International Conference on Information Communication Technologies in Education

ICICTE 2020

Conference Proceedings

2-4 July,
On and from
Samos, Greece

International Conference on Information Communication Technologies in Education

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2020

ISBN: 978-99957-1-942-5

ICICTE 2020

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The proceedings were formatted in APA Style, 6th edition. To cite a paper in the proceedings in APA Style, 7th edition:

Last Name, First Initial. (2020). Paper title. In Varonis, E.M. (Ed.), *Proceedings of the international conference on information communication technologies in education (ICICTE) 2020* (pp. n-n). ICICTE 2020.

Editorial Board

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PREFACE TO THE 2020 PROCEEDNGS

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ICT Professionals as Essential Workers in the Parallel Universe of Pandemic 2020: Panic > Partner > Pivot > Prevail

This year, the Oxford English Dictionary (OED) chose not to identify a single "word of the year" and instead issued a report entitled Words of an Unprecedented Year. In March, according to the OED, what was then referred to as coronavirus moved from being called an "epidemic" (from the Greek word επιδημία, meaning "among the people") to a pandemic (from the Greek word πανδημία, meaning "all the people" - italicized here along with other OED 2020 words). In many ways, since March, all of us have been living in our individual support bubbles in a parallel universe, wondering when we will again experience spring, summer, and fall, or the distinction between weekday and weekend (The most popular line of Downton Abbey, according to the producers, was the Dowager Countess's snippy "What is a weekend?" in Season 1 – and now we can relate). It was supposed to be over by now.

Instead, we still strategically shop for toilet paper and sanitizer, expertly make or buy face masks, purchase more Zoom-ready tops than bottoms, and enjoy quarantine concerts. All while we try to stay safe and flexible as we react to this unprecedented year.

The first general response to the call for social distancing in education – panic. How could institutions ensure the safety of students and staff, how would instructors manage to teach remotely for the remainder of the semester, or however long it took, and just exactly how long would it take? We still don't know the answer to the "how long" question, but the answer to the "how" question was pretty clear. Although ICT professionals might not have officially been considered essential workers, we are. Many of us were called to partner with colleagues to assist with professional development and offer technology support to novices in online or remote teaching or meetings. In addition, we partnered with additional technology vendors, increasing our licenses, to ensure we had an infrastructure that could support heavy additional use of ICT. And with those partnerships, we were ready to pivot (a word OED should have included

in its list!). This meant hanging onto course goals and student learning objectives while quickly rethinking how content would be delivered and activities completed. Spring 2020 was a pivot in a pressure cooker, but when good people with pure intentions commit to a culture change, it can be and was successful. Even in a merciless hurry. ICICTE itself did the right thing by pivoting to a remote format when it became clear the conference could not safely bring everyone together face-to-face. Pivots proved that good people with pure intentions can prevail and deliver quality despite unprecedented conditions.

There have been benefits. ICT skeptics opened their eyes to the transforming power of information communication technologies in education, developed an online presence, and will probably never return to "traditional" teaching. ICT devotees, demonstrating leadership and compassion, combatted disruption by leading culture change and helping solidify the importance of ICT in academic, work, and personal lives; this has also resulted in a more robust technology infrastructure that benefits all. An added bonus: use of ICT democratizes education because it is inclusive, allowing diverse users to access all content, complete all tasks, and communicate in multiple ways. Why did it take a pandemic to unify us in this alone but together experience?

Likely, all of us have navigated schedule changes in 2020—ask me about my work on the U.S. Census with its roving deadlines, which completely impacted my work on these proceedings. Likely, many of us have also experienced the illness of family and friends—I lost my sweet aunt, at 96, to COVID-19. These disruptive and painful events are a reminder to pace ourselves, to focus on what we value the most. They are a reminder to breathe.

Perhaps we can view ourselves as superspreaders—of a positive type—champions of ICT, conducting and disseminating research that demonstrates the power of ICT as a unifying force for good. This year, we have been part of a global anthropause, but we have also been ICT frontline workers on the pivot to online and remote learning, which has enabled education not to pause. We have faced disruption, and we have prevailed.

TAKING THE PULSE OF THE PULS PROJECT: FROM OBEDIENT USERS TO INNOVATIVE AND EMPOWERED MAKERS

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Abstract

This study reports on an initiative called PULS, due to its use of wearable heart rate monitors in a Swedish school seeking to increase physical activity among students to enhance learning, piloted with 58 seventh grade students. Wearable heart rate monitors were bought, and arrangements were made for 30-minute sessions of monitored activity twice a week. However, student data was not used for learning, and thus the initiative was initially interpreted as a sign of uncritical thinking and unreflective practice when incorporating digital technology in school. Critical discussion and further development became essential to steer the situation towards student empowerment and learning.

Introduction

There is an increasing concern in Sweden about how children are affected by extended periods of sitting still, as daily physical activity has been shown to be important for learning, in particular for boys (Karlsson et al., 2019). The concern about grade failure and motivation loss linked to reduced level of activity has therefore attracted increased attention. Some argue that screen time is to blame for both lack of physical activity for children and health issues (Orben & Przybylski, 2019; Fang et al., 2019). In 2018 the World Health Organization (WHO) introduced a new diagnosis, "gaming disorder," linked to heavy use of video and online games, and it has been shown that the more screen time children get, the more behavioral problems they exhibit (Guerrero et al., 2019). However, the results are not as straightforward as they appear, since screen time has also been associated with sleep deprivation and junk food intake (Fröberg & Raustorp, 2015; Guerrero et al., 2019), suggesting intermediate factors to problems linked to the use of digital technologies in general and screens in particular. Previous research indicates that it is not merely the technology as such that provides the explaining factor. As an example, it has been identified that student knowledge and understanding of using technology in learning situations does not explain

engagement or disengagement in studies, since both high and low knowledge of how to use technology were present in engaged as well as disengaged students (Bergdahl et al., 2020). Therefore, there is a need to tackle use of technology for learning in a much more nuanced manner as well as to investigate how and why digital technologies are used to achieve expressed goals and take measures for malpractice and risks. The combination of physical activity, digital artefacts and learning was our focus in this study. This study reports on an initiative by one Swedish municipality implementing a project called PULS, due to its use of wearable heart rate monitors in a school to measure pulse. The purpose of the study was to gain increased knowledge and understanding of how to combine and engage multiple actors to promote health and learning and empower participants in such processes from a leadership perspective in digitalization processes. The research question was: How should digitalization be led to enhance learning and increase empowerment among teachers and students?

Background

The initiative was taken by the municipal Culture and Leisure department, with one of its areas of responsibility being to increase the welfare and health of the municipality inhabitants. In collaboration with the school, they started a project called PULS, with the idea of increasing physical activity among students to enhance learning. They started with the school's two classes of 58 seventh grade students as a pilot study. Wearable heart rate monitors were bought, and arrangements were made for 30 minutes of physical activity twice each week in the gymnastic hall, in an indoor obstacle course arranged by the teachers. Each student was expected to reach a heart rate level of approximately 80% of their individual capacity. Each student should also come up with ways to reach that level, which was visually projected on a large screen during the time of activity. Parents' and students' consent were obtained by the responsible teacher at the school before starting the actual pilot trial, when the teacher-driven idea of enhancing prerequisites for learning by physical activity was presented for them. The model was implemented by the teachers and followed an already designed model developed in an adjacent municipality. A researcher and a development manager from the municipality were invited to study the PULS project shortly after it had started. The PULS project was conducted in parallel with an initiative of leading digitalization in school (Spante, 2018) and was considered a joint venture for health promotion, digitalization, and leadership. This combination attracted our attention and we collaboratively conducted a research and development initiative that will be presented in more detail in the method section.

Method

The main driver for the methodological approach was the desire to enhance mutual inclusion and engagement, taking inspiration from Van de Ven (2007) and the approach of engaged scholarship promoting equal participation among professional organizations and academia. Previous research in school development has emphasized that for sustainable and relevant results, there is a need to involve professional actors in research projects, and not only researchers should visit and observe what is going on (López-Pastor et al., 2011; Spante, 2019). The study was designed in accordance with these collaborative research ideas. It is typical of collaborative research that practitioners and researchers jointly formulate questions and create direction in what is being studied (Nilsson & Sorbring, 2019). These joint actions in the current study required participation in actual PULS sessions, ongoing discussions with the three involved and responsible teachers, and group discussions with participating students. To capture the heteroglossia, i.e., the many voices from different groups using language in different ways due to historical and sociological reasons (Vice, 1997), we used a range of data collection methods such as surveys with open questions, dialogues, and focus group interviews. The actual activities were collectively decided upon during the process since we were sensitive towards expressed issues, ideas, and unexpected turns in the ongoing PULS project, following the philosophy of collaborative research (Nilsson & Sorbring, 2019), to promote meaningful activities and results for participants as well as for transferable conclusions and suggestions for the general audience.

Analytical Framework

Theoretically, this paper builds upon ideas about interlinked notions of social and technical aspects resulting in various types of approaches to digitalization of processes and organizations. The Scandinavian school of information systems, emphasizing the role of the user in socio-technical circumstances and bottom-up processes for innovative model creation and development (Iivari & Lyytinen, 1999), was a point of departure for identifying sense-making approaches for the collaborative research project PULS. It is important to point out that the specific framework decided upon in the article, and presented below, was not explicitly used during the project. However, the overarching view of digitalization as a socio-technical process was present from the outset as an assumption of dynamic possibilities to create and change activities for involved participants. In line with this assumption we used the framework presented by Gidlund (2015), focusing on the different roles of citizens in e-government projects, where she highlights the difference between being a user or chooser of existing e-services to become a maker and shaper of what is

not yet in place. The original ideas regarding "from users and choosers to makers and shapers" is found in Cornwall and Gaventa (2000) regarding citizen participation in societal development. Gidlund suggests that we can also ask analytical questions based on theories of participation in design situations to address who will use and choose, as well as who will make and shape. These questions can serve as guidance in design or, as we will do, as analytical tools for sense-making and transferability of lessons learned of a professionally driven digitalization project conducted *in situ*. The analytical reasoning in this framework is oriented towards movement in practice and power based on prepositions and roles. The prepositions – for, with, by – signal assumptions linked to roles, i.e., users, choosers, makers, and shapers. How to think in relation to the suggested framework then becomes the task for the designer or analyst. In our sense-making of the framework we suggest that if something is designed *for* individuals, then power of participation will be linked to roles of using and choosing between what is presented. If something is designed *with* individuals, then power of participation will be linked to roles of shapers, and if something is designed *by* individuals, then power of participation is linked to roles of makers. In the analysis section in this paper we will link our empirical result to this suggested framework linked to roles and prepositions (Cornwall & Gaventa, 2000; Gidlund, 2015) when using technologies to clarify the identified and disruptive shift in focus during the conducted collaborative research in the PULS project. But first the results will be presented.

