syntactic meanings within a context in order to serve the general meaning of the text. The meaning of the word in a context and the meaning of the meaning is what grants the word its position, its uniqueness and specific meaning and even its semantic field within the creative literary work. In addition, it is also this positioning which provides a word with specific meaning embodying various types of messages.

The Arabic language in Israel faces two main challenges:

Diglossia. This is a linguistic phenomenon that characterizes the Arabic language in general, creating a gap between the spoken language, which is the mother tongue, and the literary language, which is the language of reading and writing. This phenomenon widens the gap between the readers' real world perception - which is usually rich and varied, both because of their natural cognitive abilities development and also because of their technology-rich environment, which increases and feeds their imaginative world and virtual world - and their linguistic ability. Diglossia and the gap in linguistic ability restrict the child from flowing fluently in the reading world, while he has to exert effort to use his linguistic knowledge. This means that children's literature in Arabic stands on the edge between pleasure, knowledge and understanding (Da'eem & Younis, 2007).

Bi-lingualism. In addition to diglossia, the Arab child in the State of Israel lives in a bi-lingual reality. Arabic is anyway complex and Hebrew is the State's first language. The double linguistic complexity in which the Arab student lives in Israel, both diglossic and bilingual complexity, increases children's difficulty in absorbing and understanding written literature in a language that is relatively far from their mother tongue.

It is actually at this point that the development of technological communication comes to assist children's literature, even if sometimes this is at the cost of the reading itself. If at one time the story was the *entry point* for the child to get to know a wider world, today the story simply constitutes one of the available tools to get to know the world, in the broad, developed communications technology era.

Exposure to Technological Communications

In this evolving technological era, children are more and more exposed to programs such as series, stories, films and cartoons, games, surfing through different Internet sites, etc. This brings them in touch with an expansive domain of world experience and connects them to it (Masalha, 2005).

And if I look for the value-added of the development of technological communications and their influence on the child's language, then the child is exposed to many more languages than in the past and develops the ability to use them – especially those with which he is familiar from his home or school. Thus, the Arab child is exposed to literary Arabic, the Arabic spoken language; irrespective of whether this exposure occurs while travelling in a car and listening to the radio (an old communications technology tool) or by studying the smartphone in his hand, the result is the same. This continual exposure to language reduces the gap between the student's *first language*[3] or *literary language*[4] and the disturbing factor that overshadowed the student's use of language takes on another facet; he is able to use the language or languages better and in a broader manner.

Exposure to technological communications often includes the students' watching different types of series or films, which challenge them – if they receive the correct mediation – to search for the underlying story (even in a digital book or broadcast story) of the film. Additionally, as the child's ability to use the literary language to which he is exposed in the technological communication increases, the child has a growing ability to understand new literary works and reading material of all sorts. This reduces the gap between the student's linguistic ability and the written language that he consumes whether this is in a regular book or on the Internet. So, technological communications' contribution for the development and fostering of the student's language is clear and irrefutable. But, here another challenging question arises for consideration: to what extent is the language presented in the different channels of communication correct and proper? Who ensures the accuracy? Because listening to incorrect language can detrimentally influence the student's language, especially at an early age. It is at this point that the mediator's role is empowered–especially the role of educators–as they can offer suitable programs for children and encourage them to consume them; what we used to call *guided television viewing*.

Communications technology that relies mainly on audio skills as in reading comprehension contributes in part to the development of the child's concentration ability and understanding of the spoken word, on the condition that it is produced at an appropriate level, and the benefit is greater in the case of audio-visual material that accompanies the written material (book, story, digital material). For example, many books are sold with a CD on which the story is recorded. Thus, the student can read what he hears to develop his language and expand his linguistic knowledge. Often literary works are accompanied by challenging thinking games; in this case, the story becomes a positive factor that stimulates the child's thinking.

One of the things that attract the child today to enjoy technological communications – apart from the accessibility that grows with each new day – is the exposure to a broad world of languages, stories, materials and cultures, while the student is a passive consumer. He is not pressed to invest effort, watching comfortably and enjoyably and this has cathartic benefits and produces maximum pleasure. However, this passive consumer does not enjoy the activation of his imagination as occurs when it is activated in a massive way during reading. Often it is even difficult to develop strategies for first order thinking or creative thinking while watching a story solely on these media, unless the story is constructed in a manner that stimulates thinking and imagination.

There are many sites (Internet, websites, TV channels) for children's literature in technological communications. The student can read varied stories on these channels and connect with the world, so that the child can exploit valuable time at the computer, tablet or smartphone in a positive manner. He can read, learn, gain benefits, communicate and enjoy himself. He can update information, think and choose. This activity is an opportunity that challenges agents of change and mediation to identify these sites and to write on them, to enrich them and even to refer children to use them. In this context, technological communications allow us, the educators and researchers, to know what is new in the field, both in digital books and in international magazines published the world over, that just two decades we could only know through conferences and agents who decided to import them to Israel. All the above lead to the conclusion that technological communications are effective and available on a daily basis. Yet the question remains: Are the different kinds of literary materials that are uploaded on the networks written in a suitable language?

Relevant Research

To answer this question, three researchers, Nadira Younis and Zahi Salama and I, conducted a study for the Arab Cultural Association in 2008-2009 that examined 324 books, at the general level of children's literature in Arabic, and published in Israel from 1948 - 2007. The language was one of the components tested, and this included three categories: correctness of the language, simplicity of the language, and literariness of the language.

- Out of 324 books that were tested, that constituted 90% of the children's books that were published in Arabic in Israel from 1948-2007, it was found that 293 books (90%) were written in an incorrect language.
- The language of 185 books (57 %) was literary and artistic.
- 203 books (62 %) had simple language suitable for the children's age.
- Only 77 stories (23 %) used language that was reasonable, readable, correct, literary and easily understandable.

- It is worth noticing that every book can fall under more than one category. For example, the language of a certain book can be incorrect, not literary and also inappropriate for the age group it is intended to.

Table 1

Description of the Language Used in the Books

Language	**Average %**	**Books**
Incorrect language	90 %	293
Artistic and literary language	57 %	185
Simple and suitable language for the children's age	62 %	203
Reasonable, readable, correct, literary and easy understandable language	23 %	77
Total amount of books N=324		324

Thus, although the development of technology allows the publication of more and more books, to use these books in some technological form and gain the expected literary-linguistic benefit from them, the books, or more accurately the material and knowledge in the books must be correct and reliable, as with any other materials transmitted through technological means.

Second Dilemma: What Literature Themes Reflect the Everyday Life for the Arab Student in Israel?

The second dilemma is to what extent do the subjects presented to the students reflect their regular life, at the age of kindergarten or school? To what extent do the subjects contribute to the development of their imagination or the development of identity; to what extent are these subjects relevant today? The Arab-Israeli dispute has for many years influenced children's literature in Arabic in Israel, because political detachment from Arab countries has led to serious cultural and literary separation between Arabic literature in Israel and literature in other Arab countries. Thus, Arab authors in Israel have been impeded in getting to know the literature of the Arab world and to develop accordingly, while the publication of literature written in Arabic in Israel to Arab countries has been blocked. This political detachment has also influenced and limited the areas of creativity.

In the 1980s the commercial connection with Arab countries was reopened, enabling contact with the annual international book fairs in Cairo, in which publishers and authors from all over the world participate, including Arab authors and publishers from Israel. Subsequently, in the 1990s, approximately forty years after the establishment of the State of Israel a new Arabic literature for children began to grow in Israel.

Despite this openness, the enlistment of resources, the courage of publishers and the courage of authors to write and publish for children, the subjects remained very limited, and did not attain international literary standards (Da'eem, Salama, & Younis, 2008-2009). The shaping of an identity that is considered a substantive issue in all cultures and literature has not been awarded a response in children's literature in Arabic, written in Israel, and this is especially notable when the children involved cope on a daily basis with different national, ethnic, gender, social, linguistic, and religious identities and circles of affiliation.

And to return to technological communications: there is no doubt that this dimension has benefitted children's literature. I guess that digital development has engendered the growth of book production and cheapened expenses in a significant manner. The use of computer techniques has in many cases made the expensive costs of illustration much less expensive. The Internet facilitates surfing to different sites, resulting in access by most of the world to all that is published in the Arab world. Access to the Internet also enables children to view stories as films and series from which they can enjoy and learn. Children may also internalize values and behavioral approaches. Yet again, which content does Arab children's literature impart, to feed the materials that reach the consumer through one or another technological means?

Actually, it can be determined that the content of many of the Arabic language books, published in Israel attained a good international level of children's literature. Da'eem, Salami, and Younis (2008-2009), found that out of 324 examined books, 119 stories had scientific content, and 91 stories, related to the environment, while 50 combined scientific subjects with subjects relating to the environment. They also found modern children's literature discussing contemporary world issues such as science and the environment may not comply with proper scientific standards. Thus, the scientific subject is presented in a distorted manner to the young child.

Table 2

Description of the Contents of the Stories

Contents	Average %	Books
Scientific	119	36 %
Related to environment	91	28 %
Combine scientific with environmental subjects	50	15 %
Defected subjects	95	29 %
Total amount of books N=324	324	

In general, the subjects of the stories included imagination, creativity, independence, cooperation, respect for others, friendship, good deeds, sacrifice, belonging, work, religion, environment, racism, traditional heritage, and science. However, the quality of presentation of the subjects was defective in 95 stories, or the story united several subjects and as noted not all the stories were of a good linguistic or literary quality. Technological communications – in my opinion – are not to blame for this matter, rather the financial inducement that underlies the cheapening of costs for publishers.

Certain challenging questions come to mind for consideration at this point: What creative works do the publishers choose to publish and why? Do they choose literary works that have literary characteristics? Do they publish those that have cosmopolitan characteristics? Do publishers choose works that facilitate individual identify formation? Do they select books that reinforce critical ability and open horizons for creativity? Or are there other reasons that underlie their choice when they decide which creative work to publish or market?

Third Dilemma: The Typographic Aspect

The first two dilemmas prompt me to discuss a third dilemma tightly linked to them: the typographic aspect or the form of the story and the illustrations it contains**.** In accord with the language and contents, the story may also be represented in a typographic aspect; it has a cover, illustrations, colors, and writing. The illustrations are produced with a combination of professional skills and art. They constitute an inseparable part of the literary composition for the student. The story is in principle considered to be a good story when there is a correlation between the language, the content and the illustration, in addition to the specific quality of each of these elements by themselves.

The illustrations become the story's identity card in the hearts and souls of its young consumers. Illustrations contribute to the student's linguistic education, when they help the student, the beginner reader, to tell the story in his own language, or in the case of the literary genre of *picture books* where the message is largely transmitted through the illustrations and not through the wording. Illustrations contribute to education for the development of the student's aesthetic sense, as the student learns to enjoy their artistic value and to evaluate a fine work of art. Illustrations contribute to the development of the young student's imagination, when a painted world is presented to him, elucidating the imaginative contents in the book, feeding his imagination and opening new horizons to the world.

Technological communications of various types allow the creation and inclusion of illustrations through the use of different effects and techniques in order to produce an illustration of optimal quality. It is now possible to conduct a virtual tour through an international exhibition of artists and illustrators, to study picture books of all the types in the world, to study with the assistance of video-clips and other novel creative forms. This is a broad visual world available to illustrators and publishers to make publication more efficient.

In contrast to the above and despite the intrinsic potential of technological communications for the development of the illustration field, in practice, the use of technological communications by the illustrators and publishers is badly done. Instead of exploiting the technology for the benefit of the creative work, technology is used to cheapen costs. To demonstrate this, I again rely on the review that I conducted with my two colleagues under the auspices of the Arab Cultural Association (Da'eem et al., 2008-2009).

Results indicated that only 91 of the stories in 324 books were classified as having good illustrations – in terms of a high level of artistic quality and in terms of their compatibility with the story's language and content. It was also found that 178 illustrated stories were classified as suitable. The illustrations in the rest of the stories were seriously deficient. The review found that most of the illustrators copied illustrations from Hebrew books or from world literature because the illustrations are now accessible by technological communications – and very few illustrators performed the task at a worthy artistic and professional standard.

Table 3

Description of the Illustrations in the Stories

Illustrations	Average %	Books
Good illustrations	91	28 %
Suitable illustrated books	178	54 %
Total amount of books N=324	324	

Some of the illustrators are amateurs, and some were originally painters who found easy earnings in the illustration industry. A question for thought is prompted by this state of affairs: Is the illustration with all that it embodies from a linguistic, artistic, and aesthetic point of view, not sufficiently important to be considered in a proper manner? On the other hand, does the problem stem from the publishers, who are not interested in the student's aesthetic and cognitive abilities? Or, do publishers only want to find an inexpensive illustrator?

Here a rhetoric question floats on the surface: If the illustrations are a linguistic, thinking, content-related and artistic tool, how do inappropriate illustrations influence the students' development and their consumption of good literature?

In light of the aforesaid, it seems that good children's literature is reading material for the young generation, meaning that it includes language, thinking, art and creativity and many other things. For this reason, it is significant and important for the growth of a generation of educated youth, which leads us to the fourth and last dilemma in this presentation.

Fourth Dilemma: Reading
What Does the Younger Generation Read?

Reading is a cognitive act that requires the deciphering of written codes and giving meaning for these codes. Furthermore, the act of literary reading is a process in which the readers absorb the message and the meaning of the literary work in a manner that suits their own perception.

Reading habits of young readers are acquired through exercise and imitation (Sobrino, 1994). There is no doubt that the dilemmas that accompany the reading process of the Arab reader are universal dilemmas, since they are the direct result of the post-modernist world. However, there is also no doubt that the unique nature of Arab society in Israel, as an ethnic minority in a multicultural society, with all that this entails, steers the child on the path of reading and influences the product. There is also no doubt that technological development influences the accessibility of books more than in the past, and that the number of people that can read is also far larger. However, not all books are of a good quality, and not all those able to read do indeed read. The possibilities for reading are infinite and do not end with book reading.

Here I use data from Rikaz – the first statistical online databank about the Arab minority in Israel. Founded by the Galilee Society, Rikasz is funded by the Ford Foundation and the European Union. The study entitled The Palestinians in Israel Socio-Economic Survey is considered the broadest statistical study of the Arab population in Israel and has been conducted four times in 2004 and 2007 (when I was a member of the Galilee Society's steering committee for the survey) and again in 2010 and 2014 (when I presided as Chairman of the Galilee Society).

Table 4 highlights several findings from 2004, 2007, 2010 and 2014 related to reading among young people in the 10-19 years age group.

Table 4

Reading Practices of Arab Youth (Ages 10-19) in Israel, 2004, 2007, 2010 and 2014.

Reading Practice per Year	**2004**	**2007**	**2010**	**2014**
Total amount of families participating in the survey	3270	3270	1931	1689
Do not read newspapers	41.4%	48%	53%	60.5 %
Do not read magazines	57.5%	63%	74%	80 %
Do not read books	70.6%	74%	82.6%	75.2 %
Read one book during the month of the survey	21.1%	14.3%	8.8%	13.4 %
Read two books during the month of the survey	4.9%	6.5%	2.9%	6.2 %
Read three books during the month of the survey	3.3%	4.7%	5.7%	5.2 %
The general population (all ages) – did not read any books during the month of the survey	74.1%	80.3%	82.6%	83.1 %

It is important to mention that the accessibility of books and newspapers is today far greater than in the past and costs are reasonable, but we have no statistics about reading in the past in this particular population, for comparison.

What can we learn from these data? We can see a clear reduction in book, newspaper and magazine reading among the young people and in book reading among the general population. These data created concern regarding the younger educated generation. The results imply increased responsibility for the Ministry of Education, the educational and cultural institutions and all the agents of change to publish good quality books and to establish a program to encourage reading. Of course, we should not disregard the importance of the family in encouraging reading and visiting book fairs and public libraries.

If we are talking about technology, then the question remains what about the digital book and the digital world. Many of the world's materials and books have been scanned and can be accessed from different types of information banks. They can be downloaded for use, but the student needs guidance to search these banks and find the required material. This is especially so when searching in dictionaries or encyclopedias and source books that are hundreds of years old – something that characterizes source books in Arab culture.

With regard to book reading, digital books in Arabic are not as prevalent, and it has been impossible to obtain Arabic digital books for reading until recently, although some of the literary works have been scanned and uploaded to the Internet. A digital book allows us to read at any time and in any place, like the classic hardcopy book, but the unavailability of such digital books in Arabic means that this is a lost opportunity.

I do not see the entry of the digital world into our lives as the reason for the reduction in reading. Exactly the opposite is true. The digital world can replace one product with another. In other words, it can replace a bound paper book with a digital book, if the reader prefers this and has mastered the technology to satisfy their needs. Less than ten years ago, we thought that reading a newspaper was a great delight, especially in the garden with a cup of tea … and this was not performed online through the Internet. Today, the smartphone and the tablet respond to this need, and we can read the newspapers from our smartphones even in the garden with a cup of coffee and in any other place. I also do not envisage that the digital world will constitute a threat to books, because whoever reads will do so in any case, and here the digital world can actually be beneficial by providing more possibilities for reading.

I notice the low percentage of reading – no matter what medium is used – and it is this that requires intervention and necessitates programs to encourage reading. Additionally, attention is required for the data I presented above concerning the quality of the stories or what is known in technological language as *information* that is supposed to be transmitted through technological communications.

The literature presented to the student no matter through what means, and with which technology, should be primarily good literature that contributes to the student's aesthetic, cognitive and linguistic education and enriches their life experience.

Conclusions

There is no reader without literature and no literature without a reader.

Reception Theory developed by the German literature researcher Wolfgang Iser (1926-2007) provided a conceptualization that contributed to a revolution in the critique of modern literature and the theory of literature, focusing on the reader's reaction and his interaction with the literary work. This theory argues that there a dialog takes place between the writer and the reader, who constitutes two factors interacting outside the literary work, and the text, assumes a life of its own during the reading process (Iser, 1978).

According to this theory, the implied author writes for the implied reader, who does not exist in reality. He is a reader created at the time of reading the work that the author keeps in mind when writing, without isolating the work from other external factors that influence its creation. Moreover, when a gap is created between the implied author and the implied reader, the role of the interpreter and critic becomes evident. Often an affinity is found between the implied reader that exists in the implied author's imagination and the actual reader who reads the composition. When the reader fills in the gaps created by the author during the creative process, he is able to create the story that he has in his imagination, the story that responds to his needs, dreams, and experience.

And here a further question is posed: Do the theories that feed literary critique influence the appearance of good children's literature? Good relations between different entities such as the publisher and consumers – a school principal, teachers' mentor, mostly influence the publication of children's books. Economic factors also influence the publisher's decisions, which may lead to an act that contradicts the Reception Theory. Books that respond to the needs of a restricted population and their personal and economic preferences have led to one form or another of publication, irrespective of professional considerations and Reception Theory.

It is perversely in this situation, when technological communications facilitate access, that authors are invited to create good quality works without the auspices of publishers. When this occurs, who decides or determines that a particular artistic work is good or not? Who can guarantee that the work will be received by the audience of young readers – in line with Iser's theory – without the intervention of educators, supervisors, or salesmen? The dilemma remains unresolved. Information is freely available, but the responsibility of those who provide or use the information necessitates a thorough and precise examination.

Summary

Finally, despite the covert or declared conflict between literature from books and literature from the developing technology, having access to technology, especially the Internet, exposes children to a rich accessible world.

Despite all the different types of technological means, the era of knowledge explosion and children are flooded by rapid and strange developments, that leave us, the adults, open-mouthed and wondering *what else will we have to learn with the children.* Is it still possible to manage the preservation of reading habits among children and adolescents? Can we help students transform reading into a regular practice, maintaining an intimate relationship between the child and the book? There is no replacement for reading from a book, even if the book is a digital book.

Our optimal aspiration as authors, parents, educators, and agents of change is to present the child with an artistic story that includes rich language, a vocabulary, connotations and style, worldly knowledge, art and an aesthetic experience. Furthermore, we should not relinquish the emotional and pleasurable experience that such a story can bring. However, every story published in substandard quality constitutes a crime against humanity. It harms the student's intellectual and emotional abilities. In conclusion, with regard to technology, the infinite possibilities that it offers are welcome, as long as the literature is of high quality, appropriate and well written.

Notes

1. *Biographia Literaria*, first published in 1817.
2. Manuscript from the 11th century; First published in a book in Egypt in 1902.
3. Spoken language or mother tongue.
4. The language of academic studies and reading.

References

Abu-Alsa'd, A. (1994). *The child and his literal world*. Cairo: Dar Al-Ma'arif. (Arabic)
(أبو السعد، ع. (1994). الطفل وعالمه الأدبي. القاهرة: دار المعارف)

Al-Jurjani, A. (1991). *The secrets of rhetoric*. Jidda, Sudi Arabia: Dar Almadani. (Arabic) (الجرجاني، ع. (1991). أسرار البلاغة. جدة، العربية السعودية: دار المدني)

Coleridge, S. T. (1984). *Biographia Literia – Biographical sketches of my literary life and opinions*. Edited with an introduction, by George Watson. London: Dent.

Da'eem, R., Salama, Z., & Younis, N. (2008-2009). *A review in children's Arabic books.* Nazareth, Israel: Arab Cultural Association. (Arabic)

Da'eem, R. (2004). Reading in a developing world. *Al-Sharq, 24*(1), 79-86. (Arabic)
(دعيم، ر. (2004). القراءة في عالم متطور. في الشرق 24 (1)، 79 86)

Da'eem, R., & Younis, N. (2007). *The language and the identity*. Acre: Acre Women Association, Dar Altifl Alarabi. (Arabic)
(دعيم، ر. & يونس، ن. (2007). اللغة والذات. عكا: جمعية النساء العكيات، دار الطفل العربي)

Iser, W. (1978). *The act of reading: A theory of aesthetic response*. Baltimore: John Hopkins University Press.

Mansour, A. H. (2000). *Studies in learning technology.* Egypt: Dar Al-Wafa'.
(منصور، أ. ح. (2000). دراسات في تكنولوجيا التعليم. مصر: دار الوفاء)

Mansour, A. H. (2001). *The Internet and its educational use*. Egypt: Jami'at Almansoura. (Arabic) (منصور، أ. ح. (2001) . الإنترنت واستخداماته التربوية. مصر، جامعة المنصورة)

Sobrino, G. (1994). *Notes on children's literature: How to encourage reading skills*. Madrid, Spain: Alfaguara.

The Galilee Society. (2004). *The Palestinian in Israel socio-economic survey*. Shefa'am, Israel: The Galilee Society. Retrieved from http://www.rikaz.org/ar/index.php?s=publications_SE

The Galilee Society. .(2007). *The Palestinian in Israel socio-economic survey*. Shefa'am, Israel: The Galilee Society & Al-Ahali. Retrieved from http://www.rikaz.org/ar/index.php?s=publications_SEII

The Galilee Society. (2010). *The Palestinian in Israel socio-economic survey*. Shefa'am, Israel: The Galilee Society. Retrieved from http://www.rikaz.org/ar/publication/SE3/Third%20Socio%20Economic%20Survey.pdf

The Galilee Society. (2014). *The Palestinian in Israel socio-economic survey.* Shefa'am, Israel: The Galilee Society.

Author Details

Roseland Da'eem
roselandda@gmail.com

Back to Contents page

INTEGRATING ICT IN THE ARABIC GRAMMAR LESSONS AT THE ELEMENTARY SCHOOL: ATTITUDES AND EFFECT!

Zuhaira Najjar
The Arab Academic College for Education in Israel-Haifa
Israel

Abstract

Teaching grammar aims to encourage learners to achieve accuracy in language. However, learning Arabic grammar is difficult for Arabic-speaking pupils at all teaching levels due to its complicated structures, forms and derivatives. This study explores the impact of information communication technologies (ICT) in teaching Arabic grammar on the achievement of elementary school pupils at Arab schools and their attitudes towards learning Arabic grammar. Findings show that ICT has been found to have remarkable potential for promoting achievement in Arabic grammar. Following the computerized tutorials, there was significant improvement in pupils' achievement in Arabic grammar and in their attitudes towards learning Arabic grammatical rules.

Introduction

Language, whether spoken or written, is the medium through which the individual can understand and communicate with other members of his society in different situations and attitudes. Language is considered one of the most important components of the individual and collective national and cultural identity. It has a fundamental role in the individual's life because through it, he can express his feelings, thoughts, tendencies, and needs on one hand, and enjoy and acquire knowledge and facts on the other (Amara, 2013).

Education is considered the most prominent preserver of the legacy of nations and its transferor from one generation to the other, and language is the medium for that process. The importance of a certain language emerges from the care of its speakers to it, as it is their representative; it grows through their growth, develops with their development, weakens with their weakness, decays with their decay, and dies with their death (Madkour, 2005).

If language is a system of communication between people, grammar in any language is the skeleton and frame of this system. If acquisition of oral and written skills of a certain language is the goal of its acquisition, grammar is one of the most important tools to achieve this goal because it represents the accurate measurement with which words are measured when they are put in a sentence to produce meaning.

Arabic

Arabic is the largest group of Semitic languages from the point of view of the number of its speakers, and one of the most dispersed languages in the world. More than 300 million people speak it, and its speakers live mainly in the Arab world and many other neighboring countries. Arabic has a great importance among Moslems, as it is the language of the two main sources of legislation in Islam: the Holy Koran and the traditions (Hadith) of Prophet Mohammad Abu- Nofal, B. (2006).

Arabic is also a main liturgical language among a number of Christian churches in the Arab world. Besides, a large number of the important Jewish religious and intellectual works in the Middle Ages were written in Arabic. Following the spread of Islam and the establishment of Islamic states, the status of Arabic became higher, and Arabic became the dominant language of politics, science, and literature for many generations in the countries where Moslem Arabs ruled. Arabic consists of 28 letters that are written in 119 forms and it is written from right to left. The Arabs call Arabic "the Language of the Dhad" because they believe it is the only language that has the letter 'dhad / ض. (Al-Tha'alibi, 2002).

Arabic Grammar
Arabic is one of the oldest languages that have kept its characteristics of lexis, syntax, grammar and literature. What characterizes it most is that it has grammatical rules that control it and has diacritic marks that keep it from decadence. The study of its grammar is indispensable, because the aspect of grammar (I'rab) and it's parsing by applying case markers to its verbs, nouns and adjectives, indicates its meaning and lends it special linguistic and lexical beauty.

In view of this, acquisition of grammatical and syntactic concepts and terms is an essential thing because that will help the learner to understand and absorb the basics of the grammatical system of the language and enables him to analyze the syntactic and grammatical structure of the words and their meaning, which is based on their position in the sentence. However, learning Arabic grammar is not an easy task due to its complicated structures, forms and derivatives. For example, the verb in the present tense is derived from the past tense by adding one of the letters that signify Present, e.g. a (أ) for the first person singular speaker (ذهب=أذهب؛); n (ن-) for the first person plural speakers (ذهب=نذهب; y (ي-) for the third person singular (ذهب=يذهب; t (ت-) for the second person singular, and third person singular feminine (ذهب=تذهب) (Al-Afghani, 2003).

Problem Statement. Arabic is the official language in the Arab countries and in Israel, though not at the same level of treatment. It is the language of teaching and learning in the different teaching stages. Although the purpose of learning grammar is to encourage the learners to achieve accuracy and apply the learned grammar in their daily life in writing and speaking, their weakness in grammar is obvious. Complaints are repeatedly heard about the learners' weakness in Arabic grammar. Teachers and parents complain about general weakness and low level of the pupils in Arabic linguistic rules (Al-Mas'udi, 2000).

Some of the traditional methods of teaching Arabic are considered the main causes of such weakness in Arabic in general and grammar in particular. The traditional teaching method, the role of the teacher and the textbook contents affect the pupil's ability to absorb grammar. The teaching process crams knowledge in the pupils' brains rather than makes him interact with the language and use it correctly and spontaneously (Abdul-Salam, 2006). This type of teaching is based on three main axes: the teacher, the learner and the textbook. The teacher is considered the source of information and most teachers adopt the traditional methods. Traditional teaching methodology appeared in ancient times and is still practiced in many parts of the world, including the Arab countries. In fact, it is impossible to give it up categorically as it also has some advantages, mainly in the teacher-pupil direct interaction and face to face passing of knowledge. Voice and image are mixed with feelings and senses interact and mutually affect the teaching situation. In this way, the learning process and interaction take place with interest.

However, modern changes and the information explosion in the field of computer and technology have proved that the actual effective teaching process and its requirements cannot be met and achieved only by traditional teaching methods that are insufficient to bring about the desired changes and solve the chronic problems. Besides, the traditional methods do not support the new teacher who is able to interact with the new developments of modern teaching methods that concentrate on the employment of information communication technologies (ICT) that have more potential to make positive changes in the teaching and learning processes (Huppert, Yaakobi, & Lezarovits, 2001).

Studies that have been conducted on pupils of different age-groups (elementary and secondary school ages) have proved that the employment of computerized software is better and more effective than the employment of traditional methods, especially in teaching less-able learners with lower achievements (Abdul- Rahim, 2010; Al-Neyadi, 2009; Jaber, 2007). It was found that the average of pupils' results who studied by the employment of computerized software programs rose significantly from 50% to 65% (Al-Jabban, 2009).