Results

The Results section is structured in line with performed activities in the PULS project with some critical remarks that triggered further actions in the project. In the following analysis section, the results are interpreted in relation to the analytical framework presented above.

Heart Rate Monitors as Organizing Tools

Initially, the digital technology worked as an organizing tool for teaching and motivated the students to move around according to the instructions. At first, this was considered as helpful by the teachers and experienced as fun by the students. The observations from the physical activities with the heart monitors showed a room full of gymnastics equipment and students moving at individual paces and patterns, mostly with smiling faces, coming up with all sorts of creative movements to get their heart rate up. It was an impressive sight to see thirty seventh-grade students entering the gymnastic hall to then put their monitors on their arms, get them started, and then start their workout on the obstacle course. Then, thirty minutes later, the first group left, and the next group of students en-

tered to perform the same activity. It was clear that the big screen where their heart rates were displayed became an important driver for the individual activity and what they decided to do, since students continuously glanced at the big screen to see their level of heart rate and seemed to modify their movements accordingly. This ownership of how to move to increase their heart rate was initially highly appreciated by the students. However, the data each student created by their pulse monitors was not used for student learning regarding their individual progress or how data could be analyzed. The focus was, initially, oriented towards goal achievement regarding level of heat rate with the hope for future subject learning based on increased level of physical activity. Therefore, the heart monitors and data became more of a control device for teachers to make sure that students moved enough to reach the general health goal of the Culture and Leisure department rather than learning about their bodies, how data was captured and analyzed, and further learning linked to curriculum-driven didactic practice. This observation was interpreted as a sign of uncritical thinking and unreflective practice when incorporating digital technology in school, thus counteracting student learning goals. Critical discussion and further development were therefore essential to actively introduce goal achievement into the school context to avoid using students for purposes beyond their own agency and learning.

Experienced Model Restrictions

Throughout the process, ongoing discussions were held with the collaborative research participants, such as principals, teachers, school development manager, and researcher. In these discussions it became clear that the specific devices and the help from a neighboring municipality were linked to private interests and thus led to specific costs that the teachers had no possibility to decide on or control. It became clear that the initial help provided from the contact person in the neighboring municipality was suddenly a service agreement with a cost per hour for assistance. Therefore, the responsible teacher was set in limbo due to no right to make financial decisions, thus calling for new practice linked to the use of the heart monitors for the students. But not only that—after a while the teachers were no longer satisfied with what happened in the PULS sessions since they experienced a slight decline in student engagement. After half a year with the copied model, the teachers created a survey and asked the 58 students from seventh grade who attended the project how they experienced the PULS sessions. The survey revealed that there were students who still liked it, but they were in the minority. The main complaint from the students was that they would rather have gotten to sleep in than to come earlier to school for the compulsory PULS

activity accepted by their parents or guardians and themselves; as one of the students claimed: *"I would rather sleep since sleeping is also important!"* They also asked for possibilities to influence the PULS sessions regarding form and content.

Student Involvement

Since the teachers felt locked into a model for which they no longer felt ownership, the creative turn became to unlock the state with student-driven suggestions. Here it was of significant importance that the second author, as development manager in the municipality at the time of the project, had access to the students and thus opportunity to conduct a number of interviews with them so that they could get their voices heard and experience that their views would matter. In addition to the students completing a questionnaire, group interviews were conducted with all seventh graders (nine groups with five or six students each in March 2019). When the students' voices were heard again, it was clear that they had become tired of the initial form of the PULS project. When asked why they thought PULS had been introduced now when gaining experiences, responses ranged from reasons of healthier lifestyle and increased cognitive functions to media exposure and research: *"I think it was introduced because we children need to keep up with our bodies and not sit still"; "Don't sit in front of your computer every day and then eat junk food but also build more brain cells so that we can work better in school later"; "Quite frankly, I think it is because our school wants both attention in newspapers and that our teacher is familiar with research. They also want to test new things and see what happens"*.

During the focus group interviews the students also pointed out this time that they wanted more variation and more influence on the PULS sessions. However, they had some concerns about whether they would be listened to and if their ideas would be taken into consideration, expressing some negative experiences from trying to share ideas: *"Some teachers do not take students' suggestions and opinions seriously but simply say that we are lazy if we want change"; "There are teachers who understand us and take us seriously — everyone who works here should do so"*.

It was evident that the students had given the PULS project serious thought despite their criticism towards the current model. They suggested many new ways of using the pulse monitors: *"For example, I think you could use heart rate monitors in NO [science] for some experiments"; "Make sure you do not stress during test"*.

We also talked about leadership with students and many of them want-

ed to try to lead a PULS session or another lesson. The teachers listened to the students and made changes based on their ideas. This was a brave and open-minded approach from the teachers' point of view since initially, the teachers had also been too obedient concerning the PULS model without owning the method or the process, like they did with the student-driven situation. After the new "listening approach", the result was better, and students liked it more.

During the same period, all teachers at all schools in the municipality conducted a project focusing on student influence. In this phase, following the dynamic philosophy of collaborative research (Nilsson & Sorbring, 2019), the PULS project deliberately changed from initially being a pulse-raising project focusing on individual health promotion to becoming a leadership project where students were trained to be led, to lead themselves, and to lead others. This change was also a reaction to incorporate students' voices and expressed wishes to have more influence on the PULS activities. Yet another form that characterized the new direction of the PULS project focused on representative democracy by appointing the reference group of students where they also considered involving parent representatives. Here, too, the focus was on democratic forms and processes as well as increasing student influence and leadership. During the process, support was also available through the presence of the development manager in line with collaborative research, taking the opportunity to involve different roles and competences for driving the process and triggering collaborative content creation.

Spread of Student Involvement Model

The pilot project lasted one year, and the teachers learnt a lot during the year with seventh grade. In addition, some teachers had experienced that the PULS project did influence student motivation and attentiveness. Two teachers who had theoretical lessons directly after PULS sessions were interviewed and they had the perception that they had seen effects in the student group: "*I am lucky to have the students on Tuesdays when we have SO [social science] right after a PULS session. Then it is really relaxed, and the students work really well. They are focused and get done with everything*".

One English teacher experienced that the focus and motivation of the students changed: "*I have worked with those who normally lack motivation or cannot stay focused. I have been able to reach these students much faster now. Now, for example, it can take 5 minutes rather than 20 minutes*".

The general experience at the school and among teachers was that

the PULS project has worked quite well. As a result, the teachers started PULS sessions with all students in sixth, seventh and eighth grades driven by the student-driven and "listening approach" with support from the principals, whose interest had grown during the process and particularly when student involvement increased. It was evident that leading digitalization in this project was improved by moving from a static model implementation approach to a dynamic student-driven approach. One of the "simple" keys to success was to listen to the students and be open for change. To keep up the dialog, we invented a reference group with five students in every grade (sixth, seventh and eighth). The teachers had regular meetings with the reference groups and could continuously listen to the students' ideas and adjust the method without waiting until next term and the result of big surveys. The school now also tries leadership sessions for the students due to the experiences in the PULS sessions. Other subject teachers have also been interested in the idea of "reference groups" in their subjects.

Analysis

The implementation of the PULS project was linked to a general idea of the positive impact of physical activity for grade improvement. However, the model was based on two times 30 minutes each week rather than the one hour of physical activity everyday throughout the whole school period from first to ninth grade (Karlsson et al., 2019). This adaptation was not critically discussed but serves as an important reminder of how models become altered when in different new contexts. Since the evidence-based model of one hour each day was not followed, other discourses became drivers for the PULS project, such as general health improvements as goals for the Culture and Leisure department in the municipality. Staring with preposition analysis of "for, with or by" (Gidlund, 2015), we can interpret the initial PULS project as designed by the Culture and Leisure department *for* the school, *with* the teachers and *for* the students. However, moving to the role analysis of user, chooser, makers or shapers (Cornwall & Gaventa, 2000), the role of the teachers was more associated to becoming users than shapers, since the heart monitors were pre-designed in combination with the software structure for capturing student-generated data also using the predesigned model of 30 minutes in an obstacle course. The participating power for students was initially more or less nonexistent, and over time we could see and hear that they increasingly questioned the model but still obeyed, although in a resistant mode.

The teachers also got increasingly uncomfortable with the model and the role of being a user of the pre-designed PULS model rather than ex-

periencing ownership of the usage of heart rate monitors in the school context. In dialogue with the teachers, researcher, and development manager, it was collectively suggested to alter the perspective and ask for student experiences. This was an activity interpreted as a move from the preposition "for" towards "with," as well as role transition moving from user and chooser towards shaper and maker. This movement was supported by the joint project of student influence at the school where the PULS project became more actively interlinked with that initiative. We suggest that the surrounding context, with enhanced focus on student influence, was fruitful for the role transition to empower the students and show that change is possible, as well as getting a concrete experience of possibilities to also change ongoing activities, such as altering the form and content of the PULS project. This experience is interpreted as a hands-on learning experience of democratic processes, also inscribed in the Swedish curriculum.

The insight from the teachers to also create role transition for themselves was an important drive for creating change and increasing the school-related relevance of using heart rate monitors. Student suggestions were highly linked to the curriculum, thus indicating motivation to learn as well as creating models for learning with altered use of the heart monitors regarding where, i.e., not only indoors but also outdoors, and how to work with data, for example not just measuring heart rate but also to understand why the heart rate changes and what type of biological processes are involved. Thus, the bottom-up process created more innovation and engagement by the participants incorporating digital technologies in activities, as previous studies early on could show and suggest (Iivari & Lyytinen, 1999).

These ideas from the seventh-grade students were also incorporated into new practices by the teachers, suggesting that the roles changed not only for students but also for the teachers. Furthermore, teachers and students became united in this process of role transitions and mutually became makers and shapers rather that users and choosers. They also increased the prepositions to design *with* rather than being dominated by the "for" preposition. Still, an interesting note is that the making of the new "listening approach" also created a role-rotating model where the responsibility to create activities for each other also altered prepositions. For example, when the "listening approach" was implemented and further discussed by participants, one group of students got the responsibility to design a lesson for their classmates. The groups of designers then got the roles of makers and shapers designing for their classmates, who consequently then became users and choosers. The situational power of being makers and shapers was then momentarily in the design group;

however, due to the rotating model they altered these positions so that everyone had the experience of the different roles and different modes of power.

The heart rate monitors also became redefined as a more creative tool with dynamic properties rather than static, as the initial model suggested. Leading digitalization thus also became a question about prepositions and roles where the understanding of the heart rate monitor technology moved from being a static tool towards a dynamic resource, possible to actively integrate with more complex learning outcomes than simply measuring the level of heart rate for a duration of 30 minutes. Initially, teachers' interpretation of the PULS model in general and heart monitors inscribed themselves into roles of users and choosers. But, thanks to involving the students, the teachers became increasingly aware of the possibility to gain power, create empowering sessions and therefore role transitions driven by their own understanding of heart rate monitors as static or dynamic, and increasingly trust their possibility to take action together with their students. However, it is important to point out that to trigger an alternative interpretation, access to some critical voices with other roles was valuable, enhancing the benefit of heteroglossia (Vice, 1997).

Discussion

When taking the pulse of the PULS project, we could identify how initial ideas became challenged and how disruptive practices enhance the learning potential and engagement for students. The frameworks also helped to clarify what became drivers for transformative action. It is also interesting to note the need for technological reinterpretation to create meaningful practice, as shown in the PULS example. The technology did not change, but the interpretation of heart rate monitors was altered. This is an important contribution of this paper, that critical reflections of what is already in place might trigger new solutions without new investments in tools or systems. Critical reflection in schools becomes increasingly important due to societal development and curriculum demands (Selwyn, 2010). The theory of participation (Cornwall & Gaventa, 2000), and further, the thinking about prepositions and roles, could very well serve as design tools, as in Gidlund's work (2015), or as an analytical tool of already conducted research, as we did in this paper, to identify and interpret power and participation linked to explicit goals and expressed values as new insights to act upon. The results also suggest that an initiative of digitalization might have a bumpy and lengthy road but is also filled with important lessons if seriously analyzed and taken responsibility for. There are of course valid reasons to stop doing things that do not re-

ally work, but there is also a value in trying to get insight from initiatives as possible spearheads for creative efforts, as shown in this study.

Conclusion and Recommendations

The quality of the PULS project was enhanced by a shift in how to deal with students during the PULS project. At first, they were viewed as goal achievers that failed or passed, but due to growing student resistance combined with collegial discussion, students became seen as participating partners in how to redirect and transform the PULS project. After that instance in the project, it took off and spread further. Involving the students was thus key in moving from obedience to innovative thinking. Interestingly, the teachers also became more empowered by empowering the students, and we hope that this example might serve as inspiration to other types of digitalization projects in school where student involvement is lacking, and motivation goes down. We suggest to then try to redefine the situation and analyze it from roles and prepositions to become more aware of what should be redefined, altered, continued, or stopped.

References

Bergdahl, N., Nouri, J., & Fors, U. (2020). Disengagement, engagement, and digital skills in technology-enhanced learning. *Education and Information Technologies, 25*(2), 957–983.

Cornwall, A., & Gaventa, J. (2000). From user and chooser to maker and shaper: Repositioning participation in social policy. *IDS Bulletin, 31*(4), 50–62.

Fang, K., Mu, M., Liu, K., & He, Y. (2019). Screen time and childhood overweight/obesity: A systematic review and meta-analysis. Child: Care, Health and Development, 45(5), 744-753.

Fröberg, A., & Raustorp, A (2015). Klena bevis för att stillasittande ger kardiometabol ohälsa hos unga: "Skräpmat" och sena kvällar framför skärmen del i komplext samband. *Läkartidningen*, 112.

Gidlund, K.L. (2015). Makers and shapers or users and choosers participatory practices in digitalization of public sector. In Tambouris, E., Janssen, M., Scholl, H. J., Wimmer, M. A., Tarabanis, K., Gascó, M., Klievink, B., Lindgren, I., & Parycek, P. (Eds.). (2015). *Electronic Government: 14th IFIP WG 8.5 International Conference, EGOV 2015, Thessaloniki, Greece, August 30--September 2, 2015, Proceedings* (Vol. 9248). Springer.

Guerrero, M. D., Barnes, J. D., Chaput, J.-P., & Tremblay, M. S. (2019). Screen time and problem behaviors in children: exploring the mediating role of sleep duration. *The International Journal of Behavioral Nutrition and Physical Activity, 16*(1), 105.

Iivari, J., & Lyytinen, K. (1999). Research on information systems devel-

opment in Scandinavia: Unity in plurality. In W. Currie, B. Galliers, & R. Galliers (Eds.), *Rethinking management information systems: An interdisciplinary perspective* (pp. 57-102). Oxford, UK: Oxford University Press

Karlsson, M., Fritz, M., Cöster, M., Karlsson, C., & Rosengren, B. (2019). Daglig fysisk aktivitet på schemat: Bättre skolresultat för pojkarna. *Läkartidningen*, 116: FEP3

López-Pastor, V.M., Monjas R., & Manrique, J.C (2011). Fifteen years of action research as professional development: seeking more collaborative, useful and democratic systems for teachers. *Educational Action Research,19*(2),153-170.

Nilsson, L., & Sorbring, E. (Eds.). (2019). Samverkansforskning – att främja barns och ungas välfärdkommande. Stockholm: Liber.

Orben, A. & Przybylski, A. (2019). Screens, teens, and psychological well-being: Evidence from three time-use-diary studies. *Psychological Science, 30*(8), 682-696.

Selwyn, N. (2010). *Schools and schooling in the digital age: A critical analysis*. Abingdon: Routledge.

Spante, M. (2018). Organizing digitalization in school: How a municipality in Sweden arranged for new curriculum implementation emphasizing digitalization. In L. Morris, & C. Tsolakidis, (Eds.), *The proceedings of the International Conference on Information Communication Technologies in Education (ICICTE) 2018* (pp. 382-390). Crete, Greece: ICICTE.

Spante, M. (2019). Digital creativity: learning by story driven digital production. *International Journal of Information and Learning Technology,36*(3),182-191.

Van de Ven, A. (2007). *Engaged scholarship: A guide for organizational and social research*. Oxford University Press.

Vice, S. (1997). *Introducing Bakhtin*. Manchester University Press, New York: Palgrave.

World Health Organization. (2018). International Classification of Diseases, 11th Revision (ICD-11). Geneva: World Health Organization. https://www.who.int/news-room/q-a-detail/gaming-disorder

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DIGITALIZATION AND SCHOOL LEADERSHIP THROUGH THE LENS OF THE ECOLOGY OF RESOURCES MODEL

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Abstract

Through the lens of the Ecology of Resources Model, this paper focuses on how school leaders understand the activity of leading digitalization in school. The study is based on a survey and interviews conducted with school leaders. The results show that school leaders lead for digitalization through many different activities. It can be concluded that the role of the school leader is important for supporting teachers' work with digitalization for teaching and learning, and in turn supporting students' learning with digital technologies. How school leaders lead the digitalization process will most likely have an impact on school development.

Introduction

With high expectations of change and development, digitalization has formed both possibilities and challenges in the way school leaders learn, administrate and communicate. For enhanced digitalization in school, the importance of school leadership has been emphasized in international research (Yuen, Law, & Wong, 2003; Afshari, et al., 2009). School leadership is, for example, described as an important indicator for teachers' integration of information and communication technologies (ICT) in school and classrooms (Ottestad, 2013; Kozma, 2003).

At the same time, it is argued that digitalization changes the conditions for leading the work in school (Håkansson Lindqvist & Pettersson, 2019). Digitalization enhances the complexity for school leaders who need to balance existing and emerging tasks and practices representing different analog and digital logics (Pettersson, 2015). This is to be done while meeting the demands of preparing themselves, teachers, pupils, and other staff for learning and working in a digitalized society. As Flanagan and Jacobsen (2003) comment: "It is understandable that principals feel overwhelmed by the expectations inherent in their new responsibilities" (p. 140).

To understand the complexity of school leadership in a digitalized society, some studies point toward the need for contextual and holistic perspectives. Hague (2016), for example, argues for an ecological perspective in which school leadership can be understood to be framed by a sociocultural context, which is influenced and changed by the ongoing digitalization. Williams (2008) argues that school leaders need to view schools as learning organizations that need to collaborate with surrounding contexts such as community and society to put forth digitalization and change (Pettersson, 2018a).

To better understand the contextual conditions for leading in digitalized school contexts, this paper uses the Ecology of Resources Model developed by Luckin (2010). The theoretical model is based on learning and development as an interaction between the individual, in this case the school leader, and the sociocultural environment (Vygotsky, 1978). In the model the learner, in this case the school leader, is illustrated as being surrounded by three resource elements: (1) Environment, (2) Knowledge and Skills, and (3) Tools and People. The learner can interact with these resources either directly or indirectly. The learner is placed in a central position in the learning activity, putting requirements on the surrounding context and environment (Luckin, 2010). In this study, the focus will be on what constitutes these resource elements and how the school leaders interact, or do not interact, with these resources as part of the activity of leading digitalization in school. Thus, the framework provides a theoretical tool for exploring school leaders' activities and how these activities are supported in school.

With this backdrop, the aim of this paper is to explore school leadership in relation to the current digitalization in school. The following research questions are posted:

What constitutes the activity of leading school in a digitalized society?
What constitutes the contextual resource elements?
How do school leaders interact with these resources as part of the activity of leading digitalization in school?

Previous Research

As expressed by Yukl (2012): "The essence of leadership in organizations is influencing and facilitating individual and collective efforts to accomplish shared objectives. Leaders can improve the performance of a team or organization by influencing the process that determines performance" (p. 66). The same seems to be true for leadership in digitalized contexts, including school. Dexter (2008) describes for example the role and pres-

ence of effective ICT school leadership through the leaders' work with four extensive processes: *setting the direction* (formulating shared goals and objectives), *developing people*, *developing the organization,* and *developing teaching and learning.* These four processes, first developed by Leithwood & Riehl (2003, 2005; Leithwood & Jantzi, 2006), have been used to explore both aspects of ICT leadership (Håkansson Lindqvist & Pettersson, 2019; Pettersson, 2018b; Petersen, 2014), and the development of ICT policies in school and education (Vanderlinde, Dexter, & van Braak, 2012).

However, due to digitalization, the role of the school leader is said to have changed "from leading a team of teachers who have been deliverers of knowledge towards leading a team of teacher facilitators" (Chua Reyes, 2015, p. 378, Sheppard & Brown, 2014). Digitalization challenges previous communication, interaction, and power-relations among teacher, students, and their parents. Williams (2008) described this as "a clash of cultures" (p. 213) forming a cluster of challenges for school leaders to consider. The manifestation of ICT, including digital, cultural clashes, is also said to push forth new priorities and implications for school leadership. Williams (2008) means, for example, that school leaders need to undertake more radical perspectives on change by viewing schools as learning organizations that need to collaborate with the surrounding community and society (Pettersson, 2018a).