The teaching process has been accelerating in its development since the introduction of information technology into the educational field. The development can be attributed not only to the employment of technological tools, but to a new way of thinking, working and teaching. The teacher's role and the learner's role have changed in the era of teaching by technology (Mioduser, Nachmias, Forkosh, &Tobin, 2003). The significance of the teacher's role appears more in creating teaching conditions and circumstances that involve the pupils and help them in solving problems more than in the role as an explainer of knowledge, information or facts. As a result of this development, the teacher has been obliged to acquire the necessary technological skills to employ in performing his/her teaching role.

Relevant Research. Several studies have investigated the effect of using computerized tutorials on the pupils' achievements, whether in the field of Arabic or other subjects such as sciences, mathematics, English and others. Those studies point out the importance of employing ICT and its innovations in improving the teaching process and the pupils' achievements (Abdul-Rahim 2010, Al-Omary 2010, Al-Neyadi 2009, Jaber 2007, Joy 2000).

In addition to the identified weakness in the pupils’ achievements in Arabic grammar, the studies point out the existence of negative attitudes among pupils towards learning Arabic grammar rules (Abu-Nofal, 2006; Abdul-Rahim, 2010). The researchers maintain that this weakness and these negative attitudes have roots in the elementary school. Such attitudes result from the Arabic teachers' and pupils' suffering from the traditional instruction of Arabic grammar. Al-Mas'udi, (2000) concluded that the subject is new to them, and that the elementary school period is an important stage of teaching Arabic more than acquiring knowledge of other subjects.

Purpose of the Study. In view of what has been said concerning traditional grammar instruction, the low achievement of elementary school pupils in Arabic grammar, student complaints about learning it and their inability to apply grammatical rules in speaking and writing; this study aims to compare the effects of ICT in teaching Arabic grammar on the achievement of elementary school pupils at Arab schools with the traditional method. It aims also to investigate the effect of ICT in teaching grammatical rules on pupils' attitudes towards learning Arabic grammar.

Findings of the study are may enrich the professional literature about teaching Arabic grammar, and pave the way for similar studies in other subject matters at different stages of teaching. The results are expected to benefit the teachers of Arabic grammar and the planners of Arabic curriculum and to contribute to the development of methods of teaching grammar skills by using computerized tutorials as a new strategy that encourages motivation and excitement as main elements, and provides an interactive environment that takes into consideration the individual differences of the learners.

Hypotheses

Study objectives were tested with reference to four expectations/hypotheses:

1. There will be no significant differences between the achievements of pupils in both groups-- experimental-group and control-group-- in the preliminary test that examines the achievement in Arabic grammar.
2. Significant differences will be found in the achievement levels of pupils in the control-group and the experimental-group in the test that examines achievement in Arabic grammar at the end of the intervention. Children in the experimental-group will demonstrate higher levels of knowledge in achievement in Arabic grammar compared with children in the control-group.
3. Significant differences will be found in Arabic grammar achievement among pupils of the experimental-group before and after the intervention.
4. There will be no significant differences in attitudes towards learning Arabic grammar among pupils in both groups before intervention.

5. Significant differences will be found in the attitudes towards learning Arabic grammar of pupils in the control-group and the experimental-group at the end of the intervention. Children in the experimental-group will demonstrate attitudes towards learning Arabic grammar that are more positive than children in the control-group are.

Methodology

A quantitative approach was taken in the present study in order to test the research hypotheses. Examination of the relationship between the variables of the study contributed to the discussion of the processes that developed through the intervention program and their effects on the topics of the study. It also contributed to the discussion about challenges in addressing development and prediction of future behavior of Arabic-speaking pupils, when they learn Arabic grammar and start acquiring linguistic skills (Bernbaum, 1993).

Sample. The sample included 120 elementary Arabic-speaking pupils in the fourth grade: 58 boys and 62 girls, being taught in four classes. The pupils are of normal intelligence, healthy; and grew up in families with a socio-economic level that ranges from moderate to low. The pupils were divided into two groups, consisting of 60 pupils:

1. The experimental-group, where the intervention program was implemented was composed of 28 boys and 32 girls.

2. The control-group, where the children were taught according to the traditional method was composed of 30 boys and 30 girls.

The sample is one of convenience (Zamir & Beit Marom, 2005). Due to constraints of ethical procedures, we chose available pupils that were available to the researcher at the right time and right place. While this sample is not representative of the entire population, it allows us to obtain basic data and trends regarding this study without the constraints and complications of using random sampling methods.

Data Collection

Three different instruments--achievement test, computerized educational program, attitude questionnaire—were used to compare the two groups. A ten-step procedure provided the structure of the research design.

Instruments. The first instrument is an *achievement test* prepared by the researcher. The pupils' competence in Arabic grammar was tested before and after the intervention by the use of an *achievement test.* The test measures pupils` achievement in Arabic grammar in three cognitive levels: remembering, understanding, application, and focus on two subjects: the subject and object. It consists of three parts (according to student learning): multiple choices questions; verify whether the sentence is true or false; complete the following sentences by appropriate object. While checking the test one mark was given to correct answer and zero for wrong answer.

The second instrument is a *computerized tutorials program* that includes the subject and object units from Arabic language curriculum for fourth grade. The computerized program and educational units placed in the Arabic language site of the school. The program used power point presentations including animated and non-animated images and attractive sound effects. Instructions were added on each slide in the program, to help students to use the material independently. In addition, the units have been introduced by film to help pupils to understand the subject matter. The program has been presented to some specialists in the field of Arabic language teaching and education technology and teachers to ensure the of the content and objectives.

The third instrument is an *Attitude Questionnaire* towards learning grammatical rules. It is taken from a study that examined the impact of using computer in teaching Arabic grammar on the achievement of eleventh-grade students and their attitudes towards it (Abu Shatat, 2005). The questionnaire contains 30 statements and it was suited to the population of the research. Responses were measured using a five-point Likert scale (1 to 5), with 1= "completely disagree" and 5= "completely agree."

Procedure. The study was conducted in four main stages. The first stage included: (a) selecting appropriate units of teaching the subject and object from Arabic language curriculum for fourth grade and (b) preparing a computerized tutorial program for teaching the subject and object. The second stage included: (a) selecting appropriate rooms where tools and devices necessary for the implementation of the intervention program and (b) choosing a suitable test for the study. The third stage included: (a) conducting a pre-test on subject and object units in two groups and (b) examining pre-attitudes towards learning Arabic grammar rules in both groups. The fourth stage included: (a) activating the intervention program by the use of computerized tutorials in the experiment-classes, and activating the traditional program in the control-classes; (b) conducting a post-test on subject and object units in the two groups; (c) examining post-attitudes towards learning Arabic grammar rules in both groups and (d) organizing and analyzing the data.

In order to compare between the achievements of the two research groups, we used the *t-tests* in two independent samples.

Findings and Discussion

The findings of the study are introduced here with reference to the objectives and hypotheses of the study. It shows that pupils who belong to the two groups of the study have a similar level of achievement in Arabic grammar at the beginning of the experiment: $\bar{x}$=7.78 for the experimental group and $\bar{x}$=7.91 for the control group. The pre-test results of achievement in Arabic grammar show no significant differences between the pupil's achievements in the experimental-group and the pupil's achievements in the control-group (hypothesis 1). In the test that checked the achievement in Arabic grammar after the intervention, i.e., the use of ICT in teaching Arabic grammar; there were clear differences between the achievements of the pupils in the experimental-group and the achievements of the pupils in the control-group in the two units: the subject ($t=4.345, p<0.05, \bar{x}=15.46$) and object ($t=4.468, p<0.05, \bar{x}=14.63$) (hypothesis 2). There was improvement in the achievement in grammar rules of the pupils in the experimental-group and their achievements were higher than the achievements of the pupils in the control-group . This finding is compatible with the findings of previous studies that found positive correlation between the use of ICT and the improvement of grammar skills in Arabic language (El-Omary, 2010; Awidi, 2009; Hamadneh & Sliman, 2009; Gaber, 2007; Lafy, 2007; and Joey, 2000). These studies show significant differences in the role of computerized tutorials in increasing student achievement in linguistic skills compared to the normal way in teaching.

The findings indicated significant differences in the achievements of the pupils of the experimental-group in the two units of the subject and object (hypothesis 3). As a result of using computerized tutorials, there was a significant improvement in the final grade of the pupils of the experimental-group in subject unit ($t=14.3, p<0.05, \bar{x}=15.45$), and in object unit ($t=13.6, p<0.05, \bar{x}=14.61$). This result is consistent with the results of studies of Abdul-Rahim (2010), Al-Neyadi (2009) and Zliei (2008), which showed statistically significant differences between the pre-test results and the post-test results. These studies indicate the effectiveness of using ICT in teaching Arabic grammar rules and improving student's achievement in this topic. This result is due to the advantages the computer has and its contribution to increasing student achievement, such as the inclusion of a color and sound and image, providing feedback, suspense, attracting student to the learning material, and providing opportunities for students that cannot be available in traditional teaching environment, which increases student motivation towards learning.

No significant differences in attitudes towards learning Arabic grammar were found among pupils in both groups before intervention (hypothesis 4). However, after implementing the computerized tutorials, significant differences were found in the attitudes of pupils in the control-group and the experimental-group ($t=4.308, p<0.05, \bar{x}=118.78$). Pupils in the experimental-group demonstrated attitudes towards learning Arabic grammar, which are more positive than children in the control-group, are (hypothesis 5). This finding is compatible with the study of Lafy (2007), which found that the attitudes of students towards learning Arabic language skills changed after using ICT in teaching the topic. This change in attitudes can be interpreted as a result of the effective involvement of pupils in the teaching and learning process, and in accordance with their abilities. The experimental group pupils showed motivation and willing to learn the topic more than pupils in the control group did.

The findings of the current study are consistent with the findings of previous studies, whose authors have argued that the use of ICT as innovative teaching method in teaching Arabic grammar rules contribute more effectively than traditional teaching methods towards developing Arabic language skills achievements among Arab pupils in elementary school. The contribution stems from the activities provided in the computerized tutorials specifically the feedback, which helps pupils, diagnose their strengths and weaknesses; providing a positive promotion which helps pupils to evaluate themselves and reach the stage of mastering the subjects taught; and the pupils sense of enjoyment and excitement during their study by the computerized tutorials. All these contribute to the achievement in Arabic grammar, and to the attitudes towards learning it.

Summary

The current study was designed to examine the contribution of ICT by computerized tutorials to improve the achievement of Arab elementary school in Arabic grammar. In addition, this study aimed to develop positive attitudes amongst Arab pupils towards learning Arabic language and specifically towards learning grammatical rules.

A quantitative approach was taken in the present study in order to test the research hypotheses. The sample included 120 fourth grade pupils, all of who were attending one Arab school in Israel. The pupils were divided into two groups: an experimental group and a control group.

The research hypotheses were confirmed, and the data show a major contribution of computerized tutorials to the improvement of the achievement of Arab elementary school pupils in Arabic grammatical rules and in their attitudes towards learning the topic, even though learning Arabic grammar is not easy because it is sophisticated and has a complicated system. Pupils in the experimental group exhibited a more significant change in their achievement in Arabic grammar and more positive attitudes towards learning it than pupils in the control group.

The findings indicate remarkable potential of ICT in the educational process, which is embodied in computerized tutorials and multimedia programs designed to advance learning linguistic skills. The combination of visual and auditory activities, the immediate feedback and the positive promotion, enhances the desire of pupils for learning. This, in turn, greatly influences the development of grammatical expertise and the attitudes towards learning grammatical rules.

In the light of the study issue and its findings, it is recommended to perform a comprehensive empirical study concerning the problems of Arabic language teaching and learning, and in contrast, to examine the effectiveness of digital tutorials as innovative method to teach linguistic skills for pupils in different level ages. It should be noted that an efficient integration of technology affordances along with the human aspect in education would contribute significantly to the realization of the educational goals.

References

Abdul-Salam, M. (2006). *Fundamentals of teaching and teacher's professional development*. Egypt, Alexandria: New University.

Abdul- Rahim, N. (2010). *The effect of using computerized educational programs in learning Arabic for students in first grade at schools in Nablus* (Master's thesis). Palestine, Nablus, Al-Najah National University.

Abu- Nofal, B. (2006). *The assistant mentor for teachers to teach reading and expression*. Algeria, Ain m'lila: Dar Al-Huda.

Abu- Shatat, S. (2005). *The impact of computer on teaching grammatical rules on the achievement of eleven grade students and their attitudes towards it* (Master's thesis). Palestine, Gaza, the Islamic University.

Al-Neyadi, Sh. (2009). *The impact of educational software on the achievement of fourth graders in Arabic grammar in the U.A.E. State*. Retrieved from http://www.edutrapedia.illaf.net/arabic/show_article.thtml?id=295

Al-Jabban, R. (2009). *Teaching and teaching methods*. Damascus: Dar Alaasmaa.

Al-Mas'udi, A. (2000). Impact of teaching literature in a discussion and lecture method on the achievement and expressive performance among college student teachers (Ph.D. thesis). Baghdad: The College of education.

Al-Omary, A. (2010). Evaluation of computerized mathematics curriculum on tenth grade students' achievement. *Journal of educational and psychological Sciences*, *11*(1), 175-203.

Al-Tha'alibi, A. (2002). Philology and the secret of Arabic. Comprehensive library. Retrieved from http://shamela.ws/index.php/book/11235

Amara, M. (2013). *Arabic language: Vision and challenges*. Nazareth, Dirasat: Arab Center of Law and Policy.

Awidi, H. (2009). Effect of computer assisted instruction on reading readiness skills development among pre-school children. *Journal of education faculty, University of U.A.E,. 36*, 77-113.

Bernbaum, M. (1993). *Who is afraid of a research work? Planning and writing of research proposals and a report and science of behavior.* Raanana: University Projects Publishing Ltd.

Al-Afghani, S. (2003). *Summary in Arabic grammar*. Beirut: Dar Al-fikr.

Hamadneh, A., & Sliman, M., (2009). The impact of computer use on expressive writing performance among students in the first grade of secondary in Jordan. *Journal of Educational and Psychological Sciences, 10* (1), 145-168.

Huppert, J., Yaakobi, J., & Lezarovvitz, R. (2001**)**. Learning *microbiology* with computer simulations: Students' academic achievement by method and gender. *Research in Science and Technological Education, 16*(2), 231-246.

Jaber, J. (2007). *The impact of computer use on the seventh grade students' achievement in math and attitudes of their teachers towards using it as a learning tool* (Unpublished Master's thesis). Palestine, Nablus, An-Najah National University.

Joy, F. (2000). *Integration technology into instruction in an inclusive classroom for divers learners.* Rowan University. U.S.A

Lafy, S. (2007). *Impact of tutoring by using computer on the development of language proficiency among elementary pupils and the development of* *attitudes towards Arabic language* (Master's thesis). The Faculty of education at al-Arish, Suez Canal University.

Madkour, A. (2005). *Teacher of the future* (1st ed.). Cairo: Dar Al-fikr.

Mioduser, D., Nachmias, R., Forkosh. A., & Tobin, D. (2003). *Educational innovation in schools integrated ICT in Israe*l (Research report). IEA/OECD, Tel Aviv University.

Zamir, S., & Beit-Marom, R. (2005). *Introduction to statistics for students of Social Sciences* (Unit A). Ra'nana: The Open University.

Author Details

Zuhaira Najjar
zuhaira@bezeqint.net

Back to Contents page

COMPARISON OF ACADEMIC PERFORMANCE AND ATTENTION SPAN OF CHILDREN BETWEEN MONTESSORI AND TRADITIONAL PEDAGOGICAL APPROACHES OF PRESCHOOLS

Jean Marie Villamor Juanga and Ar Caryn Ressureccion
University of the Philippines
Philippines

Abstract

This study compares test scores of preschoolers ages 5-6, when exposed to the Montessori prepared environment and teaching pedagogy with those of preschoolers experiencing the traditional lecture classroom approach. A case study done in Davao City Philippines on six preschools and an experiment were conducted by providing preschool children who were schooled in the traditional lecture method approach with activities that were modelled from a Montessori teaching pedagogy. Comparisons between the two pedagogies were done through experimental observation and by conducting pretests and posttests to find out if there was a difference in the academic performance and attention span of children exposed to the Montessori prepared environment while learning compared to children exposed to the traditional classroom lecture method only. The results of the t-tests showed that children exposed to the Montessori prepared environments with active outdoor learning approaches achieved higher mean gain results in their test scores in both math and science compared to those children inside the traditional classroom. Children learned more when exposed to active learning with an appropriate environment with different learning activities. The research also documented the attention span of children while being given writing and manipulative classroom activities. The preschoolers exhibited longer attention spans when given activities in a Montessori prepared environment than inside the traditional classroom one.

Introduction

In Philippine culture, education is perceived by most parents as the greatest legacy they can leave to their children, and good education means sending children to the best schools. Moreover, in the Philippine setting good schools are either expensive or affordable but difficult to get into because of the limited accommodation in terms of number of students due to limited facilities. Currently, the tuition fee in Metro Manila is running at the rate of P84,000.00 annually in preschools and primary years not yet including the registration fees and books. At the rate of continuous annual increase of tuition fees at 12 percent per annum, the school business has become very lucrative. In fact as of 2010 a total of 1,989 preschools had emerged. (Philippine Statistics Authority, 2010). The pioneer in the operations of preschools was O.B Montessori, which was established in 1966 conducting classes in an apartment of a middle class subdivision at Malate Manila (www.obmontessori.edu.ph). Following the establishment of O.B Montessori, various preschools followed through with the Montessori vision and mission (Montessori, 1997).. Through the years Montessori schools have created a reputation for good quality education and eventually became among the expensive schools in the Philippines. Moreover, different pedagogical approaches have surfaced ever since the first preschool was established. These pedagogies offer different learning environments with unique architectural features that affect the learning attitude of children. In a Montessori pedagogy the students are assigned their own personal workstations designed with educational items that correspond to the daily lesson plans and activities. Students are responsible for setting up the work area, choosing the learning activity, applying the physical materials, and returning the materials back to the shelves (Pickering, 2004).

Montessori teachers introduce materials with a brief lesson and demonstration and then passively guide the audience through a period of student-centered inquiry(Edwards, 2002). On the other hand, in a typical classroom lecture method, according to Perrott (1982) for all lessons or learning sequences, the teacher has to present information and ideas. He/she has to introduce topics, summarize the main points of the learning activity and stimulate further learning. All these activities require the use of lecture-explanation techniques. The lecture-explanation approach when used properly can inspire enthusiasm and capture the student imagination.

In Davao City, early childhood education has also emerged in residential communities ranging from a small neighborhood daycare centers to preschool institutions. The Department of Education (2015) has identified 206 registered and with-permit-to-operate private preschools. Montessori and traditional or traditional-developmental are currently the pedagogical approaches used by private preschools with student activities both co-curricular and extra-curricular being set by the different types of preschools. Most of these preschools mostly offer the traditional lecture or conventional method of teaching. The learning and the outdoor spaces are also among the differing features of preschools depending on their teaching pedagogy. Montessori schools refer to their classroom as the prepared environment, while traditional schools refer to it as a classroom.

For this study, three Montessori schools, namely the Abbas Orchard School, Angels at Work Montessori, and Montessori de Manila-Davao, and also three traditional private preschools in Davao City have been visited (Jose Maria College, Philippine Nikkei Jin Kai School of Davao, and Bright Angels of Tomorrow). Based on empirical observations a typical classroom for a Montessori school in Davao had specific areas for every subject.that were arranged in a logical order. Children of ages 2 to 6 interact with each other in a prepared environment. A typical subject area consists of the different learning materials that were chosen and are of unique characteristics. The area for mathematics showed a series of pencils arranged according to colour in the prepared environment. Children are trained to get the materials and return them on their own. A kitchen is also found in the prepared environment of a Montessori school, and this space is intended for their practical life lessons, which involved exercises such as spooning, pouring, washing, slicing, and other practical activities commonly done in the kitchen and dining area of a house. All materials used in the practical learning activities are real and breakable. Children are held responsible in every work that they do, so they become cautious even at a very young age according to the administrator. Children in the Montessori school are also trained to take care of themselves, where they are taught how to comb their hair, put clothes on, and other activities that pertains to taking care of one's self. There are also the daily line time activities, where children dance, sing, and recite/read poems and stories. Children from different levels interact with each other for 30 minutes with the guidance of the teachers. A reading area is also provided for children, and they are allowed to use the space anytime. Books are readily available for children to read. Tables, chairs and other materials in a Montessori school are child-size, and children as young as two years old can play soccer. Where children do physical education, which involves sports like soccer and badminton, they learn the basics of the sport three times a week.

On the other hand, in the traditional classroom lecture methodology everything is very much pre-determined by the zones or territories, which are strictly imposed upon children. Although they are usually described as *homebase* areas, many are similar in character to school classrooms. Each homebase area may be further designated into functional zones such as the cloakroom, the wet zone (with sinks for art and craft activities) and the quiet zone. This is a range of activities that is so tightly prescribed that the architecture tends to reduce and limit the scope for learning rather than extending and opening it up. The free spirit of young children is somehow narrowed down to a set of activities deemed to have educational value (Dudek, 2008). Most of the learning activities of traditional pedagogical pre-schools like reading, writing, watching, and creating artworks were done inside the classroom. Private preschools also conducted fieldtrips for children to learn about different things and experience different environments. Physical education was also noteworthy and done in school courtyards outside of the classroom, but generally all other classes were conducted inside the typical classroom with blackboard and were mostly done in a teacher-centered arrangement.

Objectives of the Study

The general objectives of the study were to explore the different exposure of preschool students in the Montessori and traditional school teaching approaches and learning spaces in order to improve learning performance of preschool students. Specifically, it aimed at the following:

1. To assess level of performance of preschool children by comparing pretest and posttest scores of preschool children exposed to Montessori teaching approaches and its prepared environment and those of students experiencing the traditional lecture method in a private school classrooms .
2. To measure the attention span of preschool children exposed to the Montessori teaching method and its prepared environment with those in the traditional lecture classroom environment of private preschools.
3. To document the different student activities and learning spaces of the Montessori and traditional private preschools in Davao City.

Research Design

This study used different research tactics such as key informant interviews, direct observations, photo documentation, and experimentation to achieve its goals. The experimental method was used in this study using the quasi-experimental pretest/posttest non-equivalent control group design.

Four sections of preschool students in Hizon elementary school and Southpoint school have been subjected to traditional classroom lecture method and the Montessori approach. Two classes of Kinder 2 students with ages 5 to 6 years in each school have participated in the experiment. Children subjected to the experiments were assessed before and after the learning activities. They were given pretests and posttests to measure the level of their performance. The design of the test was patterned to the exams given to Kinder 2 students and was checked by the preschool teachers of the classes subjected to the experiment.

The lessons were planned according to their homeroom teacher's specifications and were prepared prior to the day of experimentation. Children in Hizon Elementary School were taught counting numbers from 14-19 in math and classification of different vegetables in science. As specified by the homeroom teacher, lessons were based on the pace of the classes that were subjects of the experimentation. Children in Southpoint were taught counting numbers from 0-10 in math and parts of the plant, which involved basic gardening, in science.

The learning objectives targeted by both the Montessori and the conventional method were the same. The applied student teacher ratio in the conventional classroom lecture method only one teacher handled the whole class as patterned to the commonly used student-teacher ratio in private preschools. In the Montessori method, one teacher handled a maximum number of 10 students as specified by the consultant.

The design used for the experiment was as follows:

<u>01</u>	x	<u>02</u>	Experimental
03		04	Control

01 - is the pretest average test-score of the experimental group
02 - is the pretest average test-score of the experimental group
03 - is the posttest average test-score of the control group
04 - is the posttest average test-score of the control group
X - is the effect of the treatment

The following statistical treatments were used:

1. Solving for the mean

$$X = \frac{\Sigma x}{N}$$

Where:
X = Arithmetic Mean
x = Sum of Scores
N = Number of Cases

2. T-test formula used

$$t = \frac{(X_1 - X_2)}{\sqrt{\left[\frac{SS_1 - SS_2}{n_1 + n_2 - 2}\right]\left[\frac{1}{n_1} - \frac{1}{n_2}\right]}}$$

Where:
X = Arithmetic Mean
SS = Sum of Squares
n = Number of Cases
n + n – 2 = df (degrees of freedom)

Assumption and the Hypothesis

The assumed null hypotheses for this research would be that there is no significant difference between the pretest and posttest mean scores of students exposed to the Montessori prepared environment and its teaching approach (experimental group).

There is no significant difference in the mean gain scores of the students exposed in traditional classroom and lecture method (control group).

There is no significance difference in the mean gain scores of the students exposed to the Montessori prepared environment (experimental group) and those exposed to the traditional classroom and lecture approach (control group).

Experimental and Control Groups

This section discusses results of the experiment conducted to assess children's performance levels through pretest and posttest grades of both the experimental group subjected to the Montessori pedagogy method and the control group subjected to the traditional classroom lecture method. Included also are results on measuring the the preschool students' attention span.

In the case study, four sections of preschool students in Hizon Elementary School (n=120 students) and at Southpoint private school (also n=120) were subjected to traditional lecture and Montessori pedagogy. Two classes of Kinder 2 students from ages 5 to 6 years in each school participated. Children were assessed before and after learning activities, with lessons planned according to teachers' specifications from Montessori schools and traditional private preschools. Lessons and tests were prepared weeks prior to the day of experimentation. Hizon Elementary School children were taught counting numbers from 14-19 in math and classification of different vegetables in science. As specified by the homeroom teacher, lessons were based on the pace of the classes of the subjects of the experiment. Children from Southpoint were taught counting numbers from 0-10 in math and parts of the plant that involved basic gardening in science. Lessons were also based on the pace of the classes of the subjects of the experiment. In science, the children were also taught actively about the parts of the plant and how to plant in the Montessori approach. The same lectures were also taught to the children in the traditional lecture method. The exact environmental conditions in both the Montessori prepared environment and traditional classroom were applied.
For the traditional classroom lecture method, the homeroom teacher assigned to the class was also the one who handled and gave the lecture to the Montessori preschool class. In the Montessori pedagogical approach, the researcher plus an assistant were the ones who handled and taught the class. A trained consultant of Montessori school provided necessary guidelines in teaching in the Montessori way The learning scope and objectives aimed at by both the Montessori and the traditional method were the same.

The preschool students were given pretests and posttests to measure their performance level in both math and science. The test designs were patterned to the exams given to Kinder 2 students and were checked by the preschool teachers of the classes in the experiment. The applied student-teacher ratio in the traditional lecture method was one teacher handling an average class of 40 students, consistent with the commonly used student-teacher ratio in private preschools in Davao City. In the Montessori approach only 10 students were handled by one teacher as specified by the consultant.

The Conducted Pretest and Posttest

Pretests and posttests were conducted in math and science subjects. At Hizon Elementary school two sections from the Kinder 2 preschool students were subjects for the experimental and control group. The experimental group were taught and exposed in the prepared environment using the Montessori method, while the control group was taught using the traditional lecture method.

Table 1

Pre-test and Post-test Results in Math of Hizon Elementary School

	Experimental Group Subjected to Montessori Method at the Prepared Environment		Control Group Subjected to Traditional Lecture Method Inside the Classroom	
STUDENT	PRETEST	POSTTEST	PRETEST	POSTTEST
1	4	4	16	16
2	5	2	16	14
3	16	16	10	14
4	4	4	5	3
5	4	7	3	1
6	1	3	8	5
7	11	12	7	10
8	5	11	4	4
9	3	5	4	2
10	4	5	12	11
11	7	4	9	9
12	11	10	2	3
13	5	11	7	13
14	13	12	12	13
15	2	7	3	3
16	3	6	3	0
17	5	5	6	6
18	2	9	6	3
19	4	5	2	2
20	3	5	4	5
21	4	2	5	9
22	4	4	3	7
23	5	4		
24	0	1		
25	6	11		
26	1	2		
27	6	6		
28	2	2		
29	3	4		
MEAN SCORE	4.93	6.17	6.68	6.95

As shown in Table 1, all scores of the 51 students who took the test in math were tabulated. These results are from the students of Hizon Elementary School. Due to absences, the expected number of 60 students was not achieved. Scores were tallied in all pretests and posttests. The mean scores of students taught in the Montessori method resulted in 4.93 in their pretest and 6.17 in their posttest scores. The mean scores of students taught in the traditional lecture method were 6.68 in their pretest and 6.95 in their posttest.

Table 2

Pretest and Posttest Results in Science of Hizon Elementary School

	Experimental Group Subjected to Montessori Method at the Prepared Environment		Control Group Subjected to Traditional Lecture Method Inside the Classroom	
STUDENT	PRETEST	POSTTEST	PRETEST	POSTTEST
1	3	1	8	8
2	1	3	4	4
3	0	3	4	7
4	6	3	3	3
5	0	3	0	2
6	1	3	0	0
7	3	2	3	2
8	3	1	5	0
9	0	0	4	3
10	0	0	4	2
11	0	4	7	7
12	0	0	3	3
13	0	3	1	0
14	3	0	6	4
15	1	0	6	8
16	0	6	6	7
17	0	8	6	6
18	3	8	5	0
19	3	0	4	6
20	3	8	4	8
21	0	3	2	3
22	0	0	0	4
23	0	6		
24	0	0		
25	0	0		
26	3	0		
27	0	3		
28	3	0		
29	0	0		
MEAN SCORE	1.29	2.43	4.05	4.13

As shown in Table 2, the mean scores of students taught science using the Montessori method were 1.29 in their pretest and 2.43 in their posttest with a mean gain difference of 1.14 . The mean scores of students taught science in the traditional lecture method were 4.05 in their pretest and 4.13 in their posttest with a mean gain difference of only .08.