Studies also discuss the strain on school leaders as being 'victims' of external pressure and demands. As expressed by Hult, Lundström and Edström (2016), school leaders, to different extents, experience themselves as exposed to external pressure and demands that influence their role as a leader in school. One such example is related to the implementation of digitalization strategies with demands on digital competence for all actors in school, including school leaders (Olofsson, Lindberg, & Fransson, 2018). The digitalization strategies appear to steer school leaders to develop the competencies needed to lead and support digitalization in all aspects of school. As put forth by Flanagan and Jacobsen (2003): "It is understandable that principals feel overwhelmed by the expectations inherent in their new responsibilities" (p. 140). From a similar point of view, Håkansson Lindqvist and Pettersson (2019) discuss the complexity of leading in the midst of digitalization. In this study, school leaders' understanding of digitalization is reported to be overarching and complex.

Other studies focus more deeply on the conceptualization of school leadership in digitalized practices. For example, Mårell-Olsson and Berg-

ström (2018) argue that strategic school leadership in digitalized contexts can be conceptualized as the awareness of goals and motives, and the actions and strategies for organizing and leading processes towards digital and educational change. Further, Mårell-Olsson and Bergström (2018) argue that there are differences in how well school leaders adapt to their surrounding contexts and how well they are aware of the contextual resources available for leading change. For this, studies point to the need for professional development and support of school leaders (cf Grönlund et al., 2014; Håkansson Lindqvist, 2015; Hylén, 2011; Pettersson, 2018a; Pettersson 2018b), but also how further research on how school leadership is influenced and contextually framed by digitalization in school (Håkansson Lindqvist & Pettersson, 2019).

In summing up, most studies focus on how school leaders develop or can develop contextual conditions for their schools when it comes to digitalization. Rarer is the study of the contextual conditions that school leaders face when trying to lead in a digitalized school context or the conceptualization of aspects of leadership in digitalized contexts. It is this gap that this study will attempt to fill by means of the Ecology of Resources model, focusing on the sociocultural context in which the school leadership is to be enacted.

The Ecology of Resources Model

To better understand the contextual conditions for leading in digitalized school contexts, this paper uses the Ecology of Resources Model (Luckin, 2010). The theoretical model is based on learning and development as an interaction between the individual, in this case the school leader, and the sociocultural environment (Vygotsky, 1978). In the model the learner, in this case the school leader, is illustrated as being surrounded by three resource elements: (1) Environment, (2) Knowledge and Skills, and (3) Tools and People. Environment comprises "the location and surrounding environment with which the learner interacts" (Luckin, 2010, p. 91), which in this study could refer to the environment in the school or in the classroom. Knowledge and Skills is the "stuff to be learnt" in the specific context (Luckin, 2010, p. 91), for example, new skills or knowledge in using digital technologies in the school context.

Tools and People, the third resource element, refers to the tools and people that are available in the learning context. In this study, this could refer to school leaders or teachers as well as laptops and mobile phones. The model was first developed as a theoretical tool for describing and exploring teaching and learning activities and the support of these activities in the classroom (Luckin, 2010). From this perspective, the model was

primarily used to design, redesign or improve particular learning contexts within or closely connected to school and classroom.

A central concept for the framework is the theoretical concept of filters. According to Luckin (2010), the resources available to, in this case school leaders, can in different ways facilitate and enable but also constrain the learner - therefore described as the concept of filters. Identifying and exploring these filters and their effect on the school leader can therefore enhance the understanding of the contextual conditions surrounding the school leader when trying to lead in digitalized schools. Therefore, identifying and making filters visible can be seen as an important part of identifying the possibilities and challenges related to the leadership in digitalized school contexts.

In recent years, the model has served as a theoretical lens for understanding contextual conditions for actors such students, teachers, and school leaders (Håkansson Lindqvist, 2015; 2019). Studies focusing on school leaders are, however, few.

Method

Results in this study are based on data from surveys and semi-structured interviews with school leaders. The surveys were mainly used to generate a broad view of school leaders' understanding of the activity of leading digitalization in school, the resource elements available, and how these resources were used. The survey was based on open-ended questions concerning digitalization in school, digitalization and school leadership, and professional development and support when leading for digitalization. The survey was answered by 32 school leaders (identified as SL1-SL32) at the end of the Swedish national professional development program for school leaders. The program is a three-year advanced academic program and is mandatory for all newly employed school leaders (Swedish National Agency for Education, 2015).

Semi-structured interviews were conducted with nine school leaders working in the context of K-12. These interviews were transcribed before analyzing the data,. As an initial step, data from interviews and surveys, including open-ended comments, were read through and analyzed separately in line with qualitative content analysis (Schreier, 2014). Sentences or text comments were coded and given names describing the content as well as possible meaning in a larger context. When all data material was coded, codes from both interviews and open-ended comments were put together and read through. Thereafter, codes were analyzed and sorted into the three specific resource elements: (1) Environ-

ment, (2) Knowledge and Skills, and (3) Tools and People. The analysis resulted in two sub-themes within each category.

Results

The school leaders create a picture of digitalization as a complex area, which in turn makes leading for digitalization complex. For the school leaders, digitalization covers a broad number of different themes that they are responsible for initiating, implementing, maintaining, documenting, administrating, and leading.

Environment

In the resource element Environment, the following two sub-themes were identified: *Creating an environment for teaching and learning* and *Compensating learning*.

In the work with creating an environment for teaching and learning, school leaders expressed the responsibility for the teaching and learning environment (here and elsewhere, the open-ended comments were written in Swedish and translated into English by the authors): "That I am responsible for developing and leading the work with digitalization for both students and teachers" (SL5). Other important aspects, according to the school leaders, were developing teaching and learning through digitalization. This involved supporting and advancing teachers' work, "giving teachers the conditions to [develop teaching] through equipment and knowledge, professional development, for example online courses" (SL8). The school leaders also saw digital tools as a form of "extending/strengthening pedagogy" (SL21).

Compensating learning was also reported as an important theme. The school leaders saw the importance of digitalization in creating an environment that involved preparing students for the future: "That we prepare the students for technology in the information society and how they can use it in the best way" (SL6). According to some school leaders, digitalization is also found to be important from the perspective of equity. According to one school leader, this is construed as: "All teachers and students have the same basic foundation. Those who want to get a bit further must have the possibility to do so" (SL12). Here, the school leaders mean that digitalization is also important for compensation: "Compensating children and families who do not have technology at home" (SL31). This involves using digital tools for developing teaching for students and "supporting all students despite their difficulties" (SL7).

Skills and Knowledge

In the resource element Skills and knowledge, the following two subthemes were reported: *Own skills and knowledge* and T*eachers' skills and knowledge*.

In regard to own skills and knowledge, many of the school leaders noted the importance of knowledge in the steering documents and course plans as a necessary form of professional development, which often could be connected to their own needs for professional development: "professional development in the new knowledge requirements" (SL14). Another school leader expressed the need to "update myself in the new knowledge requirements in the courses that have been changed" (SL18). This also involved more personal knowledge from an educational perspective as well as from the student perspective: "more digital competence about education as well as the student's view of digitalization" *(*SL6). The need for professional development in digitalization itself was also reported: "in order to lead digitalization, I must have knowledge about the concept" (SL2) as well as what digitalization would mean for "teachers' work, technology, functions, etc., at the school" (SL23).

Another important aspect of professional development was teachers' skills and knowledge. This involved providing beneficial conditions in digitalization for teachers. School leaders reported the need for teachers to deepen their competence in order to develop new forms of teaching and learning which comprised digitalization. One school leader commented upon digital competence and the "courage" (SL19) to use digital tools for his/her own use and in turn for teacher use. This school leader also found that, despite strong technical development "method and pedagogy were behind" (SL1) and therefore the need for professional development for teachers. The school leaders also saw "basic digital skills" (SL27) as important. It is important that the teachers receive "the right professional development based on their level of knowledge" (SL30). According to the school leaders, teachers needed support to "see the advantages and adapt their work methods" (SL26). One school leader saw digitalization as a resource: "Digitalization is a hidden resource in school and must begin to be used to its full potential" (SL25).

Tools and People

In the resource element Tools and people the following two subthemes: *New possibilities with tools* and *In-school collaboration.*

The school leaders saw new possibilities with tools. Developing teaching and learning involved supporting development of tools in teaching

on a higher level of digitalization: "for example, (distance, flex-distance, remote) in order to be able to simplify work (communication, assignment and study materials) and taking advantage of more possibilities (multimedia, images, film)" (SL19). New technology was also seen as an important condition for developing the organization. New tools were necessary: "Tools to facilitate meetings, not necessarily physical meetings. Platforms for information and dialogue, joint Office 365 groups, and changes in textbooks" (SL2). Another school leader expressed this as the need for "infrastructure, e-mail, learning management systems" (SL13). The new technology also involved managing inventory "checking the accessibility to computers/tablets" (SL14) as well as issues of "digital work environmental issues" (SL13).

In-school collaboration, as a possibility to share teaching methods and experiences with digitalization was important, was reported by the school leaders. Collaboration was suggested within the school, for example, with the school's IT-group. This could involve the opportunity to "test programming" (SL22) as well as "basic and deeper skills in critical review" (SL9). Supporting teachers' collaborative work was also important. This involved supporting collaboration and spaces to share materials: "that the teacher can share information and materials with each other" (SL19). In supporting the development of teaching and learning, the school leaders provided examples of different methods for *teachers teaching teachers*. A central aspect here is "collegial learning" (SL2) as well as "leading teachers' learning processes" (SL4). Methods for supporting collegial learning were identified as "web tools, best practice, and pedagogical cafés" (SL13).

Discussion and Conclusion

In this paper, an attempt has been made to better understand the conditions for school leadership in digitized context through Luckin's (2010) theoretical framework, the Ecology of Resources model. By adopting this framework, this study aimed to explore how school leaders understand the activity of leading digitalization in school. As school leaders set the direction for digitalization, it appears that the role of the school leader as a leader becomes a more complex task in a complex area.

In regard to the resource element Environment, the school leaders in this study see digitalization as a complex concept in itself. Further, digitalization appears to increase the complexity of the role of the school leader in leading for digitalization (Dexter, 2008; Petersen, 2014). Thus, in the resource element Environment, filters are manifested as challenges in leading for creating a supportive environment for teaching and learn-

ing, advancing teacher and student learning, as well as compensating learning. These challenges also complicate the necessary competences needed for school leaders to drive the work with digital technologies forward.

In the resource element Tools and People, a central aspect seen in this study involved accessibility to technology. Accessibility to technology, according to these school leaders, appeared to be a strong condition for supporting the organization in its developmental work. Technology was a vital aspect for digitalization as the responsibility of the school leader (Dexter, 2008). This is an interesting finding, when considering otherwise reported good accessibility to technology (Swedish National Agency for Education, 2016). Despite good accessibility to technology, challenges related to technology prevailed. This challenge would appear to be even more complex in schools and municipalities in which students do not have access to computers at home. Another important factor will be creating good conditions for teachers to access technology, as well as supporting and managing teachers' professional development, including knowledge, methods for teaching with technology, and developing teachers' professional stance towards digitalization. For a school leader, supporting teachers' work with digitalization appears to be a strong base for supporting student outcomes (Dexter, 2008). Therefore, there is the need for professional development for school leaders (Grönlund et al., 2014; Hylén, 2011).

In the resource element Skills and Knowledge, two important findings emerged. First, school leaders noted that own skills and knowledge were important creating beneficial conditions for leading for digitalization. School leaders' work with learning for digitalization can be seen as supporting the work in developing new knowledge and work methods for themselves and for their organizations and will most likely take time (Grönlund, 2014; Grönlund et al., 2014; Tallvid, 2015). Therefore, in this resource element school leaders' knowledge and skills in digital technologies could be seen as a filter. If school leaders do not gain these skills, it may be difficult to lead teachers in this same process. Thus, the second finding emerges: supporting teachers' skills and knowledge can also be said to manifest a filter if teachers' skills and knowledges are not supported and developed. Professional development for teachers is reported by the school leaders in this study as an important part of leading for digitalization. Further, the collaborative work with digitalization is expected to contribute to a larger picture, i.e., school development. Dealing with issues regarding own professional development as well as teacher professional development involves

combining their own competences and leading others in the digitalization process (Leithwood & Riehl, 2003, 2005; Leithwood & Jantzi, 2006).

The results of this study show that, for school leaders, digitalization is a complex concept. Leading for digitalization can be related to aspects which are related to school leaders creating a beneficial environment for digital technologies, developing their own skills and knowledge as well as supporting and developing teachers' skills and knowledge, access to technology, and use of digital tools. For school leaders, the need for professional development comprises their own professional development, teachers' professional development, students' digital competence, and leading for digitalization in schools as organizations. Conclusions can be drawn that the role of the school leader is important for supporting teachers' work with digitalization for teaching and learning, and in turn supporting students' learning with digital technologies. How school leaders lead for digitalization will most likely have a strong impact on school development.

Implications for Practice and Future Research

Regarding implications for practice, it is important to consider the ways in which time, resources, and professional development are made available to support school leaders in their work with leadership for digitalization. This also concerns the prioritization of digitalization as one of many important areas in schools as organizations. Considering the complexity of school leaders' leadership, future research could involve a deeper study of what professional development would be of interest to school leaders in their leadership for digitalization. Moreover, a critical viewpoint on how school leadership is affected by, and can be employed in, the ongoing digitalization is important to study.

References

Afshari, M., Bakar, K. A., Luan, W. S., Samah, B. A., & Fooi, F. S. (2009). Technology and school leadership. *Technology, Pedagogy and Education, 18*(2), 235-248.

Chua Reyes, V. (2015). How do school leaders navigate ICT educational reform? Policy learning narratives from a Singapore context. *International Journal of Leadership in Education*, *18*(3), 365-385.

Dexter, S. (2008). Leadership for IT in schools. In J. Voogt & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education* (pp. 543–554). New York, NY: Springer.

Flanagan, L. & Jacobsen, M. (2003). Technology leadership for the twenty-first century principal. *Journal of Educational Administration, 41*(2), 124-142.

Grönlund, Å., Andersson, A., & Wiklund, M. (2014). *Unos uno årsrapport 2013* [Unos uno yearly rapport 2013]. Örebro, Sweden: Örebro University.

Grönlund, Å. (2014). *Att förändra skolan med teknik: Bortom "en dator per elev."* [Changing school with technology: Beyond 'one computer per student']. Örebro, Sweden: Örebro Universitet.

Hauge, T. E. (2016). On the Life of ICT and School Leadership in a Large-Scale Reform Movement. In *Digital Expectations and Experiences in Education* (pp. 97-115). SensePublishers.

Håkansson Lindqvist, M. (2015). *Conditions for technology enhanced learning and educational change: A case study of a 1:1 initiative*. Doctoral thesis, Umeå University: Department of Education.

Håkansson Lindqvist, M. (2019). School leaders' practices for innovative use of digital technologies in schools. *British Journal of Educational Technology, 50*(3), 1226-1240. DOI:10.1111/bjet.12782.

Håkansson Lindqvist, M., & Pettersson, F. (2019). Digitalization and school leadership: on the complexity of leading for digitalization in school. *International Journal of Information and Learning Technology*, *36*(3), 218-230.

Hult, A., Lundström, U. & Edström, D. (2016). Balancing managerial and professional demands: School principals as evaluation brokers. *Education Inquiry, 7*(3), 283-304.

Hylén, J. (2011). *Digitaliseringen av skolan* [The digitalization of school]. Lund, Sweden: Studentlitteratur.

Kozma, R. B. (Ed.). (2003). *Technology, innovation, and educational change: a global perspective*. A report of the Second Information Technology in Education Study Module 2. Eugene, OR: International Society for Technology in Education (ISTE).

Leithwood, K. A., & Riehl, C. (2003). *What we know about successful school leadership*. Philadelphia, PA: Laboratory for Student Success, Temple University.

Leithwood, K. A., & Riehl, C. (2005). What do we already know about successful school leadership? In W. A. Firestone & C. Riehl (Eds.), *A new agenda for research in educational leadership* (pp. 12–27). New York, NY: Teachers College Press.

Leithwood, K., & Jantzi, D. (2006). Transformational school leadership: Its effects on students, teachers and their classroom practices. *School Effectiveness and School Improvement, 17*(2), 201–227.

Luckin, R. (2010). *Re-designing learning contexts: Technology-rich, learner-centred ecologies*. London, England: Routledge.

Mårell-Olsson, E., & Bergström, P. (2018). Digital transformation in Swedish schools: Principals' strategic leadership and organisation of

tablet-based one-to-one computing initiatives. *Seminar.net*, *14*(2), 174-187.

Olofsson, A.D., Lindberg, O.J. & Fransson, G. (2018). Students' voices about information and communication technology in upper secondary schools. *International Journal of Information and Learning Technology, 35*(2), 82-92.

Ottestad, G. (2013). School leadership for ICT and teachers' use of digital tools. *Nordic Journal of Digital Literacy, 8*(1-2), 107-125.

Petersen, A. L. (2014). Teachers' perceptions of principals' ICT leadership. *Contemporary Educational Technology*, *5*(4), 302–315.

Pettersson, F. (2015). *Learning to be at a distance: Structural and educational change in digitalizing medical education*. Doctoral thesis, Umeå University: Department of Education.

Pettersson, F. (2018a). Digitally Competent School Organizations: Developing Supportive Organizational Infrastructures. *International journal of media, technology & lifelong learning, 14*(2), 132-143.

Pettersson, F. (2018b). On the issues of digital competence in educational contexts: A review of literature. *Education and Information Technologies, 23*(2018), 1005–1021.

Schreier, M. (2014). Qualitative content analysis. In U. Flick (ed.) *The Sage Handbook of Qualitative Data Analysis* (pp. 170-183). London: SAGE.

Sheppard, B., & Brown, J. (2014). Leadership for a new vision of public school classrooms: Technology-smart and learner-centered. *Journal of Educational Administration*, *52*(1), 84-96.

Swedish National Agency for Education. (2015). *The National School Leadership Training Programme: Goal document 2015-2021*. Stockholm: Skolverket.

Swedish National Agency for Education. (2016). *It-användning och it-kompetens i skolan. Skolverkets IT-uppföljning 2015* [It-use and It-competence in school: NAE IT-follow-up 2015]. Stockholm, Sweden: Skolverket.

Tallvid, M. (2015). *1: 1 i klassrummet: Analyser av en pedagogisk praktik i förändring* [1:1 in the classroom: Analyses of a pedagogical practice in change]. (Doctoral thesis, Center for Educational Science and Teacher Research and Research School in Educational Science, 42). Acta Universitatis Gothoburgensis, Gothenburg, Sweden.

Vanderlinde, R., Dexter, S., & van Braak, J. (2012). School-based ICT policy plans in primary education: Elements, typologies and underlying processes. *British Journal of Educational Technology, 43*(3), 505–519.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Williams, P. (2008). Leading schools in the digital age: A clash of cultures. *School Leadership and Management*, *28*(3), 213–228.
Yuen, A.H.K., Law, N. and Wong, K.C. (2003). ICT implementation and school leadership: Case studies of ICT integration in teaching and learning. *Journal of Educational Administration, 41*(2), 158-170.
Yukl, G. (2012). Effective Leadership Behavior: What We Know and What Questions Need More Attention. *Academy of Management Perspectives*, *26*(4), 66-85.

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STRUGGLING WITH LEADING DIGITALIZATION: DIVERSE EXPERIENCES AMONG SCHOOL AND PRESCHOOL PRINCIPALS

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Abstract

A municipality in Sweden took initiative to enhance the competence for all principals to lead digitalization in schools. The initiative was implemented during 2018-2019. Participant observations and surveys were used to document results, which showed a gap in the chain of command, as well as different attitudes towards the course between school and preschool principals. The attitudes were more mixed among the school principals than preschool principals, who were mainly positive about the initiative. The study suggests that leading digitalization through a chain of command should be done as a process, not a project, enabling integration of multilevel organizational aspects over time.

Introduction

Organizing digitalization for learning in school has proven to be a daunting and multi-layered task. Previous studies have argued that it is important to address issues such as culture and structure, as the potential for digital technology to become supportive of learning is closely linked to the context in which the school operates (Tondeur et al., 2009; Selwyn, 2011). Supportive leadership, supportive organizational culture, and collegiality are singled out as important foundations for the professional development of teachers' digital competence (Schrum & Levin, 2016). In addition to teachers' need for skills to develop methods, supportive measures, and collaborative routines for students, principals need skills to support teachers in their professional development regarding school digitalization (Vanderlinde & van Braak, 2010; Håkansson Lindqvist, 2015). Dexter (2011) highlighted that a recurring theme in leadership research linked to the school's digitalization is distributed leadership, arguing that successful management in this context is driven by the stated purpose of digitalization by principals and their ability to incorporate leadership of collegiality. Despite the key role of principals in the process of digitalizing schools, they receive little training in how they can support this through their leadership (Balanskat et al., 2013). According to Blossing and Liljenberg (2019), getting support for leadership development is crucial, as there are risks related to an overly instrumental and formal approach

to leadership (as a response to external pressure to meet measurable goals) that may lead to a not meaningful learning environment in the school. Previous studies also highlight risks in organizations in which investments are limited or only a few people are involved in the development of the projects. Such projects run the risk of creating 'islands' of insights that are not disseminated in the school as an organization (Grensjö, 2002). In addition, whether principals act with an integrated or separate practice has consequences on how the development of the process functions and spreads further (Björkman, 2011). Furthermore, Håkansson Lindqvist and Pettersson (2019) show that digitalization is seen as organizational challenges at all levels of the school as well as an area of activity by school administrators. It is important to continuously ask in what way digitalization affects individuals in school, what commercial forces influence decisions regarding digital governance, management and organization, and in what way it affects the opportunities for equal participation in education (Selwyn, 2017). Against the background of previous research showing lack of investment in principals' competence to lead digitalization (see for example Balanskat et al., 2013; Selwyn, 2017; Håkansson Lindqvist & Pettersson, 2019), there is a strong need to study strategic work on principals' competence development regarding leading digitalization, which is the focus of this study.