Results for Southpoint in math are presented in Table 3. The mean scores of students taught using the Montessori method were 23.26 in their pretest and 24.42 in their posttest with a mean gain difference of 1.16. The mean scores of students taught in the traditional lecture method were 22.65 for their pretest and 23.31 for their posttest with a mean gain difference of only .66.

Table 3

Pretest and Posttest Result in Math of Southpoint School

	Experimental Group Subjected to Montessori Method at the Prepared Environment		Control Group Subjected to Traditional Lecture Method Inside the Classroom	
STUDENT	PRETEST	POSTTEST	PRETEST	POSTTEST
1	15	19	22	23
2	25	26	20	22
3	25	25	23	23
4	25	24	24	25
5	25	22	15	17
6	24	26	25	25
7	20	22	22	23
8	26	26	24	26
9	18	26	22	22
10	25	26	26	26
11	25	25	20	21
12	24	25	25	25
13	21	26	23	24
14	26	25	25	26
15	24	26	22	23
16	24	24	23	23
17	25	23	24	24
18	23	24		
19	22	24		
MEAN SCORE	23.26	24.42	22.65	23.41

As shown in Table 4, all scores were tabulated for the 36 students who took the tests in science at Southpoint School.The mean gain difference for the experimental group was .89 and for the control group was .82

Table 4

Pretest and Posttest Result in Science of Southpoint School

	Experimental Group Subjected to Montessori Method at the Prepared Environment		Control Group Subjected to Traditional Lecture Method Inside the Classroom	
STUDENT	PRETEST	POSTTEST	PRETEST	POSTTEST
1	4	4	2	4
2	4	4	4	4
3	0	2	4	4
4	1	1	4	4
5	4	4	4	4
6	4	4	2	2
7	2	4	2	4
8	4	4	2	2
9	4	4	1	2
10	0	2	0	2
11	2	4	4	4
12	4	4	1	4
13	4	4	1	2
14	2	4	2	2
15	4	4	1	4
16	1	4	2	2
17	4	4	2	2
18	2	4		
19	2	4		
MEAN SCORE	2.74	3.63	2.24	3.06

Summing up the results, it can be seen that that the difference of the mean gains of preschool students who were subjected to the Montessori pedagogical approach were higher than those of students subjected to the traditional classroom lecture method, which indicates that the Montessori approach was significantly better. See Table 5.

Table 5

Summary Mean Gain Results and Computed t-value of Hizon Elementary Preschool Students

Experimental Group Subjected to Montessori Method at Hizon Elementary School					
Subject	Pretest Mean	Posttest	Mean Gain	Computed t value	Critical t
MATH	4.93	6.17	1.24	7.18	2.07
SCIENCE	1.29	2.43	1.14	11.89	2.07
Control Group Subjected to the Traditional Method at Hizon Elementary School					
Subject	Pretest Mean	Posttest	Mean Gain	Computed t value	Critical t
MATH	6.68	6.95	0.27	3.04	2.05
SCIENCE	4.05	4.13	0.08	2.12	2.05

Moreover, the computed t-value of the those students subjected to the Montessori approach at 7.18 against 3.04 in math and 11.89 against 2.12 in science were also significantly higher, which indicate again that it is the better pedagogy. However, the results of the computed t value of the traditional lecture method at 3.04 in math and 2.12 in science were also higher than the critical t which indicated also that it is also a good method of teaching.

Table 6

Summary Mean Gain Results and Computed t-value of Southpoint Preschool Students

Subject	Pretest Mean	Posttest	Mean Gain	Computed t value	Critical t
MATH	23.26	24.42	1.16	2.88	2.09
SCIENCE	2.74	3.63	0.89	6.91	2.09
Subject	Pretest Mean	Posttest	Mean Gain	Computed t value	Critical t
MATH	22.65	23.41	0.76	2.11	2.01
SCIENCE	2.24	3.06	0.82	6.48	2.01

Additionally, the mean gain results of Southpoint preschool students also showed the same conclusions. Referring to Table 6, the mean gain result of the students subjected to the Montessori method is 1.16 in math and .89 in science compared to the .76 in math and .82 in science of those students of the classroom lecture method, which showed that the Montessori pedagogical approach resullts are higher. The computed t value was also slightly higher in math at 2.88 against 2.11 and at 6.91 and 6.48 in science, which indicated that Montessori approach results were again higher and thus better. Moreover, the computed t value of 6.48 in science, which is higher than the critical t value of 2.01, meant that the lecture method also improved the performance of the control group evaluated based on the subjects covered. The computed t value for math is 2.118, which is still higher than the critical t value of 2.01. This means that students of the control group still learned the covered topics in the two subjects using the traditional lecture method. Thus, it is indeed a classic and effective method in teaching.

Attention Span Result

An experiment was also conducted with the preschool students given the same set up of using the Montessori approach compared to the lecture method in both math and science subjects. The preschool students were subjected to writing and manipulative activities while their attention spans were recorded. The results concluded that children of ages 5 to 6 had an average of 10 to 20 minutes attention span. Moreover, the experimental group also showed a longer attention span than the control group. The average attention span of children in the experimental group was 7 minutes during science period and 12 minutes during the math period. Preschool students from the control group had an average attention span of 5 minutes during science period, and the average attention span was 6 minutes in math.

Learning Spaces and Learning Competencies

Based on empirical and ocular observation from preschools in Davao City different learning competencies were provided with different learning spaces. These spaces are necessary in order for children to be more productive and effective. As observed and documented in the conducted school visits, there were different learning spaces found in a Montessori school. The spaces were provided according to the learning competencies covered by the school. They have a kitchen complete with utensils, table, and sink where children do their practical learning activities. There are specific spaces provided for math and sensorial subjects. Children were also provided with a reading area. They are also provided with an open space where they can gather as a class and do activities such as dancing, singing, reciting poems and stories. Montessori schools abroad provide organic gardens for the children to indulge into activities like planting. Such space is not provided in Montessori schools found here in Davao City due to spatial constraints. Most Montessori schools visited used to be houses and were then renovated into a school. An open field is provided for children to play. It is where they learn the art of different sports. A fish pond can also be found in a Montessori school. It is where they get the opportunity to learn about fishes and feed them, which is also a part of their learning experience. Hence, children in the Montessori school experience different spaces while learning. A typical traditional preschool, on the other hand, has classrooms for every level. Most of the learning activities are done inside the classroom. Children go on field trips as one of their learning activities. Only then do children experience other spaces for learning other than the classroom.

Conclusions

The results of pretest and posttest results for both math and science in both pedagogical approaches indicated a higher computed t value compared to its critical t value evident in the results of both schools, which means that both types of teaching pedagogy are significant and deliver good and positive academic performance in preschool students.

The mean gain results for the postest and pretest of the Montessori pedagogy, however, resulted in a great difference compared to those for the traditional lecture method, which showed that it offers more points as a better learning method given its practical learning spaces.

Moreover in the attention span experiment, results showed that the children subjected to the Montessori activities and learning spaces had an attention span higher than the children subjected to the lecture method inside the classroom, leading to the conclusion that children have more interest in learning when they are involved in different activities and in different learning environments rather than just one.

To conclude and summarize, the exposure of children in different kinds of environments present in the Montessori prepared environment while learning as conducted in the experiment resulted in an attention span higher than the children exposed to the same classroom environment. Also children have better levels of performance as reflected on the conducted pretests and posttests for the experimental group exposed to the Montessori prepared environment than for those inside the classroom. Hence, children learn more if exposed to active learning with the appropriate environment for the different learning activities.

The traditional preschool provided a classroom where most of the learning activities took place. The Montessori school offered a prepared environment where areas for specific subjects were provided. There were different student activities that each type of pedagogy included in their curriculum. Children showed to be more attentive and have a higher level of performance when exposed to the Montessori way compared to that of the traditional classroom approach.

References

Deparment of Education, Davao City, Philippines (2015). Access at http://www.deped-davaocity.ph

Dudek, M. (2008). *Schools and kindergartens: A design manual*. Berlin: Birkhauser Publishing Ltd.

Edwards, C. (2002). Three approaches from Europe: Waldorf, Montessori, and Reggio Emilia. *Early Childhood Research & Practice, 4*(1). Retrieved from http://ecrp.uiuc.edu/v4n1/edwards.html

Montessori, M. (1997). Basic ideas of Montessori's educational theory : Extracts from Maria Montessori's writings and teachings. *Clio Montessori Series* [Vol. 14]. Oxford, England : Clio Press.

Perrott, E. (1982). *Effective teaching: A practical guide to improving your teaching*. New York: Longman.

Philippine Statistics Authority. (2010). Access at https://www.psa.gov.ph

Pickering, J.S. (2004). Children with disabilities: The at risk child: How the Montessori classroom enhances learning Part 1. *Montessori Life, Winter*, 8-11.

Rushton, S., & Larkin, E., (2001). Shaping the learning environment: Connecting developmentally appropriate practices to brain research. *Early Childhood Education Journal, 29*(1), 25-33.

Author Details

Jean Marie Villamor Juanga
jeanmariejuanga@yahoo.com

Ar Caryn Ressureccion
carynmae_resurreccion@yahoo.com

Back to Contents page

USING MOBILE TECHNOLOGY TO DEVELOP UNDERSTANDING OF HEARING RISKS USING AN EXPERIENTIAL APPROACH

Lee Davison and Christopher Barlow
Southampton Solent University
United Kingdom

Abstract

Over 10 million people in the UK suffer with a hearing loss, with noise exposure identified as the biggest preventable cause (Bennett, 2007). Young people are particularly at risk, due to the rising level of personal media player (PMP) usage among their age group (Holloway, Green, & Livingstone, 2013). Lack of education results in poor understanding of hearing health, and, therefore, risk taking behaviour, which starts before university age (Barlow, 2011). Current Education is typically didactic in approach and programmes studied have had minimal impact on cohort behaviours (Borchgrevink, 2003; Portnuff, Fligor, & Arehart, 2009). This paper examines the initial stage of an action research project aiming to improve hearing health education by use of an experiential e-learning system.

Keywords: Hearing loss, health education, music listening, noise risk, young adults

Introduction

Hearing loss is a health condition that affects 10 million people in the UK, or one in six (Bennett, 2007) and is the third most prevalent chronic disability in the United States, affecting 29 million Americans between 20-69 years (Prell, Henderson, Fay, & Popper, 2011). Hearing loss also seems to be increasing among the younger demographic, with 8.5% showing a hearing loss between 20-29 years in the American NHANES (National Health And Nutrition Examination Survey), although more contemporary large scale data is now needed due to the age of the study (Agrawal, Platz, & Niparko, 2008).

While hearing loss seems like an easily diagnosed and managed condition, there are links to a wide variety of social and personal health conditions. The most commonly associated symptom of hearing loss is a significant reduction to the communication capabilities of the sufferer. As a result of this, those suffering from a hearing loss condition can be categorised as a high risk of increased social isolation (Arlinger, 2003), which has a separate set of personal and social issues in itself.

There are factors within hearing loss which go beyond the loss of sound perception and begin to affect a wider range of personal and social issues – for instance increased levels of unemployment, increased risk of falls and higher mortality rates. The economic cost is an estimated £1,800 per person with hearing loss per annum as found in Australia in 2005 (Cooperative Research Centre for Cochlear Implant & Hearing Aid Innovation, 2006; Mostafapour, Lahargoue, & Gates, 1998). The UK spent an estimated £450 million as direct costs to the health service according to the NHS (National Health Service) themselves, though undiagnosed individuals are thought to have the power to double this cost (Harker, 2011). When considering that the overall cost: benefit ratio for a national hearing screening programme is considered to be 8:1 (Action on Hearing Loss, 2010), it is fairly obvious that hearing health represents a substantial global cost burden and that the value of prevention outweighs the value of subsequent treatment dramatically.

Hearing loss is a complex condition – there are various reasons that have been shown to cause damage to hearing. The most common reasons, however, are age (presbycusis) and exposure to loud noise (Noise induced hearing disorder). Noise exposure is identified as the single biggest preventable cause of hearing loss. It is estimated that ~25% (estimates range from 23.5-29.9%) of cases of hearing loss in the US are attributable to noise induced hearing loss alone (Agrawal et al., 2008; Stanbury, Rafferty, & Rosenman, 2008).

There is some risk of mild hearing damage to people who are regularly exposed to average levels (L_{EQ}) exceeding 80 dBA (Decibel A-weighted to human hearing), while most people will suffer some degree of hearing loss if regularly exposed to average levels exceeding 85 dBA (Barlow, 2011). The guidelines suggest a dose exchange system as levels increase beyond the 85 dBA average level, whereby an increase of 3 dB reduces the time taken to exceed a *safe* dose by half (Health & Safety Executive, 2005).

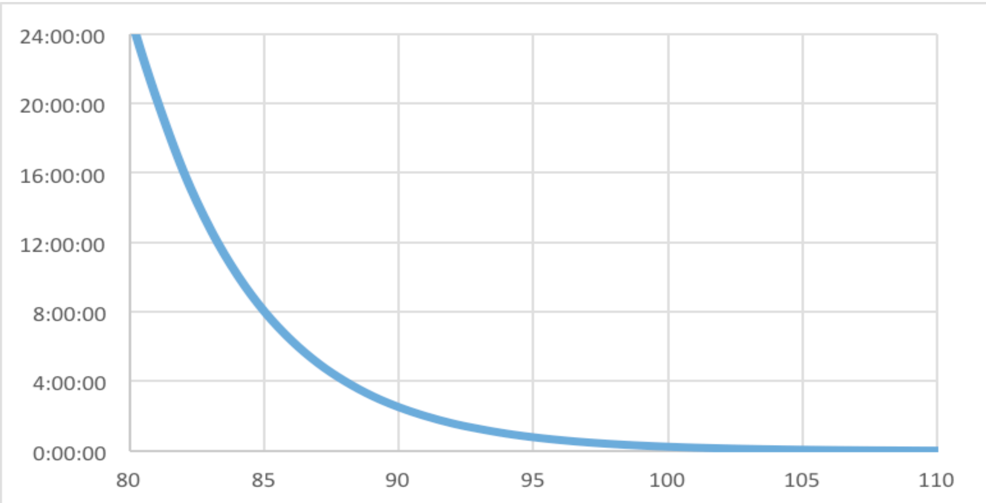


Figure 1. Maximum recommended exposure thresholds of noise.

Over the past few decades, the primary risks to hearing have been occupational, where workers are exposed to high noise levels as part of their job. However, the regulation of noise exposure in the workplace has reduced this risk significantly, while leisure based noise exposure has become an increasing issue.

Loud music has been identified as one of the two recreational noise sources most likely to be harmful (Clark & Bohne, 1999), with the other being shooting. By the 1990s, concern for hearing loss and research was turned toward assessing potential risk by the use of personal (cassette, at the time) music players. A study in a community in Hong Kong showed that risk factor was low in most cases, but measured some hearing damage likely to have been caused by negligent listening patterns and suggested increased education on the subject (Wong, Van Hasselt, Tang, & Yiu, 1990).

Thirty years later, and personal media player usage has greatly increased, with up to 100 million people using personal media players in the European Union on a daily basis (European Commission: Scientific Committee on emerging and newly identified health risks 2012). The technology in music players has also advanced changing the potential listening habits of consumers. The advances are that the devices are capable of high music storage capabilities, longer battery lives, and outputting very high sound pressure levels (Portnuff & Fligor, 2006). This leaves young people very susceptible to hearing loss due to the prolonged listening to high sound levels that can be attributed to that particular age group (Holloway et al., 2013).

As leisure noise exposure is voluntary, rather than inflicted on the person by an occupational environment, there is minimal legislative control over noise exposure, and reducing risk becomes instead an educational issue.

Young people have also shown a negligent attitude to hearing safety, taking easily preventable hearing risks (Widen, Holmes, Johnson, Bohlin, & Erlandsson, 2009). This behaviour seems to be common both during and before university age (Barlow, 2011). Although there is extensive research in this area, the information does not seem to be reaching the young people who are at risk. According to The World Health Organisation (2015) states that 1.1 billion teenagers and young adults are at risk of hearing loss due to recreational noise exposure.

A web-based survey in 2004 revealed some of the listening patterns of young adults and showed that a majority of them had experienced hearing loss and / or tinnitus after listening to loud music, with many of these people open to wearing hearing protection after learning the risks (Chung, Des Roches, Meunier, & Eavey, 2005). Shargorodsky, Curhan, Curhan, and Eavey (2010) reported that the compound effect of a lack of education and increasing potential for risk has led to an increase in hearing loss among adolescents in the US, from 14.9% to 19.5% of the demographic.

Education that does take place is commonly didactic in nature, which has been shown to be ineffective in changing cohort behaviour (Borchgrevink, 2003). Various campaigns have used educators, medical professionals or older students to present information to student groups, or have used *informational websites*, while some have used museum or web resources to explore aspects of hearing with interactive demonstrations (Gilliver, Beach, & Williams, 2013; Martin, Griest, Sobel, & Howarth, 2013).

Studies in recent years have shown a negative reaction to the didactic approach, in which increased peer pressure to turn music levels down has actually resulted in the opposite behaviour amongst teenage students (Portnuff et al., 2009).

There are also issues with the assessment of noise exposure of young people, as the majority of studies of noise risk in this population have been based on self-reporting questionnaires, and there are serious concerns about the level of potential under-reporting of noise exposure (Portnuff et al., 2009).

There are therefore a number of key questions to ask:

- What is the actual noise risk posed to students by recreational music listening?
- What are student's views and current understanding of noise risk and hearing conservation?
- Is it possible to quantify the noise risk from music listening more accurately than using self-reporting?
- How can young people best be engaged with education on noise risk and hearing loss?
- What are the most effective tools for providing young people with education regarding noise risk and hearing loss?

This paper examines the early stages of an action research project on developing an educational system capable of aiding teaching of hearing health to children and young adults.

There has been a shift in recent years away from the traditional music player to *smart* devices including mobile phones and tablet computers. According to a recent study, 65% of children internationally over the age of 8 have access to a mobile phone (GSM Association & NTT DOCOMO, 2009), while in the UK 62% of children aged 12-15 own a smartphone, and the same proportion of 5-15 year olds use a tablet computer at home (OFCOM, 2014).

As the smart phone or tablet is now the primary medium for listening to music, and is also capable of running web browsers and dedicated software, so the mobile device was chosen as the ideal tool for both gathering the required data on listening habits, and also for providing access to appropriate educational material to young people regarding noise risk.

Method

An action research project was devised as the most appropriate methodology for the overall study. Action research is a cyclical approach to the improvement of practice, in a participatory and often collaborative way. It allows the researcher to participate in the research process in a much more holistic way, allowing a deeper understanding of the problem that a cohort is facing. In this case, action research methodology was used to obtain observational data on how students respond to the use of the learning system, and what improvements could be made for the next iteration. The main advantage of this approach in these circumstances is it allows the full emphasis of the research to land on the changes to the method in question, rather than understanding the complex system of learning in people. This methodology pertains to the idea that the complex systems by which people learn cannot be reduced to a simple model.

The first stage of the action research cycle is to gain initial data and use this for the system's further development. As the core underlying issues are an understanding of the noise risk posed to students and their understanding of hearing conservation, a preliminary system was designed that allowed collection of quantifiable data regarding listening behaviours. A core element of the project is to allow students to use their own music devices and headphones to test levels of their preferred music at a level at which they would generally listen, providing direct feedback to the students regarding their own music listening.

The system designed includes both hardware and software elements. Its basic premise is for the users to set some music (using the students' own player and headphones combinations, or a unit provided) to the normal level of their listening, according to their own estimation. They would do this by using their headphones in the normal manner and listening to the normal level, and typically on music that they listen to regularly. The subjects were instructed to "set the volume to your normal maximum listening level" to ensure that all were finding the same volume parameter for themselves. The headphones were then removed from the subjects, and placed on measurement hardware, where the measurement procedure took place. The system was also explained to the students by the use of a large pop-up banner poster, which gave an overview of the subject, with details on the theory underpinning it.

The system's most complex part is an artificial ear designed as an analogue to the human ear to simulate the sound pressure that someone would be exposed to if wearing the same equipment at the same level. In this case, this artificial ear was 3D modelled and physically constructed via the use of a 3D printer. The principle behind this was to develop a system that was capable of being produced cheaply for educational use, as artificial ear systems are typically precision stainless steel and expensive. This serves to increase its availability to educational facilities with lower budgets, and overall increase the propagation of the idea. The ear is designed to mimic the acoustic performance of an average human ear canal when using insert type earphones (British Standards Institution, 2010). A mounting mechanism for the ear pinnae was made by use of a silicone formed ear model, appropriated from a headphone storage product. This allows the earphones to be mounted to fire into the ear canal, and provides realistic external mounting for over the ear (circum-aural) and on the ear (supra-aural) type headphones.

The calibrated measurements are provided by the use of an NTi XL2 sound level meter. This is connected to a calibrated microphone, inserted into the artificial ear, which was then mounted into a polystyrene hat mannequin, so that headphones can be easily mounted. This is the extent of the custom hardware, and aside from the calibrated microphone and sound level meter in use, the cost is negligible for a test with good repeatability.

The hardware was connected via USB to a Windows tablet via standard serial port emulation on the XL2 sound level meter. This allowed the computer to run some software specifically developed for this purpose, using visual programming language within National Instruments' LabView. The software queries the XL2 over the serial interface and receives the sound pressure level that is measured, which is then used to work out exposure time on the computer. While the system is currently running on a Windows device, it is planned to port the software onto the iOS and Android platforms in order to maximise the access to students in later project stages.

The system is designed to draw heavily on the constructivist philosophy of education, specifically for science pedagogy. Constructivism is a theory that proposes that students "construct" their own understanding of a subject or concept (Gray, 1997). This structure of learning suggests by its nature that learning is an interactive process, where actions from the students help them construct understanding, and contextualise it with their own experiences (Boudourides, 2003). It is this interactivity that the teaching tool seeks to exploit. By using the context provided by prior experiences of listening to loud music and previous thought into the matter of hearing safety, it provides a strong contextual correlation for the student to construct understanding. The intent is that use of the system will "effect conceptual change" (Cakir, 2008) in the way that students view the nature of decibels and how hearing safety is affected by changes in their listening habits.

This interaction is also strongly experiential, as the experiential method and the constructivist philosophy are closely linked. As both the didactic approach and blended *information delivery* approaches have proved ineffective in changing the behaviours of young people with regards to noise, an experiential approach was considered appropriate, in which students would be able to understand the issues through experimentation and experience using a range of tools. American psychologist David Kolb developed the experiential learning model in the early 1970s. The central theme of Kolb's work is an experiential learning cycle (Figure 2):

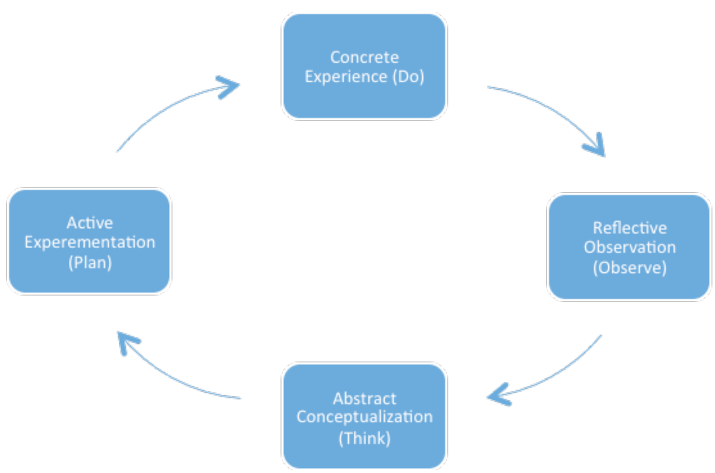


Figure 2. Kolb's experiential learning cycle (Kolb, 1984).

Kolb's theory has been shown to be effective in increasing student participation and assimilation of information (Jiusto & DiBiasio, 2006; Rocha, 2000). It has also been identified that learning technologies are extremely useful in fulfilling the goals of experiential learning, and especially mobile technology (Lai, Yang, Chen, Ho, & Chan, 2007), as it gives an easily distributable and versatile platform for interaction.

Figures 3, 4, and 5 illustrate components of the hardware and software elements of the learning system.

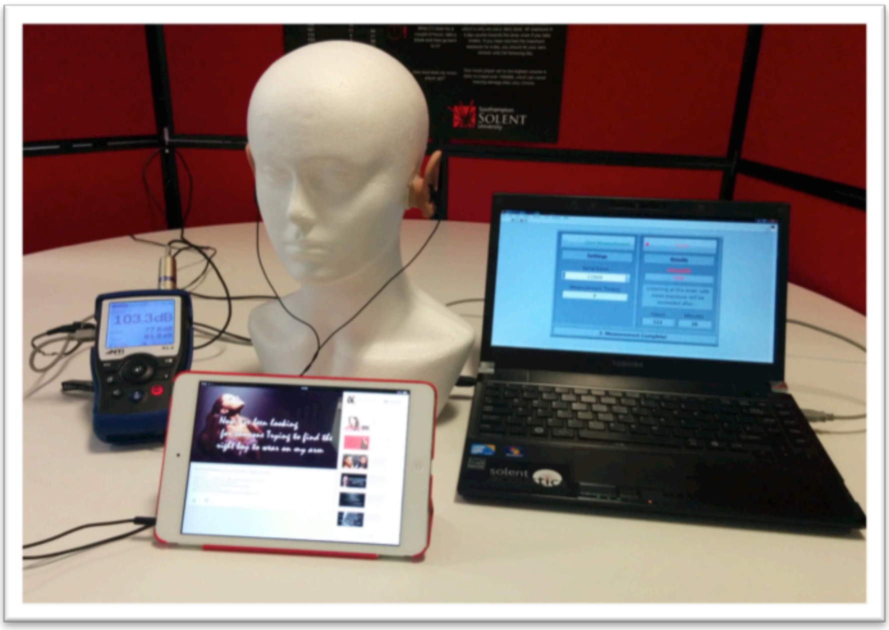


Figure 3: The complete noise exposure education system.

Figure 4: The 3D printed ear simulation.

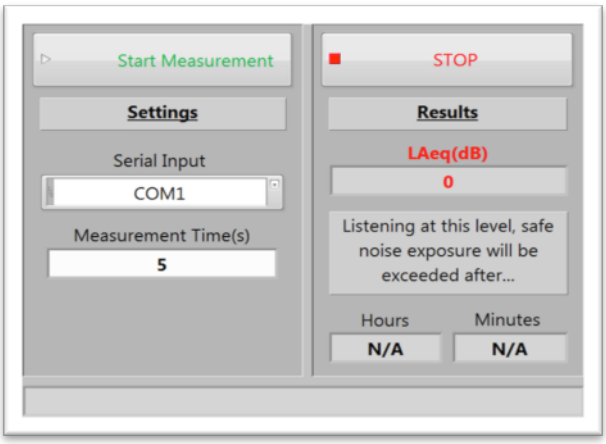


Figure 5: The user interface of the learning system.

Results

In total, 82 participants took part in using the learning tool, over three consecutive weekly events. Participants were typically male (84%), with an age range of 18-50, and a mean age of 25.7. The median age was 22, showing a skew in the distribution. As participation was on a voluntary basis, this showed that in this case males were either more interested, or easier to attract to the study.

Sound pressure levels measured varied considerably from person to person. As can be seen from Figure 6, the highest concentration of sound pressures measured fell into the 80-95 dBA range. The distribution is slightly skewed, with gradually decreasing numbers of people, as the risk gets higher.

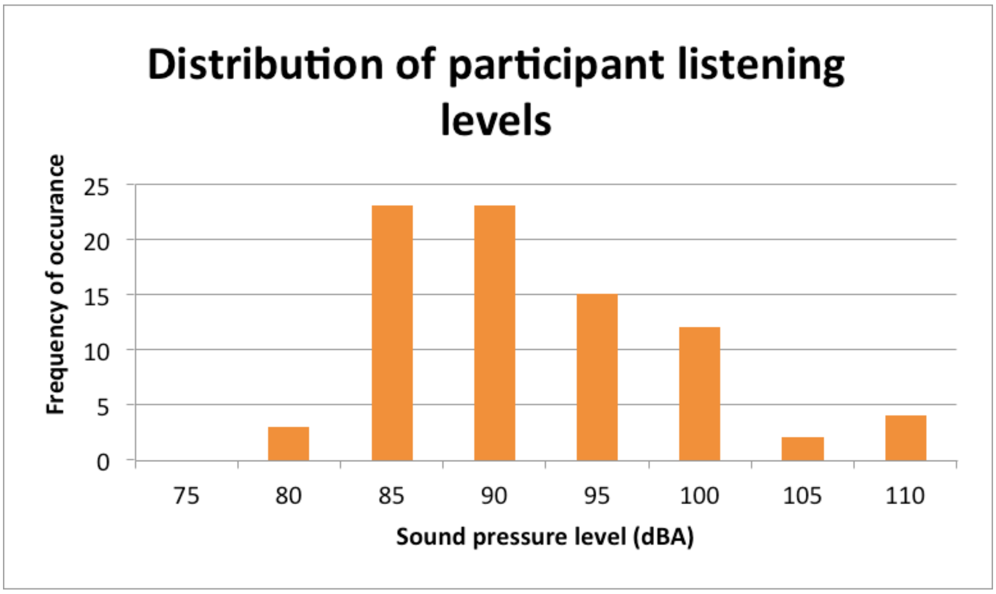


Figure 6. The distribution of sound pressure levels recorded from participants, in dBA.

Discussion

It is clear from this study that there is a wide range of listening levels amongst the initial cohort measured. However, from the initial data alone, it is clear that a high proportion of the sample were putting themselves at risk. Thirty three (39%) of the sample had an average listening level of 95 dBA or above. According to ISO guidelines, an average level of 95 dB gives a *safe* listening time of around 48 minutes, while 110 dB gives a safe listening time of around 1 minute.

This data was analysed in light of a previous survey in which students self-reported their durations of music listening. In that case 58% reported listening to a personal music player for more than 1 hour per day, and 41% listening for more than 2 hours (Barlow, 2010). These results would suggest that a significant proportion of the students whose devices were measured are putting themselves significantly at risk and either did not understand noise risk or chose to ignore it. This reinforces the evidence that an educational approach to this problem is key.

Although there was a general decrease in the proportion of students listening to higher levels, Figure 6 also shows an interesting increase in numbers at the 110 dBA value of the sound pressure level scale. This is attributable to those students who admitted to turning the sound level up to maximum on whatever device they were playing music on. This is evidence of a significant lack of understanding of noise risk.

Informal discussions were held with participants to gain their feedback on the system, and interaction with the device was generally positive; most students stated that they had learned about hearing risk from using the pilot system. Students showed a good level of interest in their hearing health, and from experience over the events it is clear that students are keen to find out how loud they are listening to music themselves.

Conclusion

Results of the pilot study show that there is a considerable requirement for increasing student education regarding hearing risk and indicate that a more interactive/experiential approach in which the student actively participates in a way which relates directly to his/her own activities may be more effective than previous approaches.

As this is an action research project, the next task is to iterate the project to improve the application currently in place, and adapt to the feedback from the data given. The goals of the project are to lower cost and make the hardware as available to schools, colleges and universities as possible. This means that the next project iteration will be focussed on moving towards a cheaper and more sustainable measurement system. While the hardware is currently of reasonable design, it is not robust enough to support a large-scale distribution, due to the fragility of the head.

The next step will also involve porting the design to a dedicated mobile platform. Windows laptops and tablets are typically expensive, and over specified for this particular task. Porting the software to a mobile platform such as Android or iOS will allow a cheaper and more specific system. Porting will also allow a more user friendly interface by using touch screen technology and potentially increase participation. There is also a potential for the system to be implemented onto students' own devices, allowing them to plug into the hardware to measure a result. This will allow students to save their own data, and thereby track their own noise exposure over time, and provide themselves with meaningful data.

References

Action on Hearing Loss (2010). *Cost benefit analysis of hearing screening for older people*. (2010). Retrieved from http://www.actiononhearingloss.org.uk/supporting-you/policy-research-and-influencing/research/our-research-reports/research-reports-2010.aspx

Agrawal, Y., Platz, E. A., & Niparko, J. K. (2008). Prevalence of hearing loss and differences by demographic characteristics among US adults: Data from the National Health and Nutrition Examination Survey, 1999-2004. *Archives of Internal Medicine, 168*(14), 1522-1530.

Arlinger, S. (2003). Negative consequences of uncorrected hearing loss--A review. *International journal of audiology*(42 Suppl 2), 2S,17-20.

Barlow, C. (2010). Potential hazard of hearing damage to students in undergraduate popular music courses. *Medical problems of performing artists, 25*(4), 175.

Barlow, C. (2011). Evidence of noise-induced hearing loss in young people studying popular music. *Medical problems of performing artists, 26*(2), 96.

Bennett, C. (2007). *"Too many people take their hearing for granted" Exploring young people's attitudes and behaviours towards loud music*. Retrieved from http://www.actiononhearingloss.org.uk/~/media/Documents/Campaigns/Protecting%20your%20hearing/Dont_Lose_The_Music_research_report.ashx

Health and Safety Executive. (2005). *Controlling noise at work*. (Series code L108, ISBN 9780717661640). HSE Books.

Borchgrevink, H. M. (2003). Does health promotion work in relation to noise? *Noise and Health, 5*(18), 25-30.

Boudourides, M. A. (2003). Constructivism, education, science, and technology. *Canadian Journal of Learning and Technology/La Revue Canadienne de L'Apprentissage et de la Technologie, 29*(3). Retrieved from http://www.cjlt.ca/index.php/cjlt/article/view/83/77

British Standards Institution. (31 July 2010). 60318-4 Electroacoustics. Simulators of human head and ear. Occluded-ear simulator for the measurement of earphones coupled to the ear by means of ear inserts. London: British Standards Institution.

Cakir, M. (2008). Constructivist approaches to learning in science and their implications for science pedagogy: A literature review. *International journal of environmental and science education, 3*(4), 193-206.

Cooperative Research Centre for Cochlear Implant & Hearing Aid Innovation. (2006). Listen Hear! The economic impact and cost of hearing loss in Australia. Retrieved from

https://www.audiology.asn.au/public/1/files/Publications/ListenHearFinal.pdf
Chung, J. H., Des Roches, C. M., Meunier, J., & Eavey, R. D. (2005). Evaluation of noise-induced hearing loss in young people using a web-based survey technique. *Pediatrics, 115*(4), 861-867.
Clark, W. W., & Bohne, B. A. (1999). Effects of noise on hearing. *JAMA, 281*(17), 1658-1659.
European Commision: Scientific Committee on emerging and newly identified health risks (2012) *Potential health risks of exposure to noise from personal music players and mobile phones including a music playing function.* Retrieved from http://ec.europa.eu/health/archive/ph_risk/committees/04_scenihr/docs/scenihr_o_017.pdf
Gilliver, M., Beach, E. F., & Williams, W. (2013). Noise with attitude: Influences on young people's decisions to protect their hearing. *International journal of audiology, 52*(S1), S26-S32.
Gray, A. (1997). Contructivist teaching and learning. *SSTA Research Centre Report*, *97-07*. Retrieved from http://www.saskschoolboards.ca/old/ResearchAndDevelopment/ResearchReports/Instruction/97-07.htm
GSM Association & NTT DOCOMO. (2009). Children's Use of Mobile Phones-An International Comparison. Retrieved from http://www.gsma.com/publicpolicy/wp-content/uploads/2012/03/GSMA_ChildrensMobilePhones2012WEB.pdf
Harker, R. (2011). NHS funding and expenditure. Retrieved from http://www.nhshistory.net/parlymoney.pdf
Holloway, D., Green, L. and Livingstone, S. (2013). Zero to eight. Young children and their internet use. London School of Economics, London: EU Kids Online.
Jiusto, S., & DiBiasio, D. (2006). Experiential learning environments: Do they prepare our students to be self-directed, life-long learners? *Journal of Engineering Education, 95*(3), 195-204.
Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. London: FT Press.
Lai, C. H., Yang, J. C., Chen, F. C., Ho, C. W., & Chan, T. W. (2007). Affordances of mobile technologies for experiential learning: The interplay of technology and pedagogical practices. *Journal of Computer Assisted Learning, 23*(4), 326-337.
Martin, W. H., Griest, S. E., Sobel, J. L., & Howarth, L. C. (2013). Randomized trial of four noise-induced hearing loss and tinnitus prevention interventions for children. *International Journal of Audiology, 52*(S1), S41-S49.
Mostafapour, S. P., Lahargoue, K., & Gates, G. A. (1998). Noise-induced hearing loss in young adults: the role of personal listening devices and other sources of leisure noise. *Laryngoscope, 108*(12), 1832-1839.
OFCOM. (2014). *Children and Parents: Media Use and Attitudes Report*. Retrieved from http://stakeholders.ofcom.org.uk/binaries/research/media-literacy/october-2013/research07Oct2013.pdf

World Health Organization. (2015). *Hearing loss due to recreational exposure to loud sounds: a review*. Retrieved from http://apps.who.int/iris/handle/10665/154589

Portnuff, C., & Fligor, B. (2006, October). *Sound output levels of the iPod and other MP3 players: Is there potential risk to hearing.* Paper presented at the NIHL in Children Conference, Cincinnati, OH. Retrieved from http://www.rockstarears.com/resources/SoundOutputLevelsofiPods&MP3Players.pdf

Portnuff, C., Fligor, B., & Arehart, K. (2009, February). Teenage use of portable listening devices: a hazard to hearing?" presentation at annual conference of the National Hearing Conservation Association. *Atlanta, GA*.

Prell, C. G. L., Henderson, D., Fay, R. R., & Popper, A. (2011). *Noise-induced hearing loss: Scientific advances*. New York, NY: Springer.

Rocha, C. J. (2000). Evaluating experiential teaching methods in a policy practice course: The case for service learning to increase political participation. *Journal of Social Work Education, 36*(1), 53-63.

Shargorodsky, J., Curhan, S. G., Curhan, G. C., & Eavey, R. (2010). Change in prevalence of hearing loss in US adolescents. *Jama, 304*(7), 772-778.

Stanbury, M., Rafferty, A. P., & Rosenman, K. (2008). Prevalence of hearing loss and work-related noise-induced hearing loss in Michigan. *Journal of Occupational and Environmental Medicine, 50*(1), 72-79.

Widen, S. E., Holmes, A., Johnson, T., Bohlin, M., & Erlandsson, S. I. (2009). Hearing, use of hearing protection, and attitudes towards noise among young American adults. *International Journal of Audiology, 48*(8), 537-545.

Wong, T., Van Hasselt, C., Tang, L., & Yiu, P. (1990). The use of personal cassette players among youths and its effects on hearing. *Public health, 104*(5), 327-330.

Author Details

Lee Davison
Lee.Davison@Solent.ac.uk

Christopher Barlow
christopher.barlow@solent.ac.uk

Back to Contents page

CLOUD-BASED TIME-EFFECTIVE LABORATORY REPORTS GRADING

Samuel Kosolapov and Nissim Sabag
ORT Braude Academic College of Engineering
Israel

Abstract

In the frameworks of the described time-effective cloud-based approach, educators are able to prepare a specific laboratory MS Word template file containing an exact list of student assignments to be executed. The student (or pair of students) compiles and finalizes the report during the laboratory by using a computer connected to the Internet. Students log all relevant measurements directly into the MS Word template file. Additionally, students are able to use their smartphones to add photos of important laboratory steps (e.g., oscilloscope' screenshots) to their report as proof of successful execution of relevant laboratory steps. Educators are able to periodically check student' progress. The graded reports are electronically signed and are stored in the cloud.

Introduction

The curriculum for the Bachelor of Science in Electrical and Electronics Engineering includes laboratory experiments as an essential part of the study program. Traditionally, students present Laboratory Reports to the educator as a hand-written or printed paper, whereas educator reads the reports after laboratory is finished. In most practical cases, after the scheduled laboratory is finished, a significant part of the laboratory equipment is re-arranged for the next laboratory. This means that if the educator finds problems in the specific report, the educator can request only minor changes. The student may not be able to provide additional measurements in order to achieve a better understanding of the material studied (and, optionally, appeal for a better grade).

When considering laboratory experiments within the framework of Electrical and Electronics education, it must be noted that, there is a number of student-friendly and inexpensive commercial PC-based electronic circuit simulators (such as “PSpice,” “Electronics Workbench,” "NI Multisim" and others). Many universities evaluated possibilities of providing electronics laboratories (or parts of them) by using simulations or by using remote laboratories (Auer & Gallent, 2000; Gustavsson, 2003). Despite obvious financial and logistics advantages of using simulations and remote equipment, many educators, including the authors, still insist on providing *old-style* lab instruction. It is strongly believed that hands-on, bench oriented electronics laboratories, with real electronic components (e.g., resistors, transistors, OA, etc.) and standard electronics laboratory equipment (e.g., power supplies, signal generators, oscilloscopes) form an essential part of the electronics engineers’ study program. It is essential for the formation of the professional infrastructure of future engineers. Students become acquainted with real properties of basic electronic components and have initial hands-on experience with the operation of basic electronics laboratory equipment. The processing and analyzing of the results of real measurements significantly assists in student success in subsequent advanced courses and in diploma projects/internships (Sabag, 2002; Waks & Sabag, 2004; Sabag, Trotskovsky, & Schechner, 2006).

During a typical laboratory, students are required to write a laboratory report containing the raw data collected from the experiment. It is clear that compiling laboratory reports in paper laboratory notebooks (PLN) must be considered an outdated and inefficient practice. A number of alternatives to PLN are known. For example, well-known "Evernote" software was used to create *Electronic laboratory notebooks* (ELN) (Walsh & Cho, 2012). Another example is the usage of Google Docs cloud service to effectively manage the data generated by a number of students. Important feature of this service is that files stored in the cloud are not processed by the local (client) computer, but by using cloud computing. This approach provides effective solutions for a number of data-management problems (Bennett & Pence, 2011).

The number of students enrolled in the electronics courses at the author' college has significantly increased in recent years, thus creating a heavy load on electronics laboratories. The authors therefore designed a system to provide time-effective laboratory report management and grading which has been reported in other publications (Kosolapov & Sabag, 2009a, 2009b). The goal of the research was to create tools and techniques enabling the educator to lessen the burden of administrative work (e.g., presence logging, laboratory reports storing, handling and authentication) and thus free more time for focusing on the content.

In this paper, additional aspects of the system that were not reported earlier are described.

Educators and Students Work Organization

In the framework of our time-effective cloud-based approach, the educator prepares the specific laboratory MS Word template file containing a specially designed first page (described later) and a table containing an exact list of assignments to be executed.

Prior to the start of the semester, students register to one of the laboratory sessions within "Laboratory Groups" (each group is labeled by a decimal digit 1 to 9). A typical "Laboratory Group" consists of a maximum of 16 students organized in Pairs/Sub-Groups, (labeled 1 to 9). Laboratory tasks are divided into Assignments labeled 0 to 9. Label "0" is reserved for special purposes.

Upon registration to the laboratory, each pair of students receives a laboratory kit (lightweight plastic box containing a set of cables, breadboards and breadboard-compatible electronic components, according to the list created by educators). This enables the students to carry the laboratory assignments without being dependent on educator assistance. Moreover, students may utilize these kits at their convenience, outside of the official laboratory hours, in an attempt to accomplish tasks that were not finished in due time.

For the purpose of the following description, it is assumed that basic Electronics Laboratory contains at least 10 positions, i.e., one for educator and nine dual student positions, each consisting of a PC connected to the Internet with preinstalled “MS Office” and above mentioned simulation software, e.g., "Multisim," “EWB,” or “PSpice.” Following a short explanation provided by the teacher, concerning the current assignment, each pair of students downloads from the laboratory course site and opens the MS Word Template relevant to the current assignment. While executing laboratory assignments, students log every operation into the template by using plain texts and tables. They describe what they do, by adding screenshots of simulation screens, and adding photos of the assembled circuit connected to the measurement equipment. This is possible because nearly all of our students now have cellular phones equipped with still cameras having resolution high enough to visualize symbols on the screens of the measurement equipment. In cases where hand-written text (for example, manual calculations or graphs) must be inserted into the report photos of scans of the hand-written text can be used, However, most students prefer to use standard computer means, such as “Equation Editor” and “Excel Graph means” for that purpose. Thus, all simulation results, measurements, calculations, and other raw and processed data are summarized in a single MS Word file labeled “Work Report.”

During the final 20 minutes of each laboratory session, students stop their experimental work. They switch to the first “Work Report” page (see Figure 1) and fill in the mandatory fields. Although it is safe to authenticate students by their “Group-Sub-Group” two-digit index, it is recommended that students also fill in the redundant fields specifying their IDs and names. The purpose of this redundancy is to cover situations when students enter a wrong two-digit index. However, in cases where there exists an anonymity policy, for the sake of objective evaluations, those fields must not be filled in. According to our practice, the addition of student photos assists the educator in the grading process, but again, in case of compliance with anonymity requirements, or when a student photo is not available, these fields may be ignored. The template fields up to “Abstract” are self-explanatory and can be freely modified according to educator requirements. However, we found it essential for the students to summarize, in a short abstract (approximately 10 lines), what was done during the laboratory session, and what remains to be done.

<table>
<tr><td colspan="4">1st Student’ ID</td><td colspan="5">1st Student’ Name</td><td colspan="3">1st Student’ Photo</td></tr>
<tr><td colspan="4">2nd Student’ ID</td><td colspan="5">2nd Student’ Name</td><td colspan="3">2nd Student’ Photo</td></tr>
<tr><td colspan="12">College/University Name</td></tr>
<tr><td colspan="12">Department Name</td></tr>
<tr><td colspan="12">Laboratory Course Name and Number</td></tr>
<tr><td colspan="12">Assignment Name and Number</td></tr>
<tr><td colspan="12">Educator’ name</td></tr>
<tr><td colspan="12">Abstract</td></tr>
<tr><td>Gr#</td><td>SGr#</td><td>Ass#</td><td>Year</td><td>Month</td><td>Date</td><td>Hour</td><td>Min</td><td>Sec</td><td>Msg</td><td>Hash1</td><td>Hash2</td></tr>
<tr><td>1</td><td>1</td><td>3</td><td>2008</td><td>02</td><td>26</td><td>16</td><td>12</td><td>00</td><td>00</td><td>000</td><td>000</td></tr>
</table>

E-Signature	113-2008-02-26-16-12-44-00-**254-579**

Figure 1. Example of first page of laboratory template/work report.

In Figure 1, some template fields were resized to decrease figure size. The template is set up in monitor-friendly landscape orientation, allowing for ample field lengths, with no intention to print reports on paper.

E-Signature of the Reports

An important element of the time-effective logistics is the E-Signature. When a specific sub-group of students completes the first page of the "Work Report," the educator comes to their physical position to review the abstract and may ask questions or asks students to scroll the "Work Report" to validate the assembled data. The educator then electronically signs the report (by using "AuNum" utility described later). The first 15 digits of the signature are self-explanatory and are pre-filled by the students. The last 10 digits (described later) are dictated by the educator, pausing between fields to signal the student to enter a delimiter ("-") symbol. Usage of delimiters makes E-Signatures readable. All of the symbols of the signature are available on the keypad, so that the signature process requires not more then 15-20 seconds, for each pair of students. Following the signature acceptance, the student copies it to the clipboard (Ctrl-C) and saves the "Work Report" with the E-Signature as filename. Retyping the long signature isn't necessary: paste, "Ctrl-V" may be used. One of the students in the pair then opens e-mail utility and sends an e-mail to the educator (and to the second student) with the following rules: "Subject" of the e-mail is filled by the E-Signature (again, no need to retype, because the signature is still on the Clipboard, and "Ctrl-V" will paste it in the "Subject" field). The Abstract from the first page is used as message text, and "Work Report" is attached to the e-mail. It is highly recommended, that the e-mail be sent in the presence of the educator in order to prevent undesirable report modifications by students after the educator leaves the position. According to our timing measurements, the entire signature procedure requires not more than 10-15 minutes of the educator's time per group of 16 students.

"AuNum" Utility for E-Signature

E-Signatures are generated by a specially designed ".NET AuNum" software utility. This utility was specially developed as a PC version and as a PDA/Cellular phone version by using "MS Visual Studio C# IDE." An example of the GUI appearance of this utility is presented in Figure 2. The utility can be easily deployed to educators' PDA/Cellular phones connected to PCs by using the "deploy" options of the "Visual Studio."

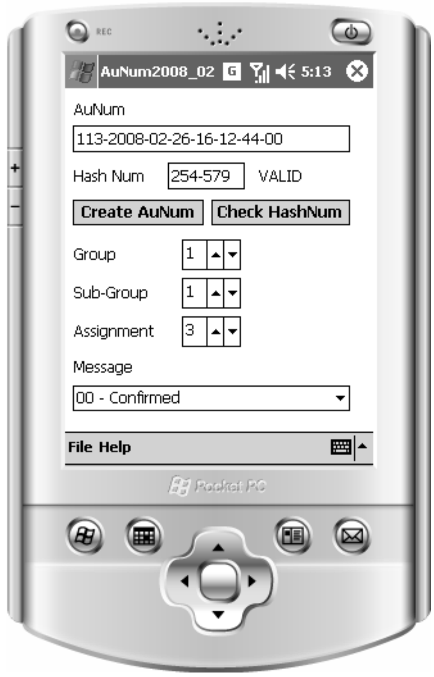


Figure 2. Example of the GUI appearance of the Cellular Phone screen.

In order to create an E-Signature, the educator sets relevant numbers for “Group,” “Sub-Group” and “Assignment.” The “Message” field is used to set “instant indirect grade.” This two-digit message field encodes up to 100 strings to describe students’ work. The default message code is 00 (meaning “Confirmed”). Code “26,” for example, means “Excellent Simulation,” whereas code “43” means “Wrong Measurements.” Codes and correspondent messages are stored in the plain text file. Educator can modify this file in accordance with his personal preferences. The educator may reveal meaning of the codes to students or hide them in accordance of his preferences.

The E-Signature is created by pressing the “Create AuNum” button. Time information (including seconds) is automatically extracted from the educator’s PDA/Cellular phone. The last 6 digits are Hash Code created by using any appropriate algorithm. The next pressing of the “Create AuNum” button will create a different Hash Code (because the seconds were incremented), and thus a Hash Code can be considered as an electronic signature for a specific “Group - Sub-Group - Assignment” index, with an encoded message and a specific time. A Six-Digit Hash Code is enough to meet the chosen goals and short enough for fast entries. However, it is important to understand that the E-signature does not sign the MS Word file, “Work Report.” As indicated earlier, this file can be modified after the signature. Hence it is important to ensure that the file be sent in the presence of the educator. The advantage of this approach is flexibility: “Work Report” can, subsequently, be modified by students and re-signed after explaining what was changed and why. The time-stamp of the E-Signature in this case will clearly be marked in readable form to indicate that changes were made (and accepted by the educator) at a later time. An additional feature of the “AuNum” utility is that all created E-Signatures are stored in the PDA Memory and are backed-up in the educator’s

PC during a routine synchronization process. The E-Signature structure enables easy search and auto-arrangement of uploaded files.

Reports Review and Grading

In addition to “Work Reports,” students compile a number of “Final Reports,” combining data from a number of relevant “Work Reports” with additional sections like “Discussion,” “Simulation-Measurements-Calculation and Comparison.” During the last laboratory meeting of the semester, each sub-group fills out an “Excel Template” (created by the educator) containing the list of all “Work Reports” and latest versions of the “Final Reports.” Upon filling the template, the student automatically sees the expected grade in the column “Student’ grade estimate.” The “Excel Template” is e-mailed to the educator with an assignment number “0.” In order to finalize the grade, the educator checks the validity of the E-Signatures by using the “Check HashNum” button of “AuNum” utility (the label “Valid” appears in case of a valid E-Signature, and “Invalid” appears in the opposite case). The educator finds “Final Reports” by exploiting a search engine of e-mail software using E-Signatures in the “Excel Template,” e.g., "search keyword." The educator finalizes the grade by modifying the “Educator’s grade” column after reading the relevant sections of the reports.

Non-Standard Situations

If, for any reason, E-Signature cannot be provided by the due time, the student can send the report at any other time by setting the last 8 digits as zeros with a relevant explanation in the text of the e-mail. In this case, the educator decides how to grade the student’s work according to prevailing policies. The reasonable redundancy of the templates enables it to cope with human input errors such as e wrong assignment number. If the educator cannot generate E-Signatures by using AuNum utility, any pseudo-random numbers can be used instead of Hash Code. In this case, the educator must manually log the provided signatures.

Discussion

The logistics were tested during 2007-2012 in the laboratories “Introduction to Electronics” and “Analog Electronics.” With slight changes, the same techniques were used during 2010-2015 in the "Image Processing" laboratory. It is important to note that with the exception of 10-15 min required for signatures, all remaining educator time is totally dedicated to “education” – what, how and why students do, and to additional explanations and answers to questions. The logistics effectively avoids possible unpleasantness for the educator and for the student, in situations of a “lost report.” All reports are stored by the cloud e-mail server and can be accessed by the educator from any computer having access to Internet. This flexibility enables educators to utilize their time more effectively. “Strange” appearances of “Subject” field of the e-mail (a 25 digit E-Signature) serves as an additional anti-spam indicator. Practically, a dedicated e-mail address is used for collecting laboratory reports, thus messages with other “Subject” entries must not be opened. Any student appeal can be effectively processed by extracting the relevant report, e.g., by assignment number, by date. At any time, the educator can see a student's progress by sorting reports by assignment number, which provides immediate information regarding assignment completion. When a number of educators provide the same laboratory for the different groups of the students, responsible for this specific laboratory can monitor student' progress for all groups, quality of their reports and homogeneity of grading in different groups.

Conclusions

The described logistics significantly decreases the time spent on non-pedagogic and administrative chores, e.g., presence checking, report searching and sorting and thus, allows for an increase in instructor-student interactions ("quality time").

The quality of the students' work and reports were found to be significantly better than that of PLN used in the previous years. Strict reporting rules enable better and more homogeneous grading, especially in cases of weak students, through the readily available information regarding the non-implemented elements of assignments. Advanced students may add additional elements into their reports and, for example, provide detailed analysis of possible measurements errors.

Future Improvements

Currently all the logistics, reports structure and software are being re-designed for use with MS Azure cloud services. When finished, this approach will enable any educator to use the described approach by using any modern i-Phone, Android Phone, Windows Phone or tablet without the need to download any extra software.

References

Auer, M. E., & Gallent, W. (2000). The "Remote Electronic Lab" as a part of the telelearning concept at the Carinthia Tech Institute. *Proceedings of the ICL2000,* Villach/Austria, 28/29.09.2000.

Bennett, J., & Pence, H. (2011). Managing laboratory data using cloud computing as an organizational tool. *Journal of Chemical Education*, *88*(6), 761-763.

Gustavsson I. (2003, July). *Traditional laboratory exercises and remote experiments in electrical engineering education*. Paper presented at International Conference on Engineering Education. Valencia, Spain.

Kosolapov, S., & Sabag, N. (2009a). *Time-effective logistics of electronically signed laboratory results reporting.* Paper presented at American Society for Engineering Education Northeast Section Conference. Bridgeport, CT, USA.

Kosolapov, S., & Sabag, N. (2009b, October). Usage of cloud computing services for storing, handling and validation of electronically signed laboratory reports. *Abstracts of the 5rd ORT Braude College Interdisciplinary Research Conference, (20)*, Naharia, Israel.

Sabag, N. (2002). *Investigating characteristics of project-based learning in electronics* (Theses). Technion, Haifa, Israel.

Sabag, N., Trotskovsky, E., & Schechner, P. (2006). Internship as an obligatory requirement for the Degree of B.Sc. in Electronic and Electrical Engineering. *ITRE 4th International Conference on Information Technologies* (pp.94-98). Tel-Aviv, Israel.

Waks, S., & Sabag, N. (2004). Technology project learning vs. lab experimentation. *Journal of Science Education and Technology*, *13*(3), 333-342, Kluer Academic / Plenum Pub.

Walsh E., & Cho I. (2012). Using Evernote as an electronic lab notebook in a translational science. *Laboratory Journal of Laboratory Automation*, *18*(3), 229-234.

Author Details

Samuel Kosolapov
ksamuel@braude.ac.il

Nissim Sabag
nsabag@braude.ac.il

Back to Contents page

INTRODUCING MICROCONTROLLER BASED COMPUTER PLATFORMS INTO ENGINEERING COMPUTER EDUCATION

Jian Jiang
Southampton Solent University
United Kingdom

Abstract

Computer skills have become essentials for most of us living and working in this modern world. For engineering students, an understanding of computer architecture, interfacing, resource management and networking is fundamental. The current module used in our university to teach students this knowledge is facing some problems, including poor student engagement, lack of practical experience and weak linkage between content. One reason for this is that modern computers are highly integrated and are well designed to prevent non-specialists from making changes to the system. Students rarely have the opportunity to look into a real computer to understand how the hardware links together. A potential solution is introducing microcontroller platforms, such as Raspberry Pi, Arduino and Phidgets, into the module. These beginner-friendly computer platforms can give students the chance to explore and actually take control of the system. Although they are less powerful, they have a similar structure to PC's. Knowledge and skills gained from the microcontroller platforms can be easily transferred to other more complicated modern computer systems. These microcontroller platforms are also cost effective and benefit from huge open sources. They have been very popular with students as well as professionals in recent years. By introducing the microcontroller platform into our module, we hope to help students' learning and improve their engagement. Building, using and working on these microcontroller platforms, students can get a better understanding of how computer systems work and a better linkage among content taught in class.