Background

The study was conducted in a municipality in Sweden that took the initiative to enhance the competence among principals to lead digitalization in school with the aim to improve learning and digital competence for students and staff. The starting point for the training effort for all principals regarding leading digitalization was that principals' skills and understanding are important for teachers and students. Hence the mandatory participation for all principals. This decision was made based on the extensive experience in the municipality of initiating and driving digitalization in the various school forms such as pre-school, school, and special needs school, identifying that there were differences to handle. Furthermore, the Swedish National Agency for Education (SNAE), which developed the Leading Digitalization program for school administrators, recommended involving as many people as possible (and throughout the chain of command) to learn from the educational material, highlighting a holistic approach. The material contains six specific parts that in turn have four elements. The six parts are: 1) Digitalization—society and school, 2) Digitalization and leadership, 3) Chain of effects, 4) Digitalization and teaching, 5) Digital ecosystem, and 6) Developmental plan. The SNAE suggests that participants meet on twelve occasions and that each occasion should last for 120 minutes. Between meetings, group

members should be allowed time for individual preparations and assignments. The recommended duration of the competence development course is 24 weeks. The municipality reported on here designed a venture that followed SNAE's recommendations with a view to obtaining a comprehensive and sustained investment and also providing room for collegial skills development through the continuous meetings that took place during a year from January to August.

Purpose

The purpose of this study of "Leading Digitalization" is to gain a deeper understanding of the content and form of the competence development and its importance for the principals' experience of relevance and influence on their own competence in leading digitalization in their units. Therefore, this study aims at answering the following research questions:

RQ1. How did the principals feel that the top-down project affected their understanding and ability to lead digitalization?
RQ2. What did the principals find to be of special significance for their own perceived development of knowledge and understanding to lead digitalization?
RQ3. How should top-down driven projects be organized to enhance continuous knowledge and understanding to lead the digitalization among principals?

Method

This paper focuses on describing and analysing educational activities and experiences from the principals' perspectives during the course and a follow up survey one year after the course had finished.

Accompanying and Practice-Based Research

The methodology was driven by two approaches, accompanying research and practice-based research, both built on the idea of engagement and intervention. The strength of accompanying research is the combined role of an external observer who can also act as a critical friend to the process, as was the case in this study. But there is a risk of becoming too uncritical of what is being studied by creating close relationships with those involved in the process during the study (Albinsson & Arnesson, 2010). At the same time, these relationships open opportunities for getting closer to the phenomenon, in this case the mandatory Leading Digitalization course for principals. Differences in experiences and understanding are seen as a prerequisite for learning and for continued progress towards more insight and understanding of the local conditions that need to be addressed in the direction of the desired de-

velopment goals (Albinsson & Arnesson, 2010). Practice-based research has emerged as a response to societal challenges that require more collaboration to gain knowledge regarding both improved practice and theoretical depth rather than to settle for distanced theorizing. Key concepts in this context are commitment and participation in the joint knowledge-creation work (Van de Ven, 2007; Gunnarsson et al., 2016). In this study, focus lies in the strength of the combination of accompanying and practice-based research with the aim of jointly asking relevant questions and getting closer to the effects that a competence development effort can generate.

The Participant's Observations

To gain a deeper understanding of what happened during the educational investment and how it was experienced by the principals, participatory observations were made during course sessions. Approximately 40 principals participated and were divided into two groups: primary school and preschool. This breakdown has historical foundations and reflects the arrangements with the municipality's principals at the regular Thursday meetings. These two groups were then subdivided by the course leaders from the municipality into smaller groups with about five principals in each group (this varied over time due to normal causes such as sick leave, new appointments, etc.). Each group of school principals had a group leader from a private company. Each group of the pre-school principals had a group leader from the municipality. The researcher participated on six of the 12 occasions and followed the principals of both schools and preschools, three occasions with school principal learning groups and three with pre-school principal learning groups. Each session was 120 minutes. Field notes were taken during each observed session. The researcher achieved a broad understanding by participating in the principals' learning groups and listening to how process managers led the talks, guided the principals through the educational material, followed up from one time to another on the units, and asked challenging questions to trigger organization-related reflections and analyses among the principals. In combination with these group discussions, the researcher also participated in the process managers' subsequent meeting at each occasion, where they shared information on how they got into collegial conversations and reflections in the various groups and the progression they observed in the groups based on the conversations held. After the sessions, all session group leaders from the private company and the municipality met for 30-40 minutes in a common discussion to inform each other of what had been discussed in their groups. Furthermore, discussions of groups' similarities and differences were brought up. The researcher took part in these discussions as a critical friend to ask for

clarifications if needed. Field notes were also taken during these meetings.

Follow-up Surveys of the Initiative Leading Digitalization

The principals' experiences were followed-up by surveys on two occasions, the first being at the end of the course and measuring the general experience of the course by seven items formulated by the course leaders in the municipality on a scale of one to six (see Table 1 in the Results section below). As the vision of leading digitalization was characterized by an organizational development ambition, it was also important to follow up on consequences. Therefore, one year after completing the course, the principals at school and preschool were asked to fill out the second survey. It concerned how they experienced the initiative on the basis that they previously, in the first survey, emphasized collegiality in the learning groups as central to perceived relevance and effect of the initiative. Social learning for professional development has proven to be an important dimension for continuous learning linked to professional practice (Littlejohn et al., 2019). Therefore, the follow-up study was based on dimensions of social learning. The survey of 30 questions on a 4-item scale measures experiences of dimensions of social learning such as practice, value creation, collective identity, and organization (Wopereis & Vrieling, 2018). The survey was used to capture how the way of developing knowledge, understanding, and ability to lead digitalization was graded by the principals. The survey was distributed to all those present during the principals' meetings to both secure anonymity and increase the response rate. Twenty seven school and 20 preschool principals participated. One pre-school principal was not present at the time of the second survey. The responses were coded as agreeing positively or negatively on each statement. Response options 1-2 have been coded as negative, and 3-4 have been coded as positive. The responses were then compiled as combined measures on each item, providing visual distributions of negative and positive attitudes on each question (see Figures 1 and 2 in the Results section below).

Results

From the participant observations of learning groups, it was revealed that there were major differences within and between schools and preschools and that work was done differently on the units in the municipality. The difference that emerged during the observed occasions was the use of digital technology and motivations to use it. While the school principals tended to talk about problems with specific systems and lack of support from the municipality, preschool principals and special education principals tended to talk about how they would learn over time and

suggested methods and approaches that involve children to develop an exploratory spirit among staff. Relatively early in the accompanying research process, it emerged that there was a gap in the chain of command, which the municipality management team needed to become more aware of and take responsibility for. Part of the management team had chosen not to actively participate in the skills development effort due to time issues. Furthermore, the respective heads of school and preschool had different approaches to the efforts during the course regarding modes of involvement. The head of pre-school participated in each session. The head of school participated during the last sessions. The recommendation from SNAE was to involve the entire chain of command on every occasion in the teaching material (as discussed in the Background section). However, such extensive commitment became too excessive during the initiative itself.

The first survey captured principals' experience of the course. Table 1 clarifies the distribution of the principals' responses. Satisfaction scores ranged from 1 (the lowest) to 6 (the highest) in response to each statement related to the Leading Digitalization training and its implementation. Table 1 summarizes the number of respondents selecting each response.

The data show that most of the principals were positively attuned to the investment and the activities they carried out directly after finishing the course. The way the competence course was handled was also appreciated. The survey also included the opportunity for open-ended responses, which many principals used to clarify their ratings, here referred to as "RP" with unique numbering. All responses were written in Swedish, with selections translated into English by the author for inclusion here.

Table 1
Distribution of Principals' Ratings for Each Question (1 = least satisfied)

Claim	1	2	3	4	5	6	
Leading digitalization has in general been	0	1	2	7	21	3	4.7
The tasks we performed have been	0	1	1	14	17	1	4.5
The course managerial efforts / control has been	0	2	10	7	13	2	4.0
The coordination has been	0	0	5	11	11	7	4.6

Claim	1	2	3	4	5	6	
The process manager's efforts have been	0	1	1	1	6	25	5.5
The work in group / collegial learning has been	0	2	1	2	11	18	5.2
My own effort has been	0	0	9	11	10	4	4.3

The process managers received the most appreciative comments, whether it was process managers from the municipality or from the external company hired to lead the groups during the process. Typical responses were: "*Thanks to our process manager. She has kept the project together.*" [RP13]; "*The guidance from the company has been the most important factor, being able to talk about leadership.*" [RP22].

Furthermore, there were some criticisms of the pace of the educational effort as there were tasks to do in addition to daily activities and some expressed difficulties in catching up and completing the course tasks as they had wished: "*I think things have been going a little fast. Do not feel that I have been able to anchor all the information*." [RP25]; "*The process manager was super. However, it was difficult to get activities as anchored [in the school] as I wanted.*" [RP29].

In general, many people were satisfied with the organization of the competence development effort, where they gathered in the same group during the spring and discussed the tasks, compared how they went about things, and shared what new ideas they gained by trying out ideas at the units, regardless of the differences in approach. An important aspect of the implementation of the tasks was that they took place in a collegial spirit and were discussed with colleagues from other units on a regular basis. Many principals experienced that as rewarding and beneficial for their own development and the creation of trust in continuous professional encounters, providing comments on what they valued: "*The collegial conversations in a secure group.*" [RP2]; "*Being able to share experiences and reflect on the group. This has created trust in the group.*" [RP3].

In addition to talking to colleagues and learning from each other in safe group configurations, a trust that grew over time during the course was achieved by having a process manager who held the sessions, gave direction to each meeting, and challenged the principals with critical issues. This was considered valuable and evolving, as one principal expressed: "*The support in each other and our fantastic process manager*

who makes us think one more step, stay on track and help us to really re-think our practice." [RP15].

Regardless of the positive experiences, there were difficulties during the course. The biggest difficulty was for principals to find time to complete the tasks on their own due to organizational reasons, difficulty to fit in with the course-specific activities in an already full agenda on the unit, wanting to delve into the assignments before moving on to the next assignment in the course structure, and pace, as noticed in the excerpts: "*Time to perform. Hard to get [the course assignments] into an already full agenda.*" [RP23]; *Being able to stop and delve more into one task before moving on to the next.*" [RP25].

The survey showed that principals particularly emphasized two wishes for how to proceed after the course. One was the desire to retain the groups they had worked with, established trust in, thus forming the basis for collegial learning in learning groups with other principals. The second clear wish was to retain process manager,s as most people considered that role to be important for getting the process started and being challenged in their own learning about digitalization, both as organization development and also the responsibility for leading digitalization in practical action. The extracts below exemplify the wishes: "*We need our learning groups and guidance as it is now the work begins.*" [RP3]; "*I would like continued work with process managers.*" [RP12].

The follow-up study one year later showed mixed results, depending on what type of school the principals were working in, i.e., school or preschool. Figures 1 and 2 below visualize the answers to each question for school and preschool, respectively, from the perspective of principals regarding dimensions of social learning (DSL).

As the figures show, reactions to the experience varied more among the principals in the schools than in the preschools. This is also evident in the open response alternatives, when some critical voices indicated that there was no continuity of the effort after the course was completed: "*Good to have a knowledgeable process manager who was knowledgeable in the field and who was from the outside. It is important to process the digitalization issue, to challenge one's own thinking with others. However, it created development during the course, then it has stalled.*" [RP#6_DSL_School]; "*Felt more important to implement than to take advantage of what emerged, feels like two separate tracks. Now we will "digitize." I do not experience any clear target image for the principal group. I have also lost focus in my own unit.*" [RP#18_DSL_School].

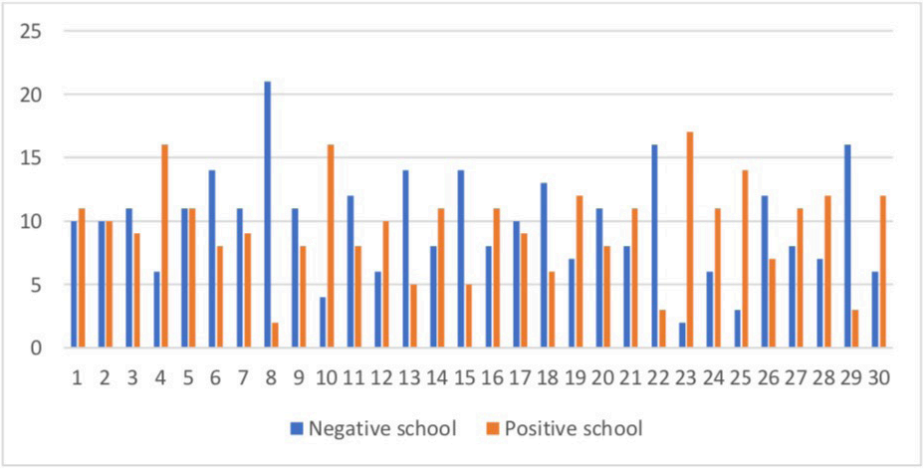

Figure 1. Distribution of negative and positive responses to each question for school principals

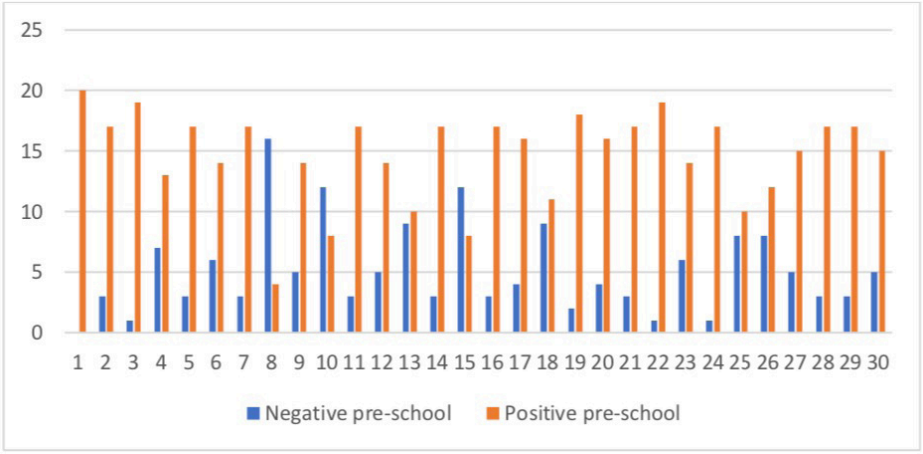

Figure 2. Distribution of negative and positive responses to each question for the preschool principals

The experience of having taken part in a project with no follow up was not brought up by the preschool principals, the majority of whom were satisfied: "*Sharing thoughts and discussions increases the chance of equality. There were several positive effects even upwards [in the chain of command] when we as a group focused on this. For example, we got our digital tools paid centrally. You should set aside time for learning*

and reflection when you want to develop something." [RP#18_DSL_Preschool].

Analysis

The training effort in leading digitalization in schools is seen as a generous investment by the municipality, especially in relation to previous criticism that the principals do not receive much guidance in this type of organization development (see for example, Balanskat et al., 2013; Håkansson Lindquist, 2015). An important aspect, however, has been how to proceed with such efforts due to differences in attitude expressed by principals of schools as compared to principals of preschools. Among the principals of schools, the initiative was seen as something with a beginning and an end, while among the principals of the preschools, the process continued but with a certain change of direction and a greater focus on collective change leadership supportive of digitalization in school (Dexter, 2011). This type of dynamic culture has also shown previous research to be an important factor in creating change and driving development (Tondeur et al., 2009; Selwyn, 2011). Previous research also perhaps helps avoid getting caught up in the idea that digitalization is somewhat measurable and therefore risk being too instrumental in digitalization, thus missing out on creating and maintaining meaningful learning environments in school (Blossing & Liljenberg, 2019). The difference between the principals of the schools and the preschools, which this study shows is important to pay attention to and act upon, relates to what Björkman (2011) refers to as integrative or separated practices. There is every reason for managers of the municipality to identify which types of differences are acceptable and which ones really need to be addressed. The constant reflection and discussion regarding digitalization is also seen here as central to the school as an organization (Selwyn, 2017). Of course, it is important to relate to the different school forms based on the missions they have. It is also important to handle the development of schools and pre-schools in a way that does not risk associating leading digitalization with a technology project but rather insists that it is about learning and student development, where digital technology sometimes has an important part in learning.

Discussion and Conclusion

In general, the study shows that during a digitalization training initiative all principals felt satisfied with both content and form of the initiative and that it influenced their knowledge and understanding in particular regarding the complexity of digitalization in school (RQ1). To benefit from the competence development course and investment in leading digitalization, the learning groups that the principals considered so valuable

should be kept as a model for continuous competence development (RQ2). Similarly, deepening conversations about views of digitalization will help avoid narrow conversations regarding number of gadgets and systems. By encouraging a view of digitalization as an organizational process, is the process can be driven in the direction of organization development and desirable transformation to create meaningful teaching and learning (RQ3). After all, it is not obvious that a digitized process is automatically an improvement. It can go in the opposite direction. It is important to know when to digitalize what in what way and why, and when not to. Digitalization can be viewed in different ways and here it is recommended to see it as a complex process that should be managed as a process, not as a project. In other words, leading digitalization is not a project. A project has a beginning and an end, while a process is ongoing. This means that those who are part of the processes need support, and here the process managers have been a significant force behind the perceived development among the principals. Furthermore, improved capacity in reporting and talking about creative and efficient efforts could help transform project views to process views, allowing Leading Digitalization to continuously create meaningful learning for students and healthy work environments for professionals in schools.

References

Albinsson, G., & Arnesson, K. (2010). How critical can you be as an on-going evaluator? *International Journal of Action Research*, 6(2-3), 256-287.

Björkman, C. (2011). Skolans ledarskap som intern förbättringskapacitet. In J. Höög & O. Johansson (Eds.) *Struktur, kultur och ledarskap, 135-152*. Lund: Studentlitteratur.

Blossing, U., Liljenberg, M. (2019). School leaders' relational and management work orientation. *International Journal of Educational Management*. *33*(2), 276-286. https://doi.org/10.1108/IJEM-07-2017-0185

Dexter, S. (2011) School technology leadership: Artifacts in systems of practice.

Journal of School Leadership, *21*(2), 166-189.

Grensjö, B. (2002). Erfarenheter sprids – Kunskaper används? Enkätstudie bland KK-stödda mindre skolutvecklingsprojekt. Pedagogiska Rapporter, Nr 67. Umeå: Pedagogiska Institutionen, Umeå Universitetet.

Gunnarsson, E., Hansen, H.P., Nielsen, B.S., & Sriskandarajah, N. (Eds.). (2016). *Action Research for Democracy*. New York: Routledge.

Håkansson Lindquist, M., Pettersson, F. (2019). Digitalization and school leadership: On the complexity of leading for digitalization in school. *The International Journal of Information and Learning Technology, 36*(3), 218-230.

Håkansson Lindqvist, M. (2015). Conditions for technology enhanced learning and educational change A case study of a 1:1 initiative. *PhD dissertation*. Umeå: University of Umeå, Sweden.

Balanskat, A., Bannister, D., Hertz, B., Sigillò, E., & Vuorikari, R. (2013). Overview and analysis of 1:1 learning initiatives in Europe.. In S. Bocconi, A. Balanskat, A., P. Kampylis, & Y. Punie, (Eds.), *JRC scientific and policy report*. Brussels, Belgium: Publications Office.

Littlejohn, A., Jaldemark, J., Vireling-Teunter, E., & Nijland, F. (Eds). (2019). *Networked Professional Learning. Emerging and Equitable Discourses for Professional Development*. Cham: Springer.

Schrum, L., & Levin, B. B. (2016). Educational technologies and twenty-first leadership for learning. *Inrnational Journal of Leadership in Education*, *19*(1), 17-39.

Selwyn, N. (2011). 'It's all about standardisation' - Exploring the digital (re) configuration of school management and administration. *Cambridge Journal of Education*, *41*(4), 473-488. doi: 10.1080 / 0305764X.2011.625003.

Selwyn, N. (2017). *Skolan och digitaliseringen. Blir utbildningen bättre med digital teknik?* Göteborg: Daidalos förlag.

Tondeur, J., Devos, G., Van Houtte, M., van Braak, J., & Valcke, M. (2009). Understanding structural and cultural school characteristics in relation to educational change: The case of ICT integration. *Educational Studies*, *35*(2), 223-235.

Van De Ven, A. (2007). *Engaged Scholarship: A Guide for Organizational and Social Research.* Oxford: Oxford University Press.