Background and current practice

Computer skills have become essentials for most of us living and working in this modern world. For engineering students, an understanding of computer architecture, interfacing, resource management and networking is fundamental. Before coming to University, our students have gained most of their knowledge of using a computer (e.g., a PC), such as basic calculation, documentation and internet communication, through their early school education and self-learning. However, few of them actually looked into the computer to understand how the hardware links together to make the whole system work, due to the fact that modern computers are highly integrated and are well designed to prevent non-specialists from making changes to the system.

For students studying audio engineering and media technology, understanding the basic fundamental principles of computer architecture and knowledge of how software and hardware interacts with each other are especially important. They underpin other knowledge and skills that will be introduced to students in their second and third years, which students will benefit from throughout their career.

In order to help students to understand how computers work behind the screen, Southampton Solent University has this first year unit, computing fundamentals, which aims to introduce students to the basics of computer architecture, interfacing, resource management, networking, peripheral and software coding, and provide students with a foundation in computer literacy that will underpin units across Levels 5 and 6.

Currently this unit is delivered between weekly lectures and tutorial sessions. Lectures explore the fundamentals of computing theory and architecture. Tutorial sessions focus on weekly group activities that require students to apply principles covered in the lectures to given problems. The teaching schedule can be roughly divided into three sections. The first 5 weeks focus on knowledge of computing theory, such as the concepts of binary system, sampling rate and bit depth. During the second 5 weeks, the lectures focus on computer structure, and tutorials focus on software development. There is one in-class test at the end of each of these two sections. Then during the final 7 weeks students will be introduced to selected topics related to modern computer science and they will be given time to finish their final project, which requires them to produce a combined hardware and software solution for a given problem, and present it as a group.

Although these all sound well designed, we are experiencing very poor student engagement. The attendance rate for some tutorial sessions is only about 20%. Students seem to lack interest and enthusiasm for the content.

Feedback from students highlighted that:

- Students think some of the tasks designed in tutorials are not very interesting, such as using Excel table to demonstrate binary theory. They can see those tasks are to help them understand the theory. But they just don’t feel exited doing it.
- They feel the unit is too theoretical and they can’t see how the knowledge links to practical problems / projects. Some of the students can remember the theory very well, but still don’t have a clue of what to do in the final project.
- They view the links between the three teaching sections as quite weak. The theory taught in the first section doesn’t seem relevant to the software development and hardware interface introduced in the second section. Most students are getting even more confused when they start their final project as they can’t see how the knowledge they learnt can be applied to the given problem.

To motivate students to learn this module, materials they are more excited about need to be included in it, especially for tutorial tasks, which can be much more flexible than theory taught in lectures. Students also need to be given more chance to use the knowledge in practical scenarios and link teaching sections with a golden thread.

Potential Solution

After discussing with colleagues teaching second and third computer units, we found something that may help: microcontroller platforms. Microcontroller platforms, such as Raspberry Pi, Arduino and Phidgets, are basically small computers but less powerful. They have a similar structure to PC's and can conduct simple tasks. From feedback, students showed great interest in the microcontroller platform, Raspberry Pi in particular. It has been a talking point for students for several years. There are competitions between universities to use them for different interesting tasks, varying from making your TV a smart TV to using it to build a touch screen game console. They are beginner friendly, cost effective and benefit from huge open sources. Many online tutorials, instructions and developer forums can give users great support.

Some of the microcontroller platforms, such as Raspberry Pi and Arduino, are actually designed for computer education purposes. They have been adopted in teaching practices at school levels (Roman, 2015) as well as at universities (Darr, Stombaugh, Shearer, & Gates, 2007; Hamrita, 2005; Land, 2015; Leeb, 2015). For example, MIT (Leeb, 2015) actually introduced students to the microcontroller as one of the most useful tools/skills that will help them to solve practical problem and even to get greater success in their career.

More often, microcontrollers were used to assist laboratory sessions of engineering classes (Ibrahim, 2007; Bolanakis, Glavas, & Evangelakis, 2007; Jones & Joordens, 2003; Milliken & Cregan, 2012). For example, Jones & Joordens used microcontrollers as a solution to the problem that distance-education students are lacking laboratory practical experiences. This is very similar to our case in which students are also lacking practical experience. After five years' (1998-2003) implementation, they concluded, "The solution proved to be extremely successful and very well accepted by all students" (Jones & Joordens, 2003, p.455).

To use the microcontroller, students will need to build up the system by themselves. Since they have a very similar structure to the more comprehensive versions of computers, all the principles students learned in the class can be applied to these microcontrollers and all the skills they learned could be transferred to other computer systems. As a result students gain direct and practical experience of building a computer and taking control of the system, which is just what we are looking for.

By introducing the microcontroller platforms into our unit from the beginning, microcomputers can actually act as a golden thread going through the unit. Students will need theory and hardware knowledge when they start to build the system up. They need the knowledge of software development when they program code to control the system. They can also use the system in their final projects and show how they link their knowledge together.

Raspberry Pi was introduced to students taking our unit this year in week 11 as a suggestion for their final project. Many students showed great interest already. More than half of students have decided to use Raspberry Pi in their final project. If we can actually use them in the unit (not only a suggestion), it surely can increase students' engagement, and hopefully stimulate their deep learning. Therefore, the teaching team decided to introduce the microcontroller based computer platforms into our computing fundamental unit to:

- Give students direct and practical experience of building a computer system.
- Help students to better link the content taught in the class.
- Improve students' engagement.

Plan

The plan is to introduce Raspberry Pi (one of the microcontrollers designed for computer science education) to our computing fundamental unit.

In the first 5 weeks, when lectures are focusing on the background theory of computing, Raspberry Pi will be introduced to students during the tutorial sessions. Students can use them to practice the theory. In addition, a variety of interesting projects will be demonstrated to students and let them know what they can do with Raspberry Pi. Students can potentially use some of the ideas in their final project. Besides generating great interest from students, this should give them a clear view of what they can expect in the final exam.
In the second 5 weeks, when the unit is focusing on hardware interface and software development, small tasks will be given to students to make changes to their own Raspberry Pi and learn how the hardware actually links with each other. During the tutorial, we can also demonstrate how the software interacts with hardware. Students can practice their (Python) coding skills on the Raspberry Pi system and actually see the results of software and hardware interaction.

In the last 7 weeks, when the lectures are trying to give students more ideas about what they can do with computer systems (not limited to the microcontrollers), tutorials are focusing on helping them with their projects and helping them to recall and link the knowledge they learnt during the first two sections. Students can use Raspberry pi in their final project. But they don't have to. If they can leave Raspberry Pi behind and go explore other computer systems they are more than welcome.

If the feedback is good and students want to go further in this direction of their study, they will be introduced to the *Raspberry Pi Challenge,* which acts as an interest group in many universities. Students can establish their interest group in Solent and network with people interested in using Raspberry Pi from other universities.

Conclusion

In conclusion, a microcontroller platform, Raspberry Pi, is planned to be introduced into a computing fundamental unit. From the literature research and our current student feedback, it has great potential to solve the problems met during current teaching practice. The plan is for the next academic year. However, as a preliminary test, students have been encouraged to use Raspberry Pi in their final project this year. Although it was introduced at a fairly late stage of the unit, students have shown great interest. As a result, more than half of students decided to use it in their final projects. By taking advantage of the huge online tutorials/resources, surprisingly, they have managed to establish the system by themselves and proposed some very interesting ideas, such as building up a motion control CCTV camera and building a drum recording device. From the feedback obtained at this stage, most of the students feel the Raspberry Pi helped their studies. On many occasions, they have to go back to check their lecture notes in order to achieve some features they want to achieve on the device. In addition, they do feel they better understand the whole concepts of this unit and feel less scared of opening a real computer.

From next academic year students will be guided step by step to build the micro-computer system by themselves throughout the unit. They can practice the knowledge taught in class on Raspberry Pi. This will give them very direct and practical experience of the computer system. The Raspberry Pi will also link the knowledge they learnt together, and they can use it in their final project. This will give students a much clearer view of the unit and help them to understand the topic better. Finally, taking advantage of so many interesting existing projects, we hope to increase students' interest, improve engagement and help them to think / learn beyond the unit.

References

Bolanakis, D. E., Glavas, E., & Evangelakis, G.A. (2007). An integrated microcontroller-based tutoring system for computer architecture laboratory course. *International Journal of Engineering Education, 23*(4), 785-797.

Darr, M. J., Stombaugh, T. S., Shearer, S. A., & Gates, R. S. (2007). A new course to teach microcontroller and embedded networking to biosystems and agricultural engineers, *International Journal of Engineering Education, 23*(4), 716-722.

Hamrita, T. K. (2005). Robotics, microcontroller and embedded systems education initiatives: An interdisciplinary approach. *International Journal of Engineering Education, 21*(4), 730-738.

Ibrahim, D. (2007). Low-cost microcontroller-based hardware for introducing digital filter fundamentals to students. *International Journal of Engineering Education, 23*(5), 1000-1010.

Jones, J. T., & Joordens, M. (2003). Distance learning for laboratory practical work in microcontrollers. *International Journal of Engineering Education, 19*(3), 455-459.

Land, B. R. (2015). Microcontrollers as components in electronic design. Retrieved from http://people.ece.cornell.edu/land/courses/ece4760

Leeb, S. (2015). Microcomputer project laboratory - Spring 2015. Retrieved from http://web.mit.edu/6.115/www/page/home.html

Milliken, J., & Cregan, M. (2012). Embedded C programming: A practical course introducing programmable microprocessors. *European Journal of Engineering Education, 37*(6), 557-574.

Roman, S. (2015). Teaching literature with the Raspberry Pi. Retrieved from http://www.edutopia.org/discussion/teaching-literature-raspberry-pi

Author Details

Jian Jiang
james.jiang@solent.ac.uk

Back to Contents page

DOES IT MATTER IF A FIRST YEAR PROGRAMMING STUDENT IS DIGITALLY LITERATE? THE EFFECT OF DIGITAL LITERACY ON A STUDENT'S PERFORMANCE IN COMPUTER PROGRAMMING

Glenda Barlow-Jones, Jacqui Chetty and Pieter Joubert
University of Johannesburg
Johannesburg, South Africa

Abstract

Information Technology is an increasing part of our everyday lives, and it is not uncommon to see students at a university walking around with smartphones, iPad's and laptops. These days', students are perceived to be digitally literate when starting their first year of studies. This, however, may not necessarily be true. This study is twofold: firstly, we examine the digital literacy level of the first year students at a South African university who are enrolled for a computer programming course; and secondly, we determine whether these students' digital literacy level has an impact on their programming ability. A quantitative approach was taken with a closed ended questionnaire used to collect data. The data that were collected were (a) analysed according to the students' access to and use of technology and (b) brought in relation to the students' final mark for their computer programming module. The results showed that there was a significant but weak positive correlation between (a) a student's computer experience and (b) use of common applications and their computer programming mark. However, the other four factors of use identified do not correlate significantly.

Keywords: digital literacy; computer programming; access to technology; use of technology; first year students

Introduction

People who embrace information and communication technologies (ICT), in particular the use of mobile phones and social media technology, possess a certain level of digital literacy. Digital literacy can be defined as "the interest, attitude and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate, analyze and evaluate information, construct new knowledge, create and communicate with others in order to participate effectively in society" (British Columbia Ministry of Education, 2013, para.3). People who are digitally literate are able to use desktop computers, laptops and mobile technologies for texting, searching the Internet, and downloading music and video files. They are part of online communities and able to use social media networks such as Facebook and twitter to communicate with friends and families as well as access services (Ng, 2012).

Digital literacy has several dimensions to it (Ng, 2012), namely; technical, cognitive and social-emotional. In the *technical dimension*, people have the technical and operational skills to use technology to either learn or to perform their everyday life tasks (Host'ovecky & Stubna, 2012). A digitally literate person would be able to operate technologies such as downloading files, understanding storage, installing software, etc. An example of a technical dimension would be connecting a computer to a printer. The *cognitive dimension* is associated with a person's ability to think critically, essential in computer programming. A digitally literate person would, for example, be able to evaluate and select appropriate software programs to learn with or to do a specific task. The *social-emotional dimension* of digital literacy focuses on people who use technology simply to socialize with others through the use of the Internet. They purely use digital technology to interact/communicate with other individuals through applications such as Facebook, Skype, MXIT, WhatsApp, Instagram, etc. (Paolini, Fiore, Contursi, & Bramani, 2006). Therefore, being digitally literate requires the development of a set of key skills that are technical, cognitive and social-emotional.

It is thus presumed that students when entering an Information Technology course at a tertiary institution know how to work with a computer and to surf on the Internet (Verhoeven, Heerwegh, & De Wit, 2010). In South Africa where this study was conducted, research suggests that this assumption may not be accurate (Thinyane, 2010). In 2013 the *Daily Maverick* (Davis, 2013) reported that out of 25 000 South African schools, 19,037 did not have a computer centre (76%). South Africa also has a relatively high proportion of households with no access to a computer (79%) (Statistics South Africa, 2012). Tertiary institutions today comprise a diverse student presence with a wide variety of digital literacy capabilities.

Context of the Study

This study is twofold: firstly, we examine the digital literacy level of the first year students studying the National Diploma Business Information Technology at the University of Johannesburg for the year 2014; and secondly, we determine whether these students' digital literacy level has an impact on their programming ability. A quantitative approach was taken with a closed ended questionnaire used to collect data from 116 first year computer programming students studying the National Diploma Business Information Technology at the University of Johannesburg. The data that were collected were (a) analysed according to the students' computer experience and use of technology and (b) brought in relation to the students' final mark for their computer programming module for semester 1.

Data Gathering Methods

Ethics approval for the research was obtained prior to the administration of the research instrument, which consisted of a questionnaire. The questionnaire was approved by a statistician at the University of Johannesburg and piloted on a group of 5 computer programming students. The questionnaire was administered in the first week of lectures for the year 2014. The first section of the questionnaire consisted of basic demographical questions, and the second section related to the students experience with and use of technology.

In order to determine how much computer experience a student had, they were asked about their experience with computers as shown in Table 1.

Table 1

How Much Experience Do You Have with Computers?

1.	I used computers for the first time at university
2.	1 to 2 years
3.	Since High School days
4.	Since Primary School days
5.	I used computers before I even started school

The questions in the second section were adopted from Kennedy, Judd, Churchward, Gray, & Krause (2008). There was a common set of a 5-point scale of AN=almost never true for me; S=sometimes true for me; HT=true for me about half of the time; O=often true for me; AA = almost always true for me; NA=I cannot respond to the statement/I don't understand the statement. The statements are shown in Table 2.

Table 2

Statements Investigating Students' Use of Technology Before Enrolling at University

Use of Technology Before You Enrolled at University
1. I used a computer in the home where I grew up
2. I used the Internet in the home where I grew up
3. I used a computer in the computer centre at school
4. I used the Internet on a computer at school
5. I used Internet Messaging (IM) like Yahoo/Windows Messenger or Mxit
6. I used search engines to search for information
7. I used the web for playing games
8. I accessed educational websites to learn more about my subjects
9. I used the web for banking, online ticketing, and other similar services
10. I used a web-based email account to send or receive email
11. I used the web to make phone calls (e.g. Skype)
12. I made use of cloud-based services like Google Drive, or Drop Box
13. I used a gaming console like Xbox, Playstation or Wii when I grew up
14. I used tools like MS Word, MS Excel or MS Publisher
15. I used computer-based music players (e.g. Winamp, Media Player, etc)
16. My teachers made use of computers to create learning materials
17. I used computers during classes to learn in my subjects
18. My teachers required that I use a computer for homework
19. I made use of Torrent services
20. I built websites
21. I had my own blog
22. I tried to have the latest version of a software programme
23. I tried to have the best hardware that I could afford

Data Analysis and Results

SPSS software was used to analyse the quantitative data. In order to determine how much computer experience students had, their answers to the questions in Table 1 were compared to their programming marks. The results show that there was a significant but weak positive correlation with a student's computer experience and programming mark, $r = .221$, $n = 114$, $p<0.05$. Interestingly, 16% of students used a computer for the first time at university and 15% only had 1 to 2 years' experience before embarking on their studies.

Table 3

Student's Computer Experience

How Much Experience Do You Have With Computers?		Frequency	Valid Percent
Valid	I used computers for the first time at university	19	16.7
	1 to 2 years	18	15.8
	Since High School days	24	21.1
	Since Primary School days	38	33.3
	I used computers before I even started school	15	13.2
	Total	114	100.0
Missing	System	2	
Total		116	

The students were then asked to indicate how often they used certain forms of technology by answering 23 related statements on a Likert scale as shown in Table 2. In order to reduce the 23 statements, five factors were identified. Factor 1 grouped commonly used applications such as MS Word, playing music, software, hardware and IM. Factor 2 grouped educational related uses such as Internet at school, computers at school, accessing of teachers' learning materials, and access in the classroom. Factor 3 grouped less common uses such as Skype, torrents, cloud-based services and banking. Factor 4 grouped web-based uses such as email, search engines, and educational websites and Factor 5 grouped creative uses such as having own blogs, building websites and playing games (see Table 4).

Table 4

Computer Use Factors

Computer Use Factor	Uses
Factor 1: Commonly used applications	in home, MS Word, music playing, gaming console, latest software, best hardware, IM
Factor 2: Education-related uses	Internet at school, computer at school, teachers learning materials, during classes to learn subjects
Factor 3: Less common uses	cloud-based services, teachers required use for homework, banking, torrent, skype
Factor 4: Web-based uses	email, search engines, educational websites
Factor 5: Creative uses	own blog, building websites, playing games

The results show that there was a significant but weak positive correlation with Factor 1 (commonly used applications) and the student's programming mark (see Table 5).

Table 5

Correlations

Correlations		
Factors		**Development Software Exam Mark**
Q20 How much experience do you have with computers?	Pearson Correlation	.221
	Sig. (2-tailed)	.018
	N	114
Computer use factor1: Common uses: in home, MS Word, music playing, gaming console, latest software, best hardware, IM	Pearson Correlation	.218
	Sig. (2-tailed)	.019
	N	115
Computer use factor 2: School use: internet at school, computer at school, teachers learning materials, during classes to learn subjects	Pearson Correlation	.099
	Sig. (2-tailed)	.293
	N	115
Computer use factor 3: Rarer uses: cloud-based services, teachers required use for homework, banking, Torrent, Skype	Pearson Correlation	.051
	Sig. (2-tailed)	.588
	N	115
Computer use factor 4: Web-based uses: email, search engines, educational websites	Pearson Correlation	.175
	Sig. (2-tailed)	.062
	N	115
Computer use factor 5: Creative use: own blog, building websites, playing games	Pearson Correlation	.141
	Sig. (2-tailed)	.135
	N	113

The other four factors of use do not correlate significantly. Interestingly, the statement "playing music" has the highest correlation with a student's programming mark (p=.000) as shown in Table 6.

Table 6

Q2.15 I Used Computer-Based Music Players Correlated with Computer Programming Mark.

Q2.15 I used computer-based music players (e.g., Winamp, Media Player, etc)	Pearson Correlation	.357
	Sig. (2-tailed)	.000
	N	113

Conclusions

In South Africa, we are becoming more digitally literate as technology evolves. This research has shown that the majority of students that choose to study the National Diploma Business Information Technology at the University of Johannesburg, have already had some level of interaction with technology. The results showed that there was a significant but weak positive correlation between (a) a student's computer experience and (b) use of common applications and the student's computer programming mark. However, the other four factors of use identified do not correlate significantly.

References

British Columbia Ministry of Education. (2013). Definition of digital literacy. Retrieved from http://www.bced.gov.bc.ca/dist_learning/digital-literacy.htm

Davis, R. (2013, June 18). Equal education to SA government: Lay down basic standards for schools. *Daily Maverick.* Retrieved from http://www.dailymaverick.co.za/article/2013-06-18-equal-education-to-sa-government-lay-down-basic-standards-for-schools/#.VQREVPyUdps

Host'ovecky, M., & Stubna, J. (2012). Development of digital literacy in technical subjects at primary schools. *Emerging eLearning Technologies and Applications (ICETA) 2012 IEEE 10th IEEE International Conference on*, 139-141. doi: 10.1109/ICETA.2012.6418606

Kennedy, G., Judd, T. S., Churchward, A., Gray, K., & Krause, K. (2008). First year students experiences with technology: Are they really digital natives? *Australian Journal of Educational Technology*, *24*(1), 108-122.

Ng, W. (2012) Can we teach digital natives digital literacy. *Computers & Education, 59*, 1065 – 1078.

Paolini, P., Fiore, N., Contursi, L., & Bramani, C. (2006). *DEA: Digital literacy open to impairments.* San Diego, CA.

Statistics South Africa (2012). *The South Africa I know, The home I understand.* Statistics South Africa. Pretoria: Author.

Thinyane, H. (2010). Are digital natives a world-wide phenomenon? An investigation into South African first year students' use and experience with technology. *Computers & Education, 55,* 406-414.

Verhoeven, J. C., Heerwegh, D., & De Wit, K. (2010). Information and communication technologies in the life of university freshmen: An analysis of change. *Computers & Education, 55*, 53-66.

Author Details

Glenda Barlow-Jones
glendab@uj.ac.za

Jacqui Chetty
jacquic@uj.ac.za

Pieter Joubert
pjoubert@uj.ac.za

Back to Contents page

A REVIEW OF THE USE OF COMPUTER ALGEBRA SYSTEMS IN VIRTUAL LEARNING ENVIRONMENTS

Juan Battaner-Moro
Southampton Solent University
United Kingdom

Abstract

This contribution will present a review on the availability and use of *computer algebra systems* (CASs) in *virtual learning environments* (VLEs) used for teaching mathematics within the context of higher education.

The integration and compatibility of different CASs in VLEs such as the free open-source Moodle environment and their potential in the support of Mathematics education will also be presented.

Keywords: Computer Algebra Systems, Virtual Learning Environment, Learning Management System, Moodle, Mathematics Education

Background

A ***virtual learning environment*** (VLE), also known as a learning management system, is a web-based platform that allows the management of most aspects of a course such as cohort organisation and enrolment, staff resourcing, the development of learning activities and online assessment, the collection of participation statistics, etc. (Paulsen, Nipper, & Holmberg, 2003).

The tools and features that comprise the VLE aim to facilitate a complete learning and teaching experience and include (O'Leary & Ramsden, 2002):

- Communication between tutors and students, e.g., email, discussion boards and virtual chat facilities that support various types of communication: synchronous and asynchronous, one-to-one, one-to-many and many-to-many.
- Self-assessment and summative assessment, e.g., multiple-choice assessment with automated marking and immediate feedback.
- Delivery of learning resources and materials, e.g., through the provision of learning and teaching materials, images and video clips, links to other web resources, online discussion and assessment activities.
- Shared work group areas-- allowing designated groups of students to upload and share files as well as communicate with each other.
- Support for students-- could take the form of communication with tutors or other students and provision of supporting materials such as course information and Frequently Asked Questions (FAQs).
- Student tools, e.g., individual student web pages, *drop boxes* for the upload of course-work, electronic diaries and calendars.

- Management and tracking of students, e.g., usernames and passwords to ensure that only registered students can access the course and analysis of assessment undertaken by students on their use of materials within the VLE.
- Consistent and customisable look and feel --a standard user interface that is easy for students to understand and use. Courses can be individualised with colours, graphics and logos – but the essential mode of use remains constant.
- Structured delivery of information supported by a standard navigation toolbar. Most VLE software assumes that students will work their way through linear sequences of instructional material. Others are more flexible and will accommodate alternative information structures, e.g., multi-path case studies.

There are many ways of using VLEs, ranging from simple uses of a limited range of tools to support face-to-face courses, through to entirely online courses that make sophisticated use of a wide range of the VLE's facilities.

As with any technology used in teaching and learning, VLEs have no intrinsic educational value in themselves. The way in which online courses and online activities are designed and delivered can add value and increase effectiveness. Below are some commonly perceived advantages and disadvantages of using a VLE.

Advantages

1. Easy online delivery of materials.
2. Easy to use for both students and lecturers.
3. Widens student access on and off campus to learning materials and resources.
4. Offers flexible support for educators who do not need to be in a fixed time or place to support and communicate with students.
5. Has the potential for new ways of learning and teaching, such as active and independent learning, which make use of online communication, online assessment and collaborative learning.

Disadvantages

1. Can become a 'dumping ground' for materials not designed to be delivered online.
2. Copyright and IPR of materials need to be considered.
3. Off campus access to hardware and networks can be problematic for both students and educators and raises issues of equality. Disability legislation and accessibility to online materials also need to be considered.
4. Need to plan online support carefully to avoid overload.
5. Such independent learning still needs to be guided and supported. Appropriate training and ongoing support is still needed for both students and educators.

Computer Algebra Systems

A ***computer algebra system*** (CAS) is a software package that performs calculation of mathematical problems in a manner that replicates the symbolic approach of a scientist or mathematician rather than using raw numerical computation. Originally developed as a scientific tool for research purposes, these computer programs are not only used for the computation of scientific problems, but also as teaching tools, mostly in science and technology subjects.

Development of CASs started in the 1960s as research tools mainly in the fields of computer science and theoretical physics. Availability was restricted to a handful of universities. The first popular computer algebra systems were muMATH, Reduce, Derive (based on muMATH), and Macsyma.

Currently, there are a number of systems available, which range from open-source to proprietary licensed software and from small user bases to large-scale adoption in industry and Academia. As of today, the most popular commercial systems are Mathematica and Maple, which are commonly used by research mathematicians, scientists, and engineers. On the open source or free-software front, packages such as Sage and SymPy are available.

The use of computer algebra systems has become increasingly important and widespread in mathematics research and teaching. Lavicza (2006), reported a questionnaire study enquiring about mathematicians' use of CAS in mathematics teaching in three countries: the United Kingdom, the United States, and Hungary. The study examined the extent of CAS use in universities, described some CAS-assisted teaching practices of mathematicians, suggested factors that influence technology integration into university level teaching, and highlighted mathematicians' views on the role of CAS in mathematical literacy. The study highlighted the importance of collaboration between mathematicians and educational researchers to enhance technology in mathematics teaching and learning. Responses from 67% of participants in Lavicza's study indicate that they used CAS for their own research at least on an occasional basis (see Table 1).

Table 1

Mathematicians' Use of CAS in Research and Teaching

Frequency		**Never (%)**			**Occasionally (%)**			**Frequently (%)**		
Country	n	HU	US	UK	HU	US	UK	HU	US	UK
CAS in research	1089	33.2	33.9	32.9	34.4	34.4	34.5	32.3	31.7	32.1
CAS in teaching	920	42.3	41.7	53.4	42.3	41	37.6	15.3	17.2	9.1

Note: Adapted from "The Examination of Computer Algebra Systems Integration into University-level Mathematics Teaching" by Z. Lavicza (2006) *Proceedings of the ICMI 17 study conference.*

Lavicza (2006) reported a large number of mathematicians who have acquired strong working knowledge of at least one mathematical software, and this knowledge can be readily utilized for CAS-assisted teaching. Proficiency in the use of a software package offers an advantage to mathematicians over teachers, as they often don't require initial training for software before beginning to use it in their teaching.

Integrating CAS in VLEs

The focus of this study is to explore if it is possible to embed a CAS in a virtual learning environment. Specifically, Moodle VLE will be assessed since this is the VLE currently in use at the author's teaching institution.

Moodle is an open-source virtual learning environment, which has been developed over several years with an emphasis on education. Moodle is claimed to be the world's most widely used school learning management system and is maintained regularly. Moodle's main characteristics are:

- The Moodle VLE is open source, which means no contracts or per user licensing costs to pay each year.
- Moodle can integrate course management structure, performing tasks such as administration and registration.
- Moodle supports personalised learning, reaching outside the teaching centres and better involving tutors, students and members alike.

Moodle is web based, and it is also highly configurable and extensible, allowing it to be customised to meet specific institutional needs. The integration of multimedia elements is typically done at a low level using JavaScript. Integrating a CAS in Moodle will then depend on its ability to merge with typical web-oriented schemas, such as HTML, Java, JavaScript, etc.

Table 2 shows a sample of free and commercial CASs that have been appraised on their ability to be integrated in Moodle.

Table 2

General-purpose Computer Algebra Systems Moodle Integration Capabilities

System	Creator	Integration with VLE
Axiom	Richard Jenks	No
Calcinator	George J. Paulos	Possible, browser based
FxSolver	Equanalysis UG	Possible via JavaScript
Mathics	Jan Pöschko	Possible via Python
Mathematica	Wolfram Research	Yes via .cdf player
Maxima	Bill Schelter et al.	No
OpenAxiom	Gabriel Dos Reis	No
Sagemath	William A. Stein	Possible, browser based
SMath Studio	A. Ivashov	No
SymPy	Ondřej Čertík	Possible, browser based
Yacas	Ayal Pinkus et al.	No

From all systems surveyed, only Mathematica (Mathematica, 1991) has been found to be capable of direct integration with Moodle. Mathematica is a commercial package that has been in development since 1988, and the current iteration is widely used in academic and commercial research. The system itself was developed as a research tool, originally in the field of symbolic mathematics, but over the years it has evolved into a whole system that allows numerical calculation, natural language processing, advanced simulation, etc. It also has a large repository of built-in curated scientific data that is accessible from the CAS itself. This repository is currently used by *artificial assistants* such as Apple's Siri, allowing them to respond to specific questions of any nature.

From a teacher's perspective, all the power of a CAS is no use if its use requires a learning curve that is above the intended learning needs for a particular topic or its use is restricted via license.

To address this Wolfram developed the ***computable document format*** (CDF) -- an electronic document format designed to allow authoring of dynamically generated interactive content using Mathematica (Wolfram, 2015). CDF is a published public format that supports *graphical user interface* (GUI) elements such as sliders, menus and buttons. Content is updated using embedded computation in response to GUI interaction. Contents can include formatted text, tables, images, sounds and animations. CDF supports Mathematica typesetting and technical notation.

The main disadvantage of the CDF is that its authoring requires the use of a licensed version of Mathematica. This disadvantage is reduced by the availability of a large repository (more than 10,000 documents) of free-to-use CDF files accessible at the Wolfram Demonstrations Project.

The Wolfram Demonstrations Project (http://demonstrations.wolfram.com/) is an open-code repository of dynamic computation files that apply to fields such as science, technology, mathematics, art, finance, etc. It is created by Mathematica users from around the world who participate by contributing code and demonstrations that can be immediately accessed via the Wolfram CDF Player plug-in, which is downloadable free of charge.

It is possible to embed demonstrations on Moodle or any other web-based service by copying and pasting a snippet of JavaScript code from the Share section of the demonstration page. Anyone with a CDF Player installed will be able to interact with the demonstration. See Figure 1 for an example.

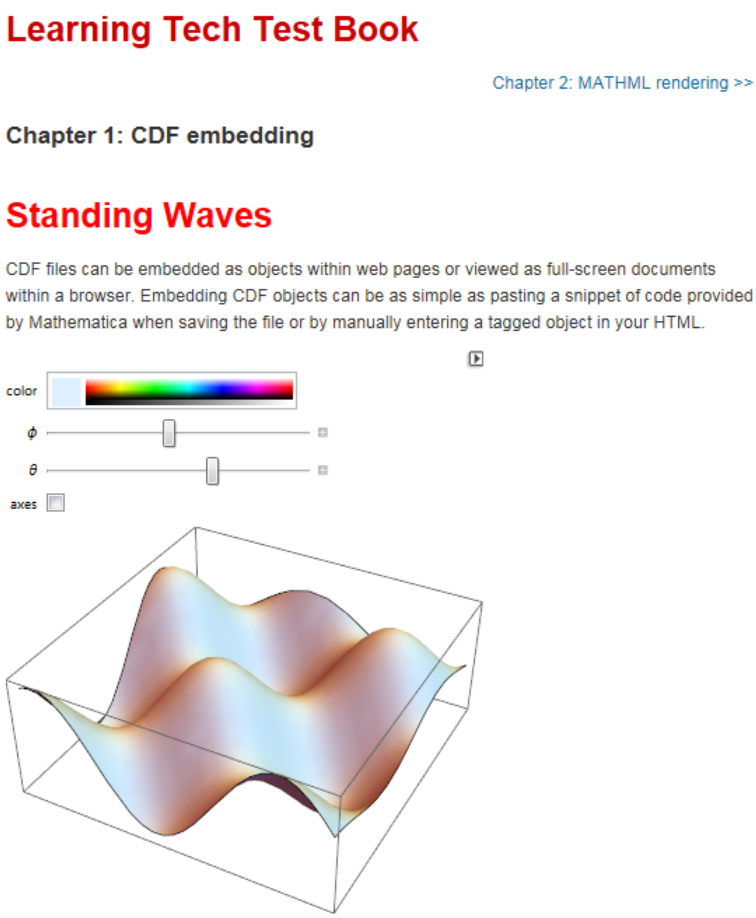


Figure 1. - Integration of a simple interactive CDF in the author's test Moodle environment.

A prototype embedded demonstration was successfully integrated by the author on Moodle showcasing interactive sliders which change the calculation parameters under the hood and update the visualisation instantly. Figure 1 shows a Moodle test page with the embedded CDF as coded by the author.

Two interactive sliders allow one to change parameters of the three-dimensional representation of two multiplying sine waves. The user can rotate the 3-D representation, and all calculations are done in real-time.

Conclusions

The use of CAS as a teaching and learning tool has been reported in several studies, but only on a computer laboratory setting.

The integration of computer algebra systems into virtual learning environments has been explored. Generally, it was found that for the majority of available CASs integration may be possible but would require significant web technology programming and understanding, which is not the typical remit of an educator.

The only CAS that was found to integrate directly with Moodle was Wolfram Mathematica, which is exclusively available commercially. However, the free availability of the CDF Player plug-in and large collection of ready-made demonstrations at the Wolfram Demonstration Project means that there is no need to acquire a license to embed existing interactive scientific demonstrations.

The embedding of computable demonstrations in VLEs is an additional tool to enhance student engagement and understanding that should be explored further.

References

Lavicza, Z. (2006). The examination of computer algebra systems integration into university-level mathematics teaching. In L. H. Son, N. Sinclair, J. B. Lagrange & C. Hoyles (Eds.), *Proceedings of the ICMI 17 study conference: Background papers for the ICMI 17 study* (pp. 37-44). Hanoi University of Technology, Hanoi, Vietnam.

O'Leary, R., & Ramsden, A. (2002). Virtual learning environments. In P Davies (Ed.), *The handbook for economics lecturers,* Bristol, UK: Learning Technology Support Service, University of Bristol. Retrieved from http://www.economicsnetwork.ac.uk/handbook/printable/vle_v5.pdf

Paulsen, M. F., Nipper, S., & Holmberg, C. (2003). *Online education: Learning management systems: Global e-learning in a Scandinavian perspective*. Bekkestua: NKI Forlaget.

Wolfram, C. (2015). Player for interactive computable document format. Retrieved from www.wolfram.co.uk/cdf-player

Wolfram. S. W. (1991). *Mathematica: A system for doing mathematics by computer* (2nd ed.). Reading, MA: Addison-Wesley.

Author Details
Juan Battaner-Moro
juan.battaner-moro@solent.ac.uk

Back to Contents page

ICICTE 2015

ICICTE Graduate Student Award Symposium Finalist Papers

EMOTIONAL EXPERIENCES IN SIMULATED CLASSROOM TRAINING ENVIRONMENTS

Kalliopi Evangelia Stavroulia, Democritus University of Thrace
Evanthia Makri-Botsari and Sarantos Psycharis, ASPETE, and
Gerassimos Kekkeris, Democritus University of Thrace
Greece

Abstract

This aim of the current research is to investigate the emotional experiences of pre-service teachers after the implementation of a simulated classroom environment during the semester. SimSchool classroom simulation was used for the training of pre-service teachers in classroom management issues. The research took place at the Democritus University of Thrace and the School of Pedagogical and Technological Education (ASPETE) in Greece. This paper presents the empirical data relative to the emotions pre-service teachers experienced during the simulated activities. Results indicated that participants experienced more negative than positive emotions including anxiety, nervousness, disappointment, insecurity, inability to deal with simSchool activities, defeat, dissatisfaction, fatigue, fear and stress. However, participants also experienced positive emotions including excitement, motivation and satisfaction.

Key words: simulation, teacher preparation, emotions

Introduction

Over the last decades, the implementation of Information and Communication Technologies-ICT in education changed dramatically the traditional teaching and learning context, providing new capabilities and tools for innovating teaching practices. However, despite the technological evolution and the modernization of the educational context, learning cannot be achieved without teachers. Teachers remain the most basic and dynamic factors of the educational process influencing student achievement and development (Mavrou & Meletiou-Mavrotheris, 2013). Undoubtedly, due to the rapid and continuous changes in today's classroom, teachers must redefine their roles and develop new and effective teaching strategies in order to create engaging and challenging learning experiences that meet the needs of their students (AITSL, 2011).

Although the technological advances promoted the transition from traditional to digital classrooms, teachers are not skilled and prepared to meet todays' challenges (Mavrou & Meletiou-Mavrotheris, 2013; Zhang, 2009). The traditional teacher training curriculum overemphasize to the theoretical pedagogical knowledge of pre-service teachers offering limited practical experience in real classrooms (Andreasen & Haciomeroglu, 2009; Darling-Hammond et al., 2005; Ellington et al., 2013; Oonk, 2009; Picollo & Oskorus, 2009; Zhang, 2009). Teacher training programs prepare future teachers on what and how to teach in ideal classroom conditions and as a result when the classroom door closes beginning teachers are unable to confront the difficulties that they face relative to classroom and behavior management issues (Andreasen & Haciomeroglu, 2009). Pre-service teachers are in need of practical knowledge in order to gain experience in practical problems that will allow them to understand the complexities and the realities of being a teacher.

According to Oonk (2009: 347) teaching practice is 'an integral component of teacher training' and can 'contribute to the making or breaking of a student teacher'. Despite the importance of teaching practice most teacher training programs offer few hours of practice in schools that in most cases has the form of observation and not of actual practice (Katsarou & Dedouli, 2008). The cost of teaching practice and school availability problems prevents student teachers from practicum experiences on authentic classroom situations (Kirby et al., 2006; Mahon et al., 2010; Zhang, 2009). In an effort to solve the lack of practice in teacher training and improve pre-service teachers' practical skills, simulation methods seem to be a promising tool providing a rich learning environment where candidate teachers can develop their teaching skills and practice (Ellington et al., 2003).

Defining the terms

Game based learning is not a new idea but has a long history. Gaming has served as tool for educational purposes since the 1600s, when war games were used for military training (Ellington et al., 2003; Jong et al., 2013). Research has indicated that gaming applications address both cognitive and affective dimensions of learning offering multiple benefits for the learners (De Freitas & Liarokapis, 2011; O' Neil et al., 2005). Moreover, game-based learning supports the constructivist learning theory that highlights the active participation of learners in knowledge acquisition. The last few year computer games like simulations are an integral part of the training programs in fields such as medicine, military, police, business, management, engineering and physics (Baek, 2009).

Simulations offer 'the unique possibility of designing an authentic learning experience when it is impossible or impractical to foster such an experience in the physical world' (Baek, 2009: 27). Within the simulated environment the user is 'in a realistic setting', confronting problematic situations that require 'active participation…decisions and actions' (pp. 29). Using simulations games in teacher training programs will allow pre-service teachers to experience real-life situations and achieve meaningful learning and deep understanding on the complexities of the classroom (Foley & McAllister, 2005; Ferry et al., 2004). Within this safe, interactive and dynamic learning environment pre-service teachers can practice their classroom management skills, learn to control their teaching time and experiment on disruptive classroom behaviors (Coffman, 2006; Ferry et al., 2004). Another significant aspect of classroom simulations is that they allow the users to reset the virtual classroom and try again making alternative decisions unlike a real classroom environment (Ferry et al., 2004; Sarpe, 2015). Within the simulated environment student teachers can experiment, make mistakes, reflect on their teaching, make changes and experiment again but in a way that does not affect negatively a real student (Baek, 2009; Foley & McAllister, 2005; Ferry et al., 2004; Zibit & Gibson, 2005).

It is recognized that classroom simulations can be used as a training tool to complement the traditional teacher preparation, promoting student teachers' awareness and decision making through authentic, engaging and dynamic learning experiences (Coffman, 2006). However, their success depends in the ability to transfer in real world situations the skills practiced and the knowledge gained during the game (Ellington et al., 2003; Kebritchi & Hirumi, 2008). One tool that seems promising for the training of student teachers is simSchool classroom simulation.

The simSchool classroom simulation

SimSchool is a dynamic web-based classroom simulation that offers pre-service teachers the opportunity to experience real life classroom situations in a virtual environment. It is a first person game where the player has the role of the teacher and is responsible for the success of the classroom. Within simSchool inexperienced teachers will have the ability to enter their virtual classroom and 'through repeated cycles of decision-making, experimentation, and refinement' develop 'new strategies and thinking like a teacher' (Zibit & Gibson, 2005:1). The technology behind SimSchool offers learners a variety of students with different attitudes and learning characteristics. During the simulation the user-teachers have an active role play and it is they who control the successful management of the classroom (Cima (2011). The user-teachers have to specify what the students need in order to assign the appropriate tasks, guide and support their students during the tasks and assess their progress by checking their academic, power and happiness levels (Cima (2011). Teachers must use a variety of teaching methods and strategies in order to engage their students and motivate them towards meaningful learning (Cima (2011).

Research in the use of simSchool in pre-service education reported a positive impact of the simulation in participants confidence and self-efficacy (IITTL, 2013; Christensen et al. 2011). Moreover, Mavrou and Meletiou-Mavrotheris (2013) and Christensen et al.'s (2011) reported that student-teachers found simSchool a safe environment to practice their teaching skills before entering a real classroom for the first time without the fear of making mistakes that can harm real students. However, despite the positive results after the use of simSchool simulation, research also identified several problems. According to Mavrou and Meletiou-Mavrotheris (2013) the use of simSchool as part of the course requirements did not allow the participants to be emotionally engaged during the game. Additionally, student-teachers characterized simSchool as a not user friendly simulation environment and they found its graphical design poor and unrealistic (Mavrou and Meletiou-Mavrotheris, 2013).

This research aims to investigate the use of classroom simulations in teachers training. For the purpose of the current research simSchool classroom simulation was used in order to train pre-service teachers in classroom and behavior management issues. The aim of the research was to investigate the emotional experiences of pre-service teachers during the simulated activities.

Emotions and learning

Emotions play an important role in any learning experience either it is a traditional classroom setting or a computer-based classroom simulation. Emotional experiences are important for the engagement of the users maximizing the quality of their learning experience (Hudlicka, 2009; Sansone & Thoman, 2005). Additionally, emotional experiences in simulation games can affect positive or negative players' attention and active participation during the simulation game (Anolli et al., 2010). According to Huldicka (2009), Hudlicka and Broekens (2009) and Conati and Zhou (2002), in order for games to be effective and realistic, game characters should possess emotional reactions such as embarrassment and body language including facial expressions, head and hand movement. The emotional variables need to affect the characters' decision making and behavior during the game leading to changes in facial expressions or body movements (Huldicka, 2009). Such emotional variables can generate emotions in real-time provoking a wide range of emotions to the players (Huldicka, 2009). The virtual students in simSchool possess 'dynamic…emotional, psychological, physical, cognitive, and social' characteristics (Gibson, 2012: 1). SimSchool virtual students are designed based on the COVE framework that is 'a computational model of learning that integrates models from Cognitive science, the OCEAN model of psychology, OCC model of emotions, Visual-Auditory-Kinesthetic perception' (Gibson, 2012: 1).

Although research on emotions has received much attention the last few years, literature relative to the emotional experiences of users in classroom simulated environments like simSchool remains extremely limited. The current research aims to investigate whether the emotional variables of simSchool virtual students generated pre-service teachers' emotional experiences during the implementation of the activities.

Method

This paper presents the empirical data of a research that sought to examine the emotional experiences of pre-service teachers during the implementation of simSchool classroom simulation. The data were collected during two different lessons in the spring semester from March to June 2014 in two different Universities, at the School of Pedagogical and Technological Education (ASPETE) and at the Democritus University of Thrace, in Greece. Pre-service teachers were trained in classroom and behavior management issues through the various simSchool activities.

Participants

A total number of 110 undergraduate students took part in the research. The sample consisted of undergraduate students. One sample consisted of N=47 (42,7%) undergraduate students from the Democritus University of Thrace-DUTH and N=63(57.3%) undergraduate students from the School of Technological and Pedagogical Education-ASPETE. Mainly, there were 63 (57.3%) men and 47 (42.7%) women, aged mostly between 18 and 30 years old (97.3%). The majority (96.4%) came from the 2nd and 3rd year of their respective undergraduate program with mostly little experience with teaching in real life settings. Furthermore, 96.3% of the participants reported having a little teaching experience up to four years and 3.7% reported having teaching experience more than 5 years.

Research Tools and Procedure

A combination of quantitative and qualitative approaches was used for the current research. Questionnaires were used as a data collection instrument consisting of open-ended and closed-ended questions. Initially, participants had to complete the first questionnaire that had to do with demographic data. Then, simSchool was introduced and explained in details, participants were registered to the online simulation and run quick simulations in order to be familiarized. At the end of the activities participants were asked to complete the second questionnaire. The final part of the questionnaire consisted of a scale with a number of words that described different feelings and emotions based on PANAS-X emotional scale. Participants had to answer to what extend they felt those feelings and emotions during the use of simSchool. Below are presented the frequency tables of the data gathered. In the current research paper only the results related to the emotional variables of the participants are presented.

Results

The distribution of gender, age and year of studies between the two universities in the research in presented in table 1 below.

Table 1

Distribution of the sample according to gender, age and year of study

		DUTH		ASPETE	
		Count	Column N %	Count	Column N %
Gender	Male	10	21,3%	53	84,1%
	Female	37	78,7%	10	15,9%
Age	18 - 30	46	97,9%	61	96,8%
	31 - 50	1	2,1%	2	3,2%
Year of Studies	2nd year	46	97,9%	3	4,8%
	3rd year	1	2,1%	56	88,9%
	4th year			1	1,6%
	5th year and above			3	4,8%

Rating their personal knowledge on Information and Communication Technology (ICT) the majority of the participants reported a fair level of understanding on the subject, while there was no differentiation in the response on account of participants' gender ($x2= 2.652$, $df = 1$, Asymp. p – value = 0.103).

Table 2

Descriptive statistics relative participants' ICT knowledge

		ICT knowledge					
		Not at all	Beginner	Fair	Good	Very good	Excellent
Gender	Male	3	16	22	18	3	1
		4,8%	25,4%	34,9%	28,6%	4,8%	1,6%
	Female	2	4	21	14	5	1
		4,3%	8,5%	44,7%	29,8%	10,6%	2,1%
Total		5	20	43	32	8	2
		4,5%	18,2%	39,1%	29,1%	7,3%	1,8%

The participants were asked to evaluate their teaching skills before the use of simSchool. As shown in table 3 below, most of the participants rated themselves as 'good' teachers, with no significant differentiations between participants' gender.

Table 3

Descriptive statistics relative to Self-reported teaching skills

		Self-reported teaching skills									
		Poor		Fair		Good		Very good		Excellent	
Gender	Male	6	(9,5%)	19	(30,2%)	30	(47,6%)	6	(9,5%)	2	(3,2%)
	Female			11	(23,4%)	28	(59,6%)	7	(14,9%)	1	(2,1%)

Six of the participants did not complete the second questionnaire since they were absent from the lesson the specific day and as a result the total number of participants for the analysis of the emotional variables are N= 104.

The final part of the second questionnaire consisted of a 16 words that described different emotions rated on a 5-point Likert scale from not at all to extremely. Participants had to answer to what extend they felt those emotions during simSchool activities. The results were analyzed with the use of SPSS 17 software. Reliability analysis was conducted on the variables of emotions. According to the results (see table 4 below) the overall alpha is 0.817>0.7 indicating a high reliability of the variables.

Table 4

Reliability statistics- Cronbach' Alpha on the variables of emotions

Cronbach's Alpha	
Cronbach's Alpha	N of Items
,817	16

Table 5 below presents the descriptive statistics relative to the emotional variables of all the participants. Tables 6 and 7 present the emotional scales for the Democritus University of Thrace-DUTH and the School of Technological and Pedagogical Education-ASPETE respectively. The results indicate that during the use of simSchool the majority of the participants (68.3%) experienced anxiety ranging from a little to extremely, whereas, 31.7% did not felt anxious at all. Moreover, 77.6% of the participants felt nervous during the simulation and their responses range from a little to extremely. However, 22.3% did not experience nervousness during playing.

The results also reveal that 73% of pre-service teachers felt disappointed during the activities and experienced high levels of insecurity (61.5%). The majority of the participants (83.7%) felt unable to deal with the various classroom and behavior management issues and experienced high levels of defeat (68.3%).

Moreover, many pre-service teachers experienced emotions of embarrassment (63.5%) and felt dissatisfied (64.4%) by themselves during the simulated activities. Another significant result is that the vast majority of the participants (94.2%) felt tired during the simSchool activities. Furthermore, many of the participants experienced emotions of fear (48.1%) and stress (69.2%) during the use of the simulation, while many of them where confused (70.2%) during the activities.

Despite the negative emotions, participants also experienced positive emotions. The vast majority of the participants felt excited (90.4%) and satisfied (90.4%) during the simSchool activities. Additionally, the results indicate that simSchool motivated the majority of pre-service teachers (92.3%) and kept their interest (95.2%).

Table 5

Descriptive statistics relative to the emotional experiences of all the users

Emotional variables										
	Not at all		A little		Moderately		Quite a bit		Extremely	
Anxiety	33	31,7%	25	24,0%	24	23,1%	21	20,2%	1	1,0%
Nervousness	23	22,3%	27	26,2%	27	26,2%	17	16,5%	9	8,7%
Disappointment	28	26,9%	30	28,8%	19	18,3%	20	19,2%	7	6,7%
Insecurity	40	38,5%	20	19,2%	25	24,0%	14	13,5%	5	4,8%
Inability to deal with the situation	17	16,3%	36	34,6%	28	26,9%	11	10,6%	12	11,5%
Feeling of	3	31,7	2	24,0	2	26,9	1	9,6%	8	7,7%

defeat	3	%	5	%	8	%	0			
Excitement	10	9,6%	15	14,4%	27	26,0%	37	35,6%	15	14,4%
Embarrassment	38	36,5%	30	28,8%	26	25,0%	9	8,7%	1	1,0%
Dissatisfied by self	37	35,6%	32	30,8%	23	22,1%	10	9,6%	2	1,9%
Fatigue	6	5,8%	25	24,0%	37	35,6%	25	24,0%	11	10,6%
Fear	54	51,9%	32	30,8%	13	12,5%	3	2,9%	2	1,9%
Motivation	8	7,7%	10	9,6%	24	23,1%	45	43,3%	17	16,3%
Satisfaction	10	9,6%	16	15,4%	36	34,6%	29	27,9%	13	12,5%
Confusion	31	29,8%	22	21,2%	24	23,1%	17	16,3%	10	9,6%
Interest	5	4,8%	10	9,6%	25	24,0%	35	33,7%	29	27,9%
Stress	32	30,8%	25	24,0%	27	26,0%	12	11,5%	8	7,7%

Table 6

The emotional variables at the Democritus University of Thrace

	Not at all		A little		Moderately		Quite a bit		Extremely	
Anxiety	13	27,7%	12	25,5%	9	19,1%	12	25,5%	1	2,1%
Nervousness	7	14,9%	8	17,0%	13	27,7%	12	25,5%	7	14,9%
Disappointment	9	19,1%	11	23,4%	11	23,4%	12	25,5%	4	8,5%
Insecurity	16	34,0%	9	19,1%	12	25,5%	8	17,0%	2	4,3%
Inability to deal with the situation	5	10,6%	12	25,5%	15	31,9%	9	19,1%	6	12,8%
Feeling of defeat	12	25,5%	10	21,3%	13	27,7%	8	17,0%	4	8,5%
Excitement	7	14,9%	9	19,1%	10	21,3%	13	27,7%	8	17,0%
Embarrassment	10	21,3%	16	34,0%	16	34,0%	5	10,6%	0	,0%
Dissatisfied by self	16	34,0%	16	34,0%	11	23,4%	4	8,5%	0	,0%
Fatigue	2	4,3%	7	14,9%	20	42,6%	10	21,3%	8	17,0%
Fear	23	48,9%	15	31,9%	8	17,0%	0	,0%	1	2,1%
Motivation	4	8,5%	4	8,5%	13	27,7%	20	42,6%	6	12,8%
Satisfaction	8	17,0%	9	19,1%	13	27,7%	12	25,5%	5	10,6%
Confusion	7	14,9%	8	17,0%	13	27,7%	12	25,5%	7	14,9%
Interest	3	6,4%	8	17,0%	11	23,4%	11	23,4%	14	29,8%
Stress	11	23,4%	9	19,1%	16	34,0%	7	14,9%	4	8,5%
a. University = DUTH										

Table 7

The emotional variables at the School of Technological and Pedagogical Education

	Not at all		A little		Moderately		Quite a bit		Extremely	
Anxiety	20	35,1%	13	22,8%	15	26,3%	9	15,8%	0	,0%
Nervousness	16	28,6%	19	33,9%	14	25,0%	5	8,9%	2	3,6%
Disappointment	19	33,3%	19	33,3%	8	14,0%	8	14,0%	3	5,3%
Insecurity	24	42,1%	11	19,3%	13	22,8%	6	10,5%	3	5,3%
Inability to deal with the situation	12	21,1%	24	42,1%	13	22,8%	2	3,5%	6	10,5%
Feeling of defeat	21	36,8%	15	26,3%	15	26,3%	2	3,5%	4	7,0%
Excitement	3	5,3%	6	10,5%	17	29,8%	24	42,1%	7	12,3%
Embarrassment	28	49,1%	14	24,6%	10	17,5%	4	7,0%	1	1,8%
Dissatisfied by self	21	36,8%	16	28,1%	12	21,1%	6	10,5%	2	3,5%
Fatigue	4	7,0%	18	31,6%	17	29,8%	15	26,3%	3	5,3%
Fear	31	54,4%	17	29,8%	5	8,8%	3	5,3%	1	1,8%
Motivation	4	7,0%	6	10,5%	11	19,3%	25	43,9%	11	19,3%
Satisfaction	2	3,5%	7	12,3%	23	40,4%	17	29,8%	8	14,0%
Confusion	24	42,1%	14	24,6%	11	19,3%	5	8,8%	3	5,3%
Interest	2	3,5%	2	3,5%	14	24,6%	24	42,1%	15	26,3%
Stress	21	36,8%	16	28,1%	11	19,3%	5	8,8%	4	7,0%
a. University = ASPETE										

Conclusions and future work

This paper identified the need to use new and innovative tools such as classroom simulations in teacher training in order to bridge the lack of practice in the traditional teacher preparation programs and familiarize future teachers with new technologies. For the purpose of this research simSchool classroom simulation was used for the training of Greek pre-service teachers in classroom and behavior management issues. The research investigated the emotions experienced by the participants during the implementation of simSchool activities.

In the empirical work reported in this paper there was evidence that simSchool generated real-time emotions to pre-service teachers. It is possible that virtual students that were embodied with emotional variables engaged and motivated the players during the game (Anolli et al., 2010; Hudlicka, 2009; Sansone & Thoman, 2005).

The results revealed that participants experienced negative emotions including anxiety, nervousness, disappointment, insecurity, inability to deal with the various situations, embarrassment, dissatisfaction by themselves, fatigue, fear, stress and confusion. During the simulation activities pre-service teachers experienced negative emotions including embarrassment, insecurity and stress that are also emotions that beginning teachers experience in the real classroom setting (Katsarou & Dedouli, 2008). It seems that simSchool created participants a sense of presence, a sense of being there, that might have generated emotions similar to those they would feel in a real classroom setting. Moreover it is possible participants' ICT level affected them negatively. Most of the participants reported to have a fair knowledge of ICT and it is possible that their unfamiliarity with computers and online networking affected them negatively. Moreover, simSchool was not in the mother tongue of the participants and maybe they found it difficult to use the menu buttons and navigate within simSchool environment despite the material with instructions and translations in Greek that they were given.

Nevertheless, participants also experienced positive emotions including excitement, satisfaction, motivation and interest. The challenge is to relate participants' emotional experiences with their cognitive development revealing the importance of emotions in the learning process. The correlation analysis between the emotional and cognitive variables is still under development but seems promising.

Several are the directions for future work. There is a need to further investigate participants' emotional experiences in simulated environments like simSchool. Moreover, future research could be conducted to identify whether the emotional experiences of pre-service teachers were generated by the modeling of emotions in the virtual students. As the traditional teacher training programs do not promote socio-emotional learning, it is essential for future classroom simulations to enhance future teachers' socio-emotional competencies that can affect students' development (Schonert-Reichl & Zakrzewski, 2014). Finally, it is also important to explore participants' sense of presence in classroom simulations such as simSchool that plays an important role in participant' learning and emotional experiences.

References

AITSL- Australian Institute for Teaching and School Leadership (2011). National professional standards for teachers. Retrieved January 11, 2015 from http://www.aitsl.edu.au/docs/default-source/default-document-library/aitsl_national_professional_standards_for_teachers

Andreasen, J. B., & Haciomeroglu, E. S. (2009). Teacher Training in Virtual Environments. In S. L. Swars, D. W. Stinson, & S. Lemons-Smith (Eds.), *Proceedings of the 31st annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1317-1324). Atlanta, GA: Georgia State University.

Anolli, L., Mantovani, F., Confalonieri, L., Ascolese, A., & Peveri, L. (2010). Emotions in Serious Games: From Experience to Assessment. *International Journal of Emerging Technologies in Learning* (iJET), 5 (3), 7-16.

Baek, Y. (2009). Digital Simulation in Teaching and Learning. In D. Gibson & Y. Baek (Eds.), *Digital Simulations for Improving Education: Learning Through Artificial Teaching Environments* (pp. 25-51), USA: IGI Global.

Cima, E. (2011). SimSchool. Retrieved February, 5, 2013 from http://omoso-cima.blogspot.com/2011/10/simschool.html

Coffman, T. (2006). Using Simulations to Enhance Teaching and Learning: Encouraging the Creative Process. VSTE Journal, 21 (2), Retrieved January 4, 2015 from http://vste.org/documents/vj_2006_02.pdf

Conati, C. & Zhou, X. (2002). Modeling Students' Emotions from Cognitive Appraisal in Educational Games. In *Proceedings of the 6th International Conference on Intelligent Tutoring Systems* (pp. 944-954). Biarritz, France.

Christensen, R., Knezek, G., Tyler-Wood, T., & Gibson, D. (2011). SimSchool: an online dynamic simulator for enhancing teacher preparation. *Int. J. Learning Technology*, 6 (2), 201-220.

De Freitas, S.D., & Liarokapis, F. (2011). Serious Games: A new Paradigm for Education. in M. Ma, A. Oikonomou, & L.C. Jain (Eds.), Serious Games and Edutainment Applications (pp. 9-24). London: Springer.

Darling-Hammond, L., Hammerness, K., Grossman, P., Rust, F., & Shulman, L. (2005). The design of teacher education programs. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world* (pp. 390-441). San Francisco, CA: Jossey-Bass.

Ellington, H., Gordon, M., & Fowlie, J. (2013). Using games & simulations in the classroom. London: Routledge.

Ferry, B., Kervin, L, Cambourne, B., Turbill, J., Puglisi, S., Jonassen D. & Hedberg, J. (2004). Online classroom simulation: The ‘next wave’ for pre-service teacher education? In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds), Beyond the comfort zone, Proceedings of the 21st ASCILITE Conference (pp. 294-302). Perth, 5-8 December.

Gibson, D. (2012). Modeling emotions in simschool. Retrieved February 16, 2014 from http://www.lorentzcenter.nl/lc/web/2011/464/presentations/Gibson.pdf

Hudlicka, E. (2009). Affective game engines: motivation and requirements. In Proceedings of the 4th International Conference on Foundations of Digital Games (pp. 299-306). Orlando: Florida.

Hudlicka, E., & Broekens, J. (2009). Foundations for modelling emotions in game characters: Modelling emotion effects on cognition. In *Affective Computing and Intelligent Interaction and Workshops* (pp. 1-6). Amsterdam, Netherlands.

IITTL-Institute for the Integration of Technology into Teaching and Learning (2013). SimMentoring. Retrieved August, 10, 2013 from http://www.iittl.unt.edu/IITTL/fipse/simMentoring_web/proposal.html

Jong, M.S.Y., Lee, J.H., & Shang, J. (2013). Educational Use of Computer Games: Where We Are, and What’s Next. In Shi, Z., Zhou, Z., & Huang, R. (Eds.), Reshaping Learning, New Frontiers of Educational Research, (pp. 299-320). Heidelberg: Springer.

Katsarou, E., & Dedouli, M. (2008). *Training and evaluation in education* (in Greek). Athens: PI-Pedagogical Institute of Greece.

Kebritchi, M., & Hirumi, A. (2008). Examining the pedagogical foundations of modern educational computer games. Computers & Education, 51, 1729-1743.

Kirby, S., McCombs, J., Barney, H., & Naftel, S. (2006). *Reforming teacher education: Something old, something new*. Santa Monica, CA: RAND Corporation.

Mahon, J., Bryant, B., Brown, B., & Kim, M. (2013).Using Second Life to enhance classroom management practice in teacher education. *Educational Media International*, 47 (2), 121–134.

Mavrou, K., & Meletiou-Mavrotheris, M. (2013). Flying a math class?: Using web-based simulations in primary teachers training & education. In S. Mukerji & P. Tripathi (Eds), Handbook of Research on Transnational Higher Education Management (pp. 391-417). USA: IGI Global.

O'Neil, H.F., Wainess, R., & Baker, E.L. (2005). Classification of Learning Outcomes: Evidence from the Computer Games Literature. Curriculum Journal, 16 (4), 455-474.

Oonk, W. (2009). *Theory-enriched practical knowledge in mathematics teacher education*. Leiden University: ICLON.

Piccolo, D., & Oskorus, A. (2009). Designing Commercial Simulations for Teachers. In D. Gibson & Y. K. Baek (Eds.), *Digital Simulations for Improving Education: Learning Through Artificial Teaching Environments* (pp. 249-272). USA: IGI Global.

Sarpe, A. (2015). A study of application of training in simulation teaching of B.Ed. teacher –trainees. Renewable Research Journal, 3, 56-60.

Sansone, C., & Thoman D. B. (2005). Does what we feel affect what we learn? Some answers and new questions. *Learning and Instruction*, 15 (5), 507-515.

Schonert-Reichl, K. & Zakrzewski, V. (2014). How to Close the Social-Emotional Gap in Teacher Training. Retrieved February 10, 2015 from http://greatergood.berkeley.edu/article/item/how_to_close_the_social_emotional_gap_in_teacher_training

Zibit, M., & Gibson, D. (2005). SimSchool: the game of teaching. Innovate, 1 (6). Retrieved February, 22, 2013 from http://www.innovateonline.info/index.php?view=article&id=173

Zhang, W. (2009). Issues of Practical Teaching in Vocational-Technical Schools in China and Their Countermeasures. International Educational Studies, 2 (4), 75-78.

Author details

Kalliopi Evangelia Stavroulia

stauroulia_ke@yahoo.gr

Evanthia Makri-Botsari

evibotsari@otenet.gr

Sarantos Psycharis

spsycharis@gmail.com

Gerassimos Kekkeris

kekkeris@eled.duth.gr

TOWARDS AN INSTRUCTIONAL TOOL FOR THE TEACHING OF ENGLISH AS A SECOND/FOREIGN LANGUAGE (ESL/EFL) IN HIGHER EDUCATION

Evriklea Dogoriti
University of Ioannina
Greece

Abstract

This study seeks to determine the way EFL can be taught online, focusing on learners' needs and envisioning a web tool to meet the dynamic needs of today's foreign language students in higher education. Hence, this paper provides a discussion about the difference that the incorporation and integration of social networking platforms make to teaching with a LMS. To meet this end, the study investigated EFL university students' perceived beneficial value of the ICT tools used in the learning process in relation to (a) motivation (b) engagement (c) performance and (d) communication in a technology-enhanced language classroom.

Key words: instructional design, e-learning tools, social networks, English as a foreign language

Introduction

The contribution of Information and Communication Technologies (ICTs) to the teaching of English as a foreign language (TEFL) is widely acknowledged. The use of technology in teaching foreign languages has been increasing extremely over recent decades as it has revolutionized the approaches to teaching foreign languages. As a result of a plethora of new pedagogical and technological tools, new education practices have been developed to accommodate educational values and human diversity. Differences in learning styles have stimulated interest in how technology can help meet students' need to acquire foreign language competency. Learners carry their own individual approach and interests to the learning situation. The literature seems to suggest that students increasingly rely on social media and the web for their studies (Junco, 2011b; Davis *et al.*, 2012).Traditional-aged university students have embraced social media technology and are known as "digital natives" or "net generation" because such social media technology exchanges have been part of their entire lives (Prensky, 2001; Jones *et al.*, 2010). Given this insight, researchers explore more opportunities to seek creative ways to use social media technology in an effort to reach out to students and meet their needs. In that regard, understanding the use and the value of ICT tools used in the learning process can help educators revolutionize their approaches to teaching foreign languages and integrate technology in a meaningful way.

Integrating Technology in Foreign Language Instruction

- Technology integration is the use of technology resources- computers, mobile devices, videos, digital cameras, social media platforms and networks, software applications, the Internet among others- in daily classroom practices. Successful technology integration is achieved when it helps supports the curricular and the students' goals, when students use it effortlessly and regularly and have easy access to it (Smith, 2007). The benefits of ICT integration in education have been extolled by many researchers and have been reported to:

- help students engage in academically purposeful activities, become autonomous in learning and support their collaborative linguistic skills (Dudeney&Hockly, 2007; Prensky, 2010).
- higher their levels of engagement (Davies, 2011)
- strengthen their ties to the educational institution(Anderson, 2007)
- Support student-centered and self-directed learning(Castro, Sánchez and Alemán 2011)
- Produce a creative learning environment (Chai, Koh and Tsai 2010)
- Offer more opportunities to develop critical (higher-order) thinking skills (McMahon, 2009)
- Improve teaching and learning quality (Gee, 2011)
- Support teaching by facilitating access to course content (Conole, and Alevizou, 2010)

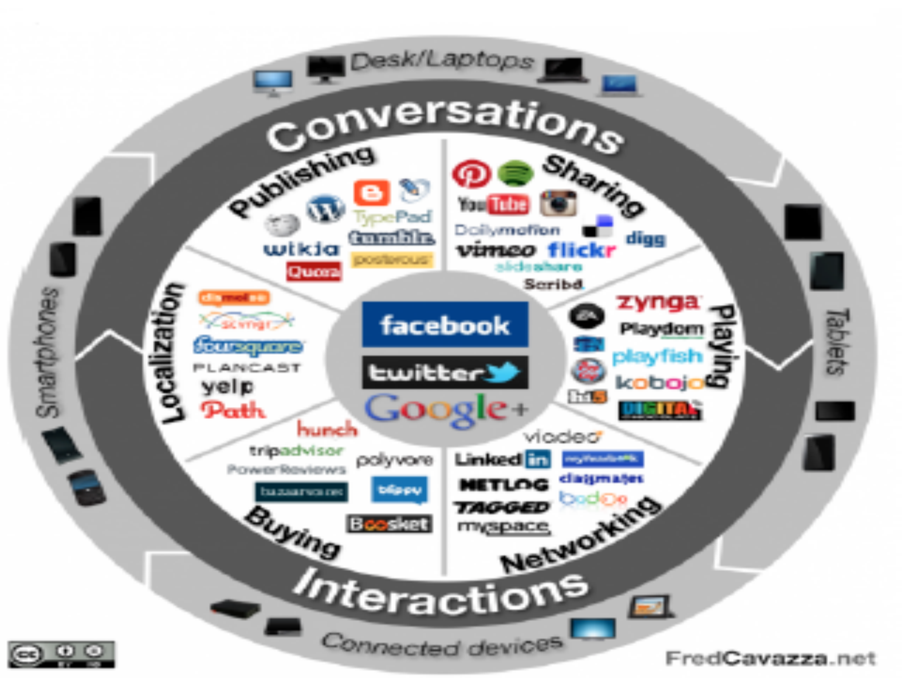
Literature suggests that instruction using ICT should be viewed as an enhancement to the traditional way of teaching rather than a substitute for it (McLoughlin & Lee, 2014). Technology tools combined with appropriate instructional design can create a good learning environment that is motivational and can lead to effective language learning (Huang *et al.*, 2011). ICT mediation can foster the students' engagement in language learning (Kharade, & Thakkar, 2012). Digital tools can affect communication between students and educators, increase their engagement and interest in their studies and benefit their performance (Project Tomorrow, 2010). Aspects of student engagement are manifested through taking initiative and responsibility for learning, using resources, time on task, sharing information and pursuing learning beyond classrooms (Parsons & Taylor, 2011). These elements constitute what Brown (2000) calls "learning ecologies", in other words an environment for learning with the right tools that supports social learning.

Technology Resources and Online Foreign Language Learning

Social interaction is undoubtedly another element which shapes effective learning experiences (Dunleavy & Milton, 2009). The fact that students engage in the digital world makes the use of alternative methods of learning quite appealing. "Net Geners want more hands-on, inquiry based approaches to learning and are less willing to simply absorb what is put before them" (as cited in Barnes, Marateo, & Ferris, 2007, p. 23). Learning becomes as much social as cognitive as students explore and take their learning into a larger community beyond the classroom seeking relevant, meaningful, and authentic tasks (Willms, *et al.*, 2009, p. 34). As Oblinger & Oblinger (2005) state student engagement and motivation depend on building social connections between learners and making curriculum and instruction relevant to their experiences and targets. Claxton (2007) further suggests that learners engage in activities that are relevant to their field of study, give them the option to organise their study and are connected to reality. Barnes, Marateo, and Ferris

(2007a) refer to a list of multimedia tools- among others social networks, learning management systems (LMS), wikis, blogs-, that comprise the technological methods that can help students engage in their learning and construct knowledge. Learning with the help of Web 2.0 tools and Social media has positive impact on language learning making learning a collaborative and communicative process that can provide a more diverse custom made student experience through asynchronous environments. (Dogoriti & Pange, 2014; Clark &Gruba, 2010).The findings of studies show that online language learning and instruction through social media and LMS help learners learn autonomously and interact with peers and facilitators with online tools like e-mail, chat, formal lowing negotiation of meaning and knowledge construction (Felix, 2005; Dogoriti & Pange, 2014;). Nevertheless, LMSs are deemed by many as a teacher-centered tool using technology to deliver content to learners, since it is no one other than the teacher who decides on the material presented in the LMS course (David, 2013). Likewise, critiques on the use of social media tools like Facebook and Twitter in language teaching mainly focus on the fact that they can be used to foster socialization, interaction, cooperative learning, facilitate peer assessment and engaging learners in generating content which in turn help to enhance learners' motivation (Shih, 2011).Given the affordances of the LMSs and social media tools, like Twitter, Facebook or Edmodo a more flexible and customizable tool such as a personal learning environment (PLE) which could perhaps combine the best of both worlds needs to be explored. As Laru *et al.* (2012) argue the integration of multiple tools to support learning has not been extensively explored. Frédéric Cavazza's diagram below shows the multitude of tools currently available in online education.

Figure 1. Social Media Landscape



(Source: http://www.fredcavazza.net/2014/05/22/social-media-landscape-2014/)

Materials and Methods

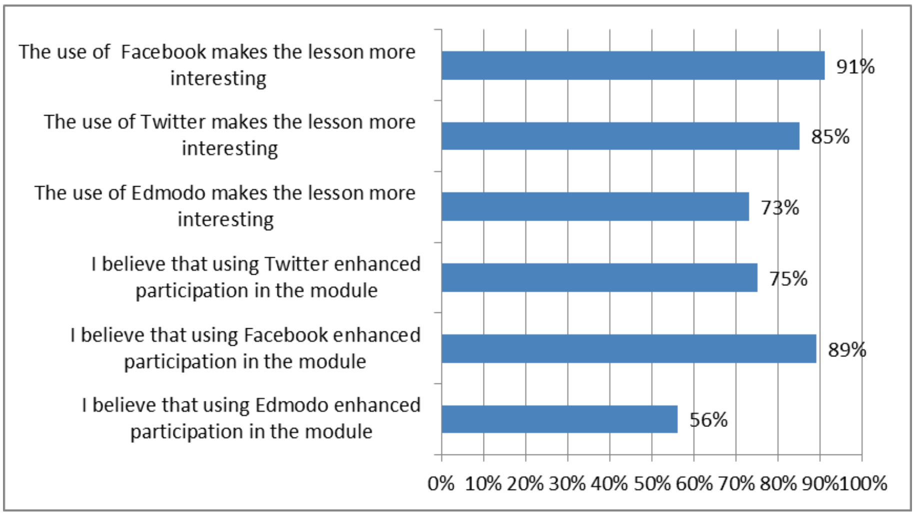
The current research seeks to explore how social media tools and LMS can be employed to facilitate language learning. Moreover, it attempts to explore the characteristics which may increase learners' motivation and engagement and lead to better interaction between students and teachers. Moodle (Modular Object Oriented Dynamic Learning Environment) has been selected as the course management tool where the course material was uploaded. Moodle is one of the most widely-used learning management platforms in education and since 2010 it is constantly evolving with many new add-ons such as forums, wikis and chat rooms. It is underpinned by a social constructivist approach to learning incorporated into language learning and can be customized for delivery of language instruction (Wright & Wright, 2011). It provides a secure environment where students and instructors must log in to access resources in which to develop their knowledge, enabling language learning autonomy and knowledge scaffolding. In this study the students were also provided with multiple social media tools, namely Edmodo, Facebook, Twitter in addition to face-to-face activities for their language learning to maximize the benefits of the Virtual Learning Environment (VLE). A qualitative approach was taken to the research to measure the students' reaction to the use of multiple social media tools within an educational context. The focus of this study is on the subject of English language taught within the context of their academic methodology course at level C1-C2 in the department of English Language and Literature in the Aristotle University of Thessaloniki. The participants consisted of 79 undergraduate students. The module was delivered over the winter semester 2014-2015. The students had three contact hours per week for this module in the context of their academic course. This module was not a mandatory component of the students' respective program, but was available as an elective module. Moodle was used as the platform for course administration and content delivery. The social media tools adopted in the course were Facebook, Twitter and Edmodo to facilitate communication. Students were asked to sign in a closed group in all three social media so as to ensure the privacy of the course content and the posts (Boyd & Ellison 2007).

They were then divided into three groups in order to use and assess each of the ascribed social network tool. A qualitative approach was taken to the research in order to examine the students' response to the use of multiple social media tools within an educational context. In addition, student reaction to the use of multiple social media tools was recorded in an online survey. Initially, students were asked to complete a pre-test to validate their language level. A mixed method (content analysis-questionnaires) was employed to measure the data: content analysis refer to the use and frequencies of the social media tools and the questionnaires to the students' beliefs, reflections, perceptions and attitudes regarding the benefits, experiences, and challenges about each of these technology tools. The questionnaire was structured in two major segments. The first segment aimed to explore and assess the motivation, engagement and communication of the participants while the second segment, aimed to seek the perceptions of the students on the SNSs particular tools for communication and information. Each set of questionnaires contained 30 questions regarding demographics, technology usage, tenure in the platform, satisfaction with the tools, motivation and communication. It contained a combination of likert type, yes/no, closed ended questions. Gender and lists of student names were collected from the existing course.

Results

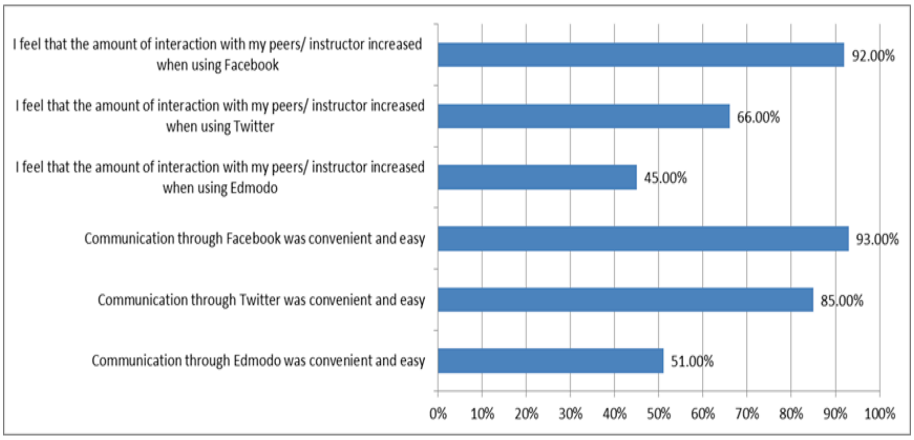
The first segment aimed to explore and assess the motivation, engagement and communication of the participants. As the results show in figure 2 students who used Facebook in their Moodle course found it makes the lessons more interesting (91%) followed by Twitter by a narrow margin (85%) and Edmodo (73%). The students' motivation for participation in class activities was enhanced most with Facebook use (89%) and a little less with Twitter (75%) and Edmodo (56%).

Figure 2: perceived degree of motivation



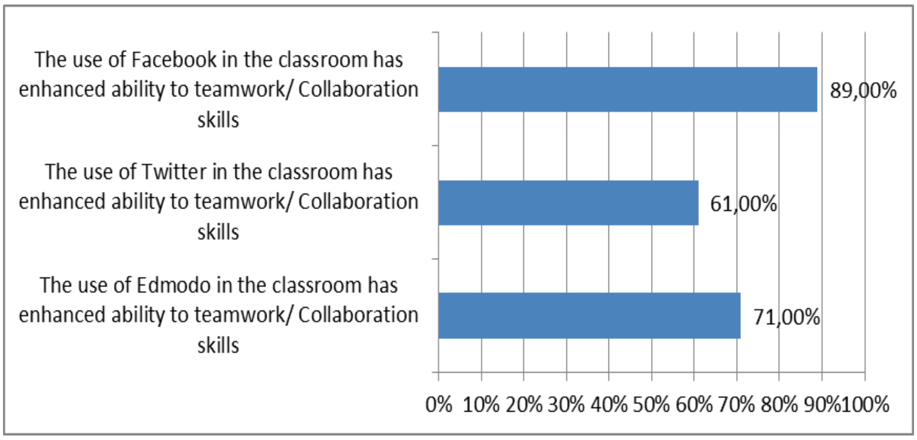
Participants were finally asked to rate communication among students and among students with their instructor (figure 3). The majority of students (89%) found Facebook a more convenient and easy means of communication. Others are more closely related to the use of Twitter for class communication (85%) and Edmodo at (51%). A total of 92 % of the participants responded that the overall amount of interaction with peers/ instructor increased when using Facebook whereas Twitter had a smaller rating (66%) and Edmodo (45%).

Figure 3: perceived degree of communication



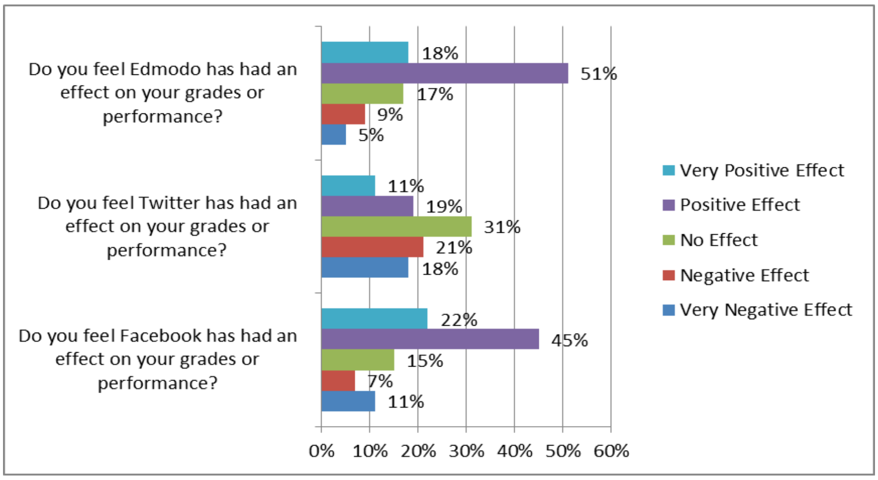
Likewise, Facebook remains the most highly rated social network (89%) concerning engagement in the module. Students felt that the use of Edmodo (71%) and Twitter (61%) in the classroom has enhanced ability to teamwork/ Collaboration skills (figure 4).

Figure 4: perceived degree of engagement



As far as performance in class goes (figure 5), results differ with the group who used Edmodo rating it higher than the other tools (51%) as having had a positive effect on grades or performance. Students indicated that Twitter has had no effect on their academic performance (31%) while Facebook users believed that it has affected their performance positively (45%).

Figure 5: Perceived Degree of Performance



As far as the second section of the questionnaire concerns, the students' answers where combined with the usage data on the several tools, aiming to reveal a trend on which is the most preferable individual tool in the learning environment. More specifically, table 1 summarizes the tools of each SNS that were assessed.

Table 1: Individual Tool per SNS

	Facebook	Twitter	Edmodo
Student-student & teacher – student	YES	YES	YES

communication			
Information feed – Announcements	YES	YES	YES
Student assessment - testing	YES	NO	YES

For each of the aforementioned tools, the answers of the students were collected and statistically analyzed, as well as the actual usage data of the student groups. The results are summarized in table 2.

Table 2: Results on Individual Tools

	Facebook	Twitter	Edmodo
Student-student & teacher – student communication	1. 75% of students responded that the chat module is easy to use 2. 431 posts were introduced during the semester on the Facebook group	1. 56% of the students responded that Twitter is appropriate for student – student communication 2. 35 tweets concerned communication between students or between student and teacher	1. 35% of the students responded that Edmodo's Forum is an easy to use module for student-student communication. 2. 19 posts on Edmodo forum were introduced
Information feed – Announcements	1. 81% of students responded that getting updates about class from Facebook is convenient 2. From total 10 announcements that the teacher introduced on Facebook, 130 acknowledgements were received	1. 92% of students responded that getting updates about class from Twitter is convenient 2. From total 10 announcements that the teacher introduced on Twitter, 183 acknowledgements were received	1. 41% of students responded that getting updates about class from Edmodo is convenient 2. From total 10 announcements that the teacher introduced on Edmodo, 71 acknowledgements were received
Student assessment - testing	1. 43% of students responded that running assessment tests using Facebook has helped them improve on the class 2. From total 8 test that the teacher introduced on Facebook, 151 submissions were received	NO	1. 89% of students responded that running assessment tests using Edmodo has helped them improve on the class 2. From total 8 test that the teacher introduced on Edmodo, 211 submissions were received

Concerning the aspect of communication (student-student & teacher – student communication in each tool), Facebook users (75%) replied that the chat module is easy to use1, (56%) of the students responded that Twitter is appropriate for student – student communication and (35%) of the students responded that Edmodo's Forum is an easy to use module for student-student communication. Tool usage analysis showed that 431 posts were introduced during the semester on the Facebook group, which makes the Facebook posts on the group's wall a more favourable means of group communication. There was a significantly smaller number of tweets (35) concerning communication between students or between student and teacher whereas 19 posts only were introduced on Edmodo forum. As for Information feed – Announcements (92%) of students responded that getting updates about class from Twitter is convenient stating a clear preference for the "tweet" feature for group interactivity. Respectively, (41%) of students responded that getting updates about class from Edmodo is convenient. From total 10 announcements that the teacher introduced on Facebook, 130 acknowledgements were received while from total 10 announcements that the teacher introduced on Edmodo, 71 acknowledgements were received. By contrast, 183 acknowledgements were received on Twitter making it seem as a more preferred means for Information feed – Announcements. With respect to student assessment - testing, (89%) of students responded that running assessment tests using Edmodo has helped them improve on the class as opposed to (43%) on Facebook while this feature is not available on Twitter. From a total of 8 tests that the teacher introduced on Edmodo, 211 submissions were received and 151 submissions were received on Facebook while this feature is not available on Twitter.

Discussion and Conclusion

The current survey indicated that students perceived that social media could enhance their learning experience. Depending on the distinctiveness of the tool, the findings indicate that such tools facilitate different aspects of perceived motivation. Engagement in tasks is driven by a perceived interest and gratification in the ICT tool. Students perceived that the use of social network tools may enhance interactional competences and collaboration which in turn may improve but not increase language competence. The qualitative data suggests that a more effective planning should be done in designing a learning environment which could accommodate the needs of learners and enhance learning. The results of the research point toward the need for a technological tool which would integrate the most preferred features of the existing popular social networks and be used effectively in language education. The time is ripe to explore more creative methods of learning and teaching (Dunn, 2013) with technology tools. Social media enhance the learning experience and must seek to meet student expectations and needs. The results of the study point towards a tool which offers an easy to use interface, enhances social interaction, assesses learning procedure and provides resource of information. These findings are in agreement with the findings of a former study which examined the perceptions and attitudes towards web-based English as a Foreign Language (EFL) among English teachers in Greece (Dogoriti, 2010). The findings of the current online survey suggested that the respondents had positive attitudes toward online learning and expressed the pressing need for a student-friendly social network to supply web-enhanced English language learning.

Limitations

There are several limitations that should be acknowledged in this mixed research method and sample. One major limitation is the self-selection bias as the instructor used social networks that were more familiar to students. Participants might be biased toward a more positive outlook on the use of the particular social networks in their module. The findings shed light on usage of social media in teaching in one discipline in a Greek higher institution but cannot be generalized to other areas of higher education. Future research could focus on usage of social networks in other disciplines and possibly from other countries.

References

Anderson, P. (2007). What is Web 2.0?: ideas, technologies and implications foreducation: Citeseer, JISC technology and standards watch, February 2007,available online at http://www.jisc.ac.uk/media/documents/techwatch/tsw0701b.pdf, accessed 11th March 2015.

Barnes, K., Marateo, R. & Ferris, S. P. (2007a). Teaching and Learning with the Net Generation. Innovate Journal of Online Education, 3(4). Reprinted in The Fischler School of Education and Human Services at Nova Southeastern University; Pennsylvania. Retrieved March 2015 from: http://www.innovateonline.info/pdf/vol3_issue4/Teaching_and_Learning_with_the_Net_Generation.pdf

boyd, d. m., & Ellison, N. (2007). Social network sites: Definition, history, and scholarship. Journal of Computer-Mediated Communication, 13, 210–230.

Brown, J. S. (2000). Growing up digital: How the Web changes work, education, and the wayspeople learn. Change, March/April, 10–20. Also accessible at USDLA Journal, 6 (2)February 2015. http://www.usdla.org/html/journal/FEB02_Issue/article01.html

Castro Sánchez, J. J. and Alemán, E. C., 2011. Teachers' opinion survey on the use of ICT tools to support attendance-based teaching. Journal Computers and Education, vol. 56, pp.911-915.

Conole, G., and Alevizou, P. (2010). Review of the use(s) of Web 2.0 in Higher Education, HE Academy commissioned report, available online athttp://www.heacademy.ac.uk/assets/EvidenceNet/Conole_Alevizou_2010.pdf

Chai, C. S., Koh, J. H. L., & Tsai, C.-C. (2011b). Exploring the factor structure of the constructs of technological, pedagogical, content knowledge (TPACK). The Asia-Pacific Education Researcher, 20(3), 607-615.

Clark, C. & Gruba, P. (2010). The Use of Social Networking Sites for Foreign Language Learning: An Autoethnographic Study of Livemocha. In Proceedings of ASCILITE - Australian Society for Computers in

Learning in Tertiary Education Annual Conference 2010 (pp. 164-173). Ascilite.
Claxton, G. (2007). Expanding young people's capacity to learn. British Journal of Educational Studies. 55(2), 1-20
Davies, R. (2011). Understanding technology literacy: A framework for evaluating educational technology integration. TechTrends: Linking Research and Practice to Improve Learning, 55(5), pp. 45-52.
David, S. A. (2013). A Critical Understanding of Learning Management System. Management_System
Davis III, C.H.F., R. Deil-Amen, C. Rios-Aguilar, & M.S. González Canché. (2012). Social media and higher education: A literature review and research directions. Report printed by the University of Arizona and Claremont Graduate University. Available at: http://works.bepress.com/hfdavis/2/
Dogoriti, E. (Ed.). (2010). Proceedings from International Conference "ICT for Language Learning" 3rd Edition: Perceptions and attitudes towards Web-based ELT among English teachers in Greece. Greece. Retrieved from http://conference.pixel-online.net/ICT4LL2010/common/download/Proceedings_pdf/SLA24-Dogoriti,Pagge.pdf
Dogoriti, E., & Pange, J. (2014).Considerations for Online English Learning. In Mallia, G. (Ed). The Social Classroom: Integrating Social Network Use in Education (pp. 1-568). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-4904-0
Dunleavy, J. & Milton, P. (2009). What did you do in school today? Exploring the concept of Student Engagement and its implications for Teaching and Learning in Canada. Toronto: Canadian Education Association (CEA), 1-22.
Dudeney&Hockly Nicky. (2007). How to Teach English and Technology. England: Stenton Associates
Dunn, L. (2013). Teaching in higher education: can social media enhance the learning experience?
Felix, U. (2005). E-learning pedagogy in the third millenium: the need for combining socialand cognitive constructivistapproaches. ReCALL, 17.1, 85-100.Dogoriti, E. (Ed.). (2010). Proceedings from Internatio
Gee, J.P., 2011. Language and learning in the digital age. New York: Routledge.
Huang, Y. M., Chiu, P. S., Liu, T. C., & Chen, T. S. (2011). The design and implementation of a meaningful learning-based evaluation method for ubiquitous learning. Computers & Education, 57(4), 2291-2302.
Jones, C., Ramanau, R., Cross, S., & Healing, G. (2010). Net generation or digital natives: Is there a distinct new generation entering university? Computers and Education, 54(3), pp. 722–732.
Junco, R. (2011a). The relationship between frequency of Facebook use, participation in Facebook activities, and student engagement. Computers & Education, 58, 162-71.
Kharade, K., & Thakkar, R. (2012).Exploring the Pedagogical Potential of ICT Mediation for Promoting Students' Engagement: A Social Constructivist Perspective.

Laru J., P. Näykki P. & S. Järvelä. 2012. "Supporting small-group learning using multiple Web 2.0 tools: A case study in the higher education context". The Internet and Higher Education, 15, 1: 29-38. DOI : 10.1016/j.iheduc.2011.08.004

Leaver (Eds.), An education in Facebook? Higher education and the world's largest social network (pp. 43–52). New York, NY: Routledge.

McLoughlin, C., & Lee, M. J. W. (2014). Beyond friending: Psychosocial engagement on Facebook and its implications for academic success. In M. Kent & T.

Mcmahon, G., 2009. Critical thinking and ICT integration in a Western Australian secondary school. Educational Technology and Society, vol. 12, pp.269–281.

Oblinger, D. & Oblinger, J. (2005). Is it age or IT: first steps towards understanding the net generation. In D. Oblinger & J. Oblinger (Eds), Educating the Net generation (pp. 2.1–2.20). Boulder, CO: EDUCAUSE. Retrieved October 30, 2010, from http://www.educause.edu/educatingthenetgen

Parsons, J., & Taylor, L. (2011).Improving student engagement.Current issues in education, 14(1).

Prenksy, M. (2001). Digital natives, digital immigrants. On the Horizon, 9(5), 1–6.

Prensky, M. R. (2010). Teaching digital natives: Partnering for real learning. Corwin Press.

Shih, R. C. (2011) Can Web 2.0 technology assist college students in learning English writing? Integrating Facebook and peer assessment with blended learning.Australiasian Journal of Education Technology. 27:5, 829-845.

Smith, F. (2007). How to Use Social-Networking Technology for Learning. Edutopia.Project Tomorrow, (2010).Learning in the 21st century: 2010 trends update. Irvine, CA: Author.

Willms, J. D., Friesen, S. & Milton, P. (2009). What did you do in school today? Transforming classrooms through social, academic and intellectual engagement. (First National Report) Toronto: Canadian Education Association

Wright, P., & Wright, G. (2011). Using Moodle to enhance Thai language learning: Instructor and learner perspectives. The Journal of Kanda University of International Studies, 23, 375–398

Author Details

Evriklea Dogoriti
dogoritievi@hotmail.com
dogoritievi@hotmail.com/ edogori@cc.uoi.gr

Back to Contents page

LANGUAGES, HUMANITIES AND TECHNOLOGIES: BLENDING INTO ONE IN ORDER TO PROMOTE A CONSCIOUS CITIZENSHIP EDUCATION FOR CHILDREN UNDER A VULNERABLE SITUATION IN BRAZIL

Sabrina Hax Duro Rosa
Instituto Federal de Educação
Brasil

Abstract

This paper aims at discussing the importance of activities which promote psycho-social-cultural development of children under social vulnerability in Brazil. An extension project of Critical Pedagogy was organized in order to raise the self-esteem of the subjects involved, and to promote the feeling of community belonging, making them understand their role as citizens in a globalized world. We observed that students improved their future perspectives after finishing the English Language and Informatics Course along with Philosophical discussions, proving that a critical education that deals with communication, technology and humanities has positive influence on students' development.

Introduction

Individuals and society in a globalized world, deeply depend on an aspect for their growth and recognition within this new context: the Information and Communication Technologies (ICT). For this reason, we should have in mind that in order to respond to this requirement we must prepare ourselves to be fluent communicators, and this means we should know a foreign language, know how to manage technologies and be critical enough to get through the messages.

In this case, the English language may play a rather important role in the process, since it is the language of international communication in this globalized society, as Crystal points out (2001; 2003; 2010). Besides knowing how to use the English language, we also must know how to use the resources offered by informatics to enable us to communicate globally, because it's through the internet that most communication, either professional or personal, takes place today. According to Almeida and Prado (2012): "The integration among technologies, languages and representations plays an important role in the formation of better qualified people to live with each other and to act positively upon the society […]".

Concerned about the young children who live under a vulnerable situation in the Information Society (Coll and Monereo, 2010), we proposed an Extension and Research Project at the Federal Institute of Education, Science and

Technology of Rio Grande do Sul (Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Sul - IFRS) in the South of Brazil. The Project offered English and Informatics classes for those children who cannot afford paying for private courses; fundamentally, children who are at risk and study in a poor public school. As we wish to prepare them to be critical thinkers, we created spaces within the Project where they could develop abilities to help them to become more reflective, friendly, and conscious citizens – for this, we also offered philosophical workshops.

Paulo Freire (1996; 2001; 2010) approaches the matter of cultural liberating action in several of his works exalting the critical, fair, respectful, autonomous and engaged teaching in order to find the ideal: that each subject may transform his or her own world in a better one.

Through a qualitative approach, based on a sociocultural perspective, we observed the students' reactions and development in the classes and took notes on the reactions to methodological changes in the teaching and evaluation; we made use of interviews with parents and the school principal; and we also had the children answering two kinds of questionnaires at the beginning and closure of the Project. After collecting the data we analyzed them to answer some of our questions: Is a project like this – involving English, Informatics and cultural activities – able to change the future perspectives of children under vulnerable situation? What are the children's perceptions on their role as students/citizens in this globalized world? What are the families' influences? How is the school receptiveness on such a project?

We hope to bring to light with this paper the idea of education as emancipatory process, and as a freedom practice for the student, also, as a project of democratization – as opposed to education as a tool, as proposed by a neoliberal capitalistic perspective to produce consumers of the information and goods.

Social Pedagogy / Critical Pedagogy

In this article, Social Pedagogy and Critical Pedagogy walk together towards the formation of a reflexive and engaged student, someone capable of performing his or her specific role in the society.

Critical Pedagogy is inspired by the social construction of knowledge. According to Baltodano and Torres (2009, p. 63): "Critical educational theorists view school knowledge as historically and socially rooted and interesting bound." It means that we learn in order to be part of a group, the group we are living with, the community we belong to. We want to feel accepted. There are always desires underneath our learning engagement and, unfortunately, it is most of the time rooted in the relation of power.

Learning is a life-long process, which means that we are being educated inside and outside the formal schooling sphere and the Social Pedagogy hopes the individual to have a social integration in his or her community, but with a critical capacity to improve this environment and to transform it.

Social Pedagogy rose in Germany due to the need of the society to encounter, in education, a solution for their human and social problems after the First World War (Díaz, 2006). The problems generated by the Great War such as unemployment, delinquency, lack of social protection in general and, especially, the problems related to children and youth, showed a clear need for a different way of thinking the educational process in Germany. Even though there has never been a War in Brazil – at least not a declared one – the necessity of education changes has also been identified here nowadays, and that is why we have had an increasing number of educators interested in this area.

Social Pedagogy has brought some important changes to Brazilian education, and today it is seen as a socio-critical pedagogy. The most striking features that characterize it are: start from a concrete situation and give importance to the cultural differences; be self-critical and use the reflection on the collective as criteria for valuing the practice; bound theory and practice in order to dialectic transform them as a consequence of their reciprocal influence.

As an important representative of this socio-critical pedagogy we can mention Klaus Mollenhauer, a German educator who was concerned with social justice and the education of children. One of his worries was about school curriculum and how it had "emerged as a representation of life 'itself' and the question of how children might become motivated to engage with such an artificial 'construction'" (Biesta, 2014, p.36). It is this setting that schools should work differently, they should consider some changes to get close to the reality and to what happens in the "real" life outside its walls.

Diáz (2006, p.99) conceptualizes social pedagogy in a way that makes us realize its real essence: "[...] a social education [...] promotes and values a society that educates and an education that socializes, integrates and helps to avoid, to balance and to repair the risk, the difficulty, or the social conflict". The author also exposes eleven different perspectives on social education, and those are: social pedagogy as adaptation; as socialization; as social competences acquisition; as didacticism of the social; as qualified professional action; as an action close to the not social adaptation; as the citizen politics formation; as prevention and social control; as social educative work; as *paidocenosis* (an educating action of the society); as extra-schooling education.

Education is a process of transformation, a process of changes: the change of a biological individual into a social individual. So, social pedagogy, that is socio-critical pedagogy, is a strong ally for the positive transformation of our society.

Extension: possibilities for a Social Pedagogy

As one of the tripod that should serve as the foundation and bases of our Institution is the Extension, which should happen along with Research and Teaching. It is through extension courses and projects that we can attend the community's demands, getting close to the people and fulfilling our role of public educators.

In our Project, extension was developed in partnership with the Municipal School Viriato Corrêa in the city of Rio Grande, in the South of Brazil, and offered 10 vacancies for students from this school in order for them to learn English, Informatics, as well as participate in several cultural activities and also the Philosophical meetings.

The work was transdisciplinary, counting on professionals and undergraduate students of Linguistics, Informatics, Philosophy, Psychology, and Social Work. Thus, the project was carried out to reach the following objectives: teaching English Language and Informatics so that students can belong to the Information Society and, therefore, improve their self-esteem; develop activities within the group so they realize their role as citizens through Philosophical meetings; promote the understanding and recognition of themselves and their relations with others to develop psychosocially through the cultural activities; and all these were accompanied through social diagnostic of the learners involved in the project.

On the perspective of the population researched, which is in social and economic precariousness, we observed a great vulnerability that often evolves to an exclusion condition. The children of the project were socially vulnerable and by enlarging their universe of knowledge and learning helped them to get through school as well as with their personal behavior, cooperating for their identities formation.

Data were collected through an interview and a questionnaire with one of the parents or the person responsible for the child, which gathered relevant information for a sociocultural and socioeconomic analysis. The profile of the families showed they belong to vulnerable groups because they are registered on *Cadastro Único para Programas Sociais* (a government social register), receiving what we call *Bolsa Família* (money from the government to support the family). Only four out of the ten students' families' representatives came for the interview. This showed the lack of commitment and interest of the families on their children's education. The ones who showed up for the interview were all mothers: two of them had studied up to the 5th grade, one had finished High School and another is studying in adult course to finish High School. Only two families have a computer at home and just one of them has access to the internet.

The concept of vulnerability refers to the individuals and families that lack emotional bonds, sense of belonging, and sociability; life cycles; stigmatized identities in terms of ethnic, culture and gender; personal disadvantages because of some deficiency; exclusion for being poor and, or, exclusion to the access of public politics; use of psychoactive substances; a range of violence from the family nucleus, groups or individuals; poor insertion or non-insertion in the work market; different strategies and alternatives to survive which may represent personal or social risk (Brasil, 2004).

The work developed with these families was based on the tripod subject (student), family and school, and it was constituted of actions that offered opportunity for the learner's social, human and educational development, aiming the socialization, their knowledge enlargement, relational bonds and schooling experience. Offering activities after school time – students studied regularly in the morning and went to the Project in the afternoon – consisting on an extra educational action that aims to enrich their informational, cultural and playful universe.

Among the interviewed families, all agreed that the activities carried out in the Project were very significant, since there was space for different learning and also dealt with current matters that triggered students' interest. Some said that their children were acting differently at home, showing more responsibility and motivation to go to school.

English classes

There is a common sense that no one learns English in Brazilian public schools (Silva, 2007; Lima, 2011). This may be confirmed with the children's testimony that answered the questionnaire saying that "at school the group of students is too big to practice English"; "the time is short"; and "the content is not well worked by the teachers".

English language competence in Brazilian schools is also seen as unachievable (Moita Lopes, 1996) and this is confirmed by the answers given to the question that dealt with having someone in the family or someone they knew that had already studied English. According to the students, none of the relatives or friends had ever had contact with the language. Most of the students also said that they came to the course because of their own will and not because of any other influence, except for one girl who said her mother told her to participate in the Project.

We researched the issues students considered more important when studying English both, before the course started and after it was finished, to compare their ideas about the foreign language learning. In the first questionnaire, they were asked to number the issues in order of importance of what they thought to be more relevant whenever studying a foreign language. The issues were disposed like this: a) grammar; b) location and weather of the speaking countries; c) the foreigner's habits; d) vocabulary. Alternatives B and C which dealt with sociocultural aspects were not checked by the students, proving that their worries were just on traditional aspects of foreign language learning. However, this belief changed when the course was over since the students now see the sociocultural aspects as fundamental for the process of learning the language to use in real situations.

The English classes provided students with an understanding of the "other" and the "other's culture", as a consequence, it provided an understanding of themselves and their own culture, their own world.

Informatics classes

The Information and Communication Technologies (ICT) permeate our daily routine, making it possible our relationship with others and with the world. For this reason, everybody who wishes to take part in the Information Society (Coll and Monereo, 2010) should have the opportunity to develop the essential abilities for a cybernetic communication.

According to Lalueza *et al*. (2010, p.47): “Culture and cognition are mutually constructed through the concrete activities which are accomplished in everyday life”. That is, if children are born in a hunting community which greatly differs from an industrial community as well as it differs from a fishing community, the tools they use also differ and that makes them culturally different from each other too. With respect to ICT, the issue is the same: what are the mediate institutional practices, what are the activities that enable and promote the development of an important amount of the population?

The people born after 1980 are called the “Y Generation” and the ones born after 1990 are named the “Z Generation”. Although the target public of the Project belonged to the Z Generation and had been born in the so called “Digital Era” (Palfrey, J. and Gasser, U, 2011), they can’t be considered “digital natives” because they have been educated in an environment which does not promote stimulus for the use of technologies in favor of their growth and sociocultural development (Rosa, 2012). The prospect questionnaire showed that learners had no computer at home, neither access to the internet. The generations Y and Z are inquisitive generations; they are willing to know, they are curious. However, if we don’t guide them on how to use the ICT wisely they probably won’t use it for their sociocultural development.

The notion of space nowadays has changed greatly. “The ‘object’ of interest must be expected to shift from *things in space* to the actual *production of space*” (Lefebvre, 1991, p. 37). As Soja (1996, p.62) points out, Lefebvre fuses (objective) physical and (subjective) mental space into social space through a critique of what he called ‘double illusion’. Actually, there is no more limited space; the space is wherever things happen, be it at school, at the club, at home, at church, or on the web.

After finishing the course, students seemed to be at ease with the internet, showing ability on the management of the computer and glad to be able to use it as a social communication tool.

Cultural activities

During the Extension Project, the students had the opportunity to participate in cultural activities which propitiated experiences they had never had before. Experiences that promoted cultural development and that allowed the students to dream, to create, to think.

Among the activities was a Museum visit; the itinerant Museum of the University of Rio Grande showed Haiti. There, students could see the similarities and differences between our culture and the Haitians' culture. They could experience a little of the new culture through the music, through the pictures and frames, as well as through the objects used by this people. None of the students had ever seen a museum before; therefore it was clear to see their happiness and involvement on the visit.

The students were also taken to the movies and only one of them had already been to a movie theater once. They were able to feel the sensations the movie provokes with its sound and its big screen with figures, as this media proposes a kind of learning which is unique.

They were also introduced to the Theater. The students could watch to a play named "Par ou Ímpar" (Odd or Even) at Theatro Guarany in the neighbor city of Pelotas. The show was a mixture of music, play, and circus, where music, lights, magic, art, juggle and dream fulfilled their hearts and souls for an hour and a half.

The origin of the dramatic play, known as Theater, gets lost in time just like language and culture, but it was in the 70's that the educational theater was inserted in the school setting and it has shown, since then, that it is a strong ally for the teaching and learning process (Lomardo, 1994). That is why it was so important to take those kids to the theatrical environment or to take the Theater to school.

In other works we have already argued about the importance of the educational theater (Rosa, 2008, p. 307-308):

> At the Educational Theater, the participants' imagination and creativity are explored; the relation with others is articulated; and the ability to think, criticize and formulate opinions is stimulated through the situations and conflicts presented on stage. Human beings are born with the need to express themselves and, through the theater, actors and viewers are emotionally affected and can reflect on moral values, attitudes and all the other aspects that influence one's personality.

Through our senses, we receive information about the world, which becomes repetitive and automatic (Pearce, 1989). Through the theater those senses are consciously and creatively experienced, offering opportunity to live uncountable antagonistic feelings such as: pleasure and pain, euphoria and relaxation, joy and sadness etc. This practice enables the subjects involved in the dramatic game to learn how to deal with several different situations that may be presented to them in the real life as well as it makes possible for them to explore the imaginary world.

All those cultural activities promote the students' sensibility to think and act, hence becoming more humans.

Philosophy and Psychology Workshops

Bearing in mind that education, including English and Informatics learning, produces an incidence on the students' subjectivities that goes beyond the process of learning which may be quantified and observed, this Project offered spaces where it was possible for the participants to express their subjectivity.

How to instigate findings and newness without working with the heuristic thinking? Piaget himself (1978, p. 130) argued: "The main objective for education is to create men who are able to do new things, not just to repeat what other generations have done". The philosophy workshops promoted the kids thinking and their comprehension of their roles at home, in their neighborhood, their community, their country, the world.

At the beginning of the course when they were asked about their role as a student in the society the answers were: "I don't know"; "study and learn"; and "graduate". In the end of the course the students answered to the same question, but then with a more conscious understanding of their role as a student: "to have a better future"; "to be someone in life"; "to make my parents proud of me"; "to help my community". Thus, after the workshops, we saw that their selfishness understanding of their role as a student turned into a more collaborative thought since they showed worry about the others – their families and the society.

About their role as citizens in their community, when asked about it in the end of the Project, the students demonstrated to have a better understanding that each one's attitude influences on someone else's life and that means living in a community, that means living in a fair society. They answered that the role of a citizen is "to work for the people"; "help and to be helped". The children were motivated to dream and to reach their dreams and they felt special because they could realize that each one has his or her own place and importance in the society.

The activities carried out during the workshops aimed to build knowledge from an epistemological constructive relation between teacher and students. This presupposes the motivation of students on thinking, on building their own knowledge, on researching. It's through the (re)appropriation of knowledge by the students that education as research may influence the appearance of technological innovations (Mansfield, 1995; Povoa, 2008; Rosenberg, 1994). The workshops had different themes in order to the children be at ease to express their subjectivity, with activities that made possible for them to get to know themselves and know how to relate with others as a contribution to their educational process and their sociocultural development.

Thus, we analyzed, as part of the process, a non-measurable sphere of the teaching and learning of English and Informatics, which accounts for the effects of learning turned to the development of cultural and psychosocial horizons of those learners.

Conclusion

The literature reviewed in this text shows that psychological, cultural and social aspects are present in human relationships – especially on communication. In our analysis we verified that sociocultural development of the students who live under a vulnerable situation improved significantly with their participation in the extension project. The project provided English language education, informatics as well as cultural activities and philosophical workshops. The foreign language and informatics teaching were the bases for the development of the other activities such as Museum visits, going to the theater, and to the movies. Activities also included sessions of group reflection and comprehension of their role in society and the understanding of themselves.

The feedback of the Principal of the participant School, when interviewed, showed that Projects like this make a difference on the students' behavior back to school.

> [the] school is located on Almirante Barroso Street, in a community which may be considered a risky area. We receive students with several peculiarities and, having in mind this group's profile, it is important to observe that they all come from families of low socioeconomic status and disadvantaged cultural standards. So, projects like this are very important for our school and hence for our students, since none of them would have conditions to experience English, Informatics and cultural activities if it wasn't for that. Our school is deeply glad to have this opportunity.

The Principal's testimony confirms the receptiveness of public school authorities when actions like the ones developed during the Project are offered to them.

According to Quintão (2005, p.1):

> Social problems cannot be faced as autonomous situations, without relating it to the structural causes that have produced them. Guaranteeing the right of education means guaranteeing the access and permanence of children and teenagers at school; discussion that mandatorily goes through social, political, economic, and cultural themes. It is within this complexity that we must search the integration of sectorial politics, the interlacement of answers that are still very apart from social necessities; this way we can leverage the results.

With the activities developed in this Project, many of the children's and teenagers' rights were achieved. The Brazilian Children and Adolescent Statute (ECA, 1990), in its article 4th, defines:

> It is the family's, the community's, the society's and the government's duty to assure, as priority, the effectiveness of the law referring to life,

> health, nourishment, education, sport, leisure, professionalization, culture, dignity, respect, freedom and the living together with family and community.

Providing access to different learning activities which are not part of the children's everyday lives, mainly through Projects such as the one discussed here, contributes for the construction of life projects, enlarging their cultural references and the development of their potentialities, making it possible for them to have better future perspectives and possibilities to overcome their difficulties.

References

Almeida, M. & Prado, M. *Integração tecnológica, linguagem e representação.* Retrieved November, 14, 2012 from : http://webeduc.mec.gov.br/midiaseducacao/material/introdutorio/etapa_3/p3_03.html.

Baltonado, M, & Torres, R. (2008). *The Critical Pedagogy Reader*. New York/London: Routledge.

Biesta, Gert. (2014) *Remembering forgotten connections: Klaus Mollenhauer's opening to theorising education differently.* Phenomenology & Practice, Volume 8, No. 2, pp. 34-38.

Brasil, *Ministério* do Desenvolvimento Social e Combate à Fome. Secretaria Nacional de Assistência Social (2004). Política Nacional de Assistência Social, Brasília.

Coll, C. & Monereo, C. (2010) *Educação e aprendizagem no século XXI. Novas ferramentas, novos cenários, novas finalidades.* In: COLL, César e MONEREO, Carles (org.). Psicologia da Educação Virtual. Aprender a Ensinar com as Tecnologias da Informação e da Comunicação. (pp. 15 – 46). Traduzido por: Naila Freitas. Porto Alegre: Artmed.

Crystal, D. (2001). *Language and the Internet*. United Kingdom: Cambridge University Press.

Crystal, D. (2003). *English as a Global Language.* 2nd Edition. United Kingdom: Cambridge University Press.

Crystal, D. (2010). *The Cambridge Encyclopedia of Language*. 3rd Edition. United Kingdom: Cambridge University Press.

Díaz, A. (2006). *Uma Aproximação à Pedagogia – Educação Social.* Revista Lusófona de Educação, v.7, n.7 (pp.91-104).

Freire, P. (1996). *Pedagogia da autonomia.* São Paulo: Paz e Terra.

Freire, P. (2001). *Pedagogia dos sonhos possíveis*. Notas de Ana Maria Araújo Freire. São Paulo: Editora UNESP.

Freire, P. (2010). *Ação cultural para a liberdade e outros escritos.* São Paulo: Paz e Terra.

Garcia, S. & Meier, M. (2007) *Mediação da aprendizagem: contribuições de Feuerstain e Vygotsky.* 2 ed. Curitiba: Edição do autor.

Lalueza, J.L.; Crespo, I. & Camps, S. (2010). *As tecnologias da informação e comunicação e os processos de desenvolvimento e socialização.* In: COLL, César e MONEREO, Carles (org.). Psicologia da Educação Virtual. Aprender a Ensinar com as Tecnologias da Informação e da

Comunicação. (pp. 47 – 65). Traduzido por: Naila Freitas. Porto Alegre: Artmed.

Lima, D. C. (2011). *Inglês em escolas públicas não funciona? Uma questão, múltiplos olhares.* São Paulo: parábola Editorial.

Lomardo, F. A. (1994). *O que é teatro infantil*. São Paulo: Brasiliense.

Machado, E. *A Pedagogia Social: diálogos e fronteiras com a educação não-formal e educação sócio comunitária.* Retrieved January 5, 2011 from: http://www.am.unisal.br/pos/stricto-educação/.../mesa8textoevelcy.pdf.

Mansfield, E. (1995). *Academic research underlying industrial innovations: sources, characteristics, and financing. The review of Economics and Statistics*. v. 77, n. 1 (p p. 55-65).

McLaren, P. (2008) *Critical Pedagogy: A look at the major concepts*. In.: Darder, A; Baltodano, M; Torres, R. The critical pedagogy reader. New York/London: Routledge. (pp. 61 – 83).

Lefebvre, H. (1991). *The Production of Space.* Cambridge, MA: Blackwell.

Lopes, L. P. M. (1996) *Oficina de Lingüística Aplicada.* Campinas, SP: Mercado de Letras.

Palfrey, J. & Gasser, U. (2011) *Nascidos na Era Digital. Entendendo a primeira geração de nativos digitais.* Traduzido por: Magda França Lopes. Porto Alegre: Artmed.

Pearce, J. (1989) *A Criança Mágica. A redescoberta da imaginação na natureza das crianças.* Rio de Janeiro: Livraria Francisco Alves.

Piaget, J. (1978). *A Formação do Símbolo na Criança*. Rio de Janeiro: Zahar.

Piaget, J. (2005). *Inteligência y afectividad.* Buenos Aires: Aique Grupo Editor.

Póvoa, L. M. C. (2008). *A crescente importância das universidades e institutos públicos de pesquisa no processo de catching-up Tecnológico.* R. Econ. contemp., Rio de Janeiro, v. 12, n. 2 (pp. 273-300)

Quintão, A. & Almeida, N. L. T. *Serviço Social e a Política Pública da Educação.* Retrieved July, 10. 2009 from: http://docentes.ismt.pt/~eduardo/supervisao_estagio/documents/13_ServicoSocialna Educacao.pdf.

Rosa, S. (2008) *O aprendizado de Língua Inglesa através do Teatro.* In: Cultura e diversidade na sala de aula de Língua Estrangeira. Santos, S. & Mozillo, I (orgs.), Pelotas: Ed. da UFPEL.

Rosa, S. (2012). *Aprendizagem de língua inglesa e inclusão digital: uma interface em busca do desenvolvimento sociocultural de alunos da escola pública em situação de risco.* In: III Simpósio Nacional e I Simpósio Internacional Discurso, Identidade e Sociedade. USP e UNICAMP. Anais eletrônicos ISBN: 978-85-62641-05-3

Rosenberg, N, R. (1994) *American universities and technical advance in industry.* Research Policy, v. 23, n. 3 (pp. 323-348).

Soja, E. (1996) *The thirdspace. Journeys to Los Angeles and other real-and-imagined places.* Oxford: Blackwell Publishing.

Silva, J. C. (2007). *A escola pública no Brasil: problematizando a questão.* Publicatio UEPG: Ciências Humanas, Ciências Sociais Aplicadas, Linguística, Letras e Artes, v. 15, n. 2.

Author Details

Sabrina Hax Duro Rosa
sabrina.rosa@riogrande.ifrs.edu.br

Back to Contents page

International Conference on Information Communication Technologies in Education
Proceedings

ICICTE 2015 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 2015 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, intellectual property, 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.

ISBN 978-0-9926958-9-7

9 780992 695897 >

Backdrop for the cover of the Proceedings: Detail from metal art by Marie Louise Kold