Vanderlinde, R., & van Braak, J. (2010). The e-capacity of primary schools: Development of a conceptual model and scale construction from a school improvement perspective. *Computers & Education*, *55*(2), 541-553.

Wopereis, I., & Vrieling, E. (2018). Facilitating social learning in teacher education: Development of a questionnaire for practice. Paper presented at the EAPRIL conference, Portoroz, Slovenia.

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THE ANTECEDENTS OF STUDENTS STUDYING AN INFORMATION TECHNOLOGY QUALIFICATION AT A HIGHER EDUCATION INSTITUTION IN SOUTH AFRICA

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Abstract

School leavers today have greater access to technology than ever before. Thus the assumption is that first year university students studying an information technology qualification are digitally literate, and do not require training in basic computer skills and concepts. Digital literacy, however, is more than just having access to technology, as it also requires having a knowledge and understanding of technology as well as being able to use technology. This paper reports on how digitally literate students studying a Diploma in Business Information Technology at a university in Johannesburg, South Africa are, before embarking on their studies.

Introduction

University students in South Africa come from different backgrounds, cultures, and schooling systems (Pather et al., 2017; Barlow-Jones & van der Westhuizen, 2018). Many of these students are foreigners from neighboring African countries, and as such, English is either their second or sometimes even third language. English is the language of instruction at South African universities. The general consensus is, that students studying Information Technology (IT) courses at university, should already be *au fait* with basic computer concepts and have mastered the software application Microsoft Office (MS Word and Excel) (Coldwell-Neilson, 2018). However, South African students who have previously been disadvantaged and attended less than adequate schools, on entering university from rural and township areas seldom have access to computers and the internet (Schlebusch, 2018).

Literature Review

Information Technology (IT) and Computer Applications Technology (CAT) are the only two computer subjects offered in South African schools. CAT includes a theory component covering the topics of hardware, software, networks, the internet, data and digital security, as well

as a practical component covering MSWord and Excel (South Africa Department of Basic Education, 2011). Information Technology includes a theory component similar to that of CAT; however, the practical component includes computer programming (South Africa Department of Basic Education, 2011). Only 3,851 learners of the 504,303 Grade 12 cohort wrote the Information Technology exams for the National Senior Certificate in 2019, less than 1%, and 35,248 learners wrote the Computer Applications Technology exams, a mere 7% of the Grade 12 cohort. This could explain why South Africa is experiencing a gap between the number of IT jobs available and the number of candidates who can fill them (Calitz, Evert, & Cullen, 2015). Stuurman (2017) highlights that the IT skills shortage in South Africa poses a serious constraint on businesses.

On investigating the reason why so few learners choose either CAT or IT as subjects from Grade 8-12 (South Africa Department of Basic Education, 2020), the researcher came across the following headlines: "Stealing SA's Future: 250 Computers Stolen from Gauteng Schools in 2019" (Mabuza, 2019); "Laptops, Smartboards and Tablets Worth Millions Stolen from Gauteng Schools" (Mkhonza, 2019); "Laptops Just Ornaments for Eastern Cape Teachers who are not Trained to Use Them" (Macupe, 2017). Many of South Africa's Government schools are plagued by barriers, preventing the integration of information technology in the classrooms; these include: a lack of computers, a lack of software and hardware, a lack of technical support, a lack of internet access, a lack of reliable electricity supplies, a lack of security, and insufficient teacher training (Hart & Laher, 2015; Bisseker, 2019).

In this paper the researcher investigates: (1) how digitally literate students studying a Diploma in Business Information Technology at the University of Johannesburg (UJ) are before embarking on their studies, and (2) if the course module IFS01A1 (Information Systems 1A) which consists of a basic computer concepts theory component and a MS Word and Excel practical component, is still a necessary first year module.

Research Methodology

The researcher collected data from a survey that produced numerical descriptions from a total of 97 students enrolled for a first year Business Information Technology Diploma at the University of Johannesburg in South Africa. Sampling for this study was based on convenience sampling as the researcher included students that were accessible to her and formed part of her lecturing classes. The data collected in the third term of 2019 were scrutinised for irregularities and cases were removed where data were incomplete. Descriptive statistics were used to anal-

yse the quantitative data from the survey. A Likert scale ranging from 1 (Often = Daily), 2 (Sometimes = A few times a week) and 3 (Never) was included for question 12. All the guidelines prescribed by the relevant ethics committee was adhered to and permission was granted to conduct the research. Utmost care was taken to ensure that data were recorded and analysed as accurately as possible.

Data Analysis

A questionnaire was given to 97 students studying the Diploma Business Information Technology at the University of Johannesburg. Thirty eight percent of the students were female and 62% were male. When students were asked if they took Computer Applications Technology or Information Technology as a Grade 12 subject, the response was that 14% of students took CAT and 6% of students took IT, resulting in a total of 80% of students not taking any computer subject prior to their studies. When students were asked why they did not choose CAT or Information Technology as a subject in Grade 12, 65% of students responded that CAT and IT were not available as a subject choice in their high school. Students were then asked if a Diploma in Business Information Technology was their first choice of study; 65% of students said that it was and 35% indicated that it was not.

Figure 1 indicates how much experience students had with computers before embarking on their studies. It is interesting to note that 32% of students only started using computers in high school and 28% didn't have much computer experience.

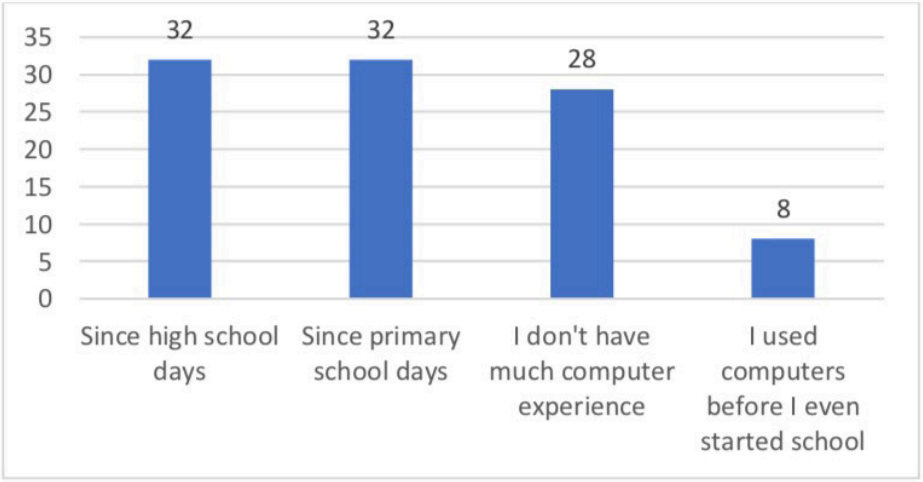

Figure 1. Experience with computers.

Figure 2 indicates how often students use different technology in their everyday life now they started studying at university. It is surprising that students don't use game consoles (48% never) or play games on the web (47% never). Only 39% of students indicated that they often used the internet at home (14% never) and only 34% indicated that they often used a computer at home (24% never). It seems that the majority of students often access the internet via their cell phone (93%) and often use Instant Messaging (88%). Seventy seven percent of students also often use a web-based email account. Fifty five percent of students said that they often used MS Word and Excel.

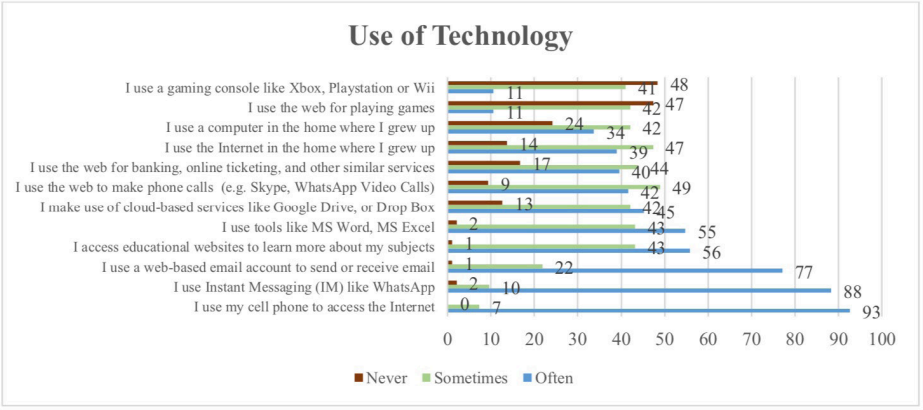

Figure 2. Use of Technology.

Findings and Conclusion

Only 35% of schools offered computer subjects in high school. However, this percentage is supported by the South African Institute of Race Relations (SAIRR) (Shezi, 2016), who say that only four out of ten public schools in South Africa have a computer lab. Even though 50% of South African's live below the poverty line, more than 75% of 15 year olds and older, who fall into the low-income group, own a mobile phone. Ninety three percent of students indicated that they frequently use their cell phone, which is slightly higher than the standard. Fourteen percent of students indicated that they never used the internet at home and 24% indicated that they never used a computer at home. This could be because many students don't have a computer or have access to the internet at home. According to Statistics South Africa (2017), only 22% of South African households owned one or more computers in 2017. In a survey conducted by UNICEF (Kardefelt-Winther, Livingstone, & Saeed, 2019), statistics showed that 88% of South African children between the ages of 9 to 17 use a mobile phone to access the internet at least week-

ly and only 30% use a desktop computer to access the internet. Forty seven percent of students never played games on the internet; however, according to the UNICEF study (Kardefelt-Winther et al., 2019) "this activity tends to be more popular in higher-income countries". Fifty five percent of students said that they often used MS Word and MS Excel, meaning that 45% of students did not.

In this study, the researcher investigated: (1) how digitally literate students studying a Diploma in Business Information Technology at a university in South Africa are before embarking on their studies; and (2) if the course module IFS01A1 (Information Systems 1A) which consists of a theory component (basic computer concepts) and a practical component (MS Word and Excel) is still a necessary first year module.

First year students studying a Diploma in Business Information Technology at the UJ come into the course with different levels of digital literacy. In order for all students to start their computer studies on the same level, they should receive practical instruction on MS Word and Excel, and lectures on basic computer concepts, no matter their level of digital literacy (Nash, 2009). This module is offered for six months in the first semester in parallel to other modules across the entire university for all university courses. For students who are already *au fait* with the basic theory computer component and practical instruction of MS Word and Excel, they can either apply for exemption for the module or see it as revision. Nevertheless, by the second semester all students should have the same foundation to move forward.

Limitations

The study relied on quantitative data only. Engaging students in focus group interviews may have provided for a richer data set for an enhanced and more complete understanding of their digital literacy experiences. Much of the data was self-reported, and therefore there may be misalignment in the understanding of questions. The sample was comprised of students who enrolled for programming courses at the diploma level. Students who enrolled for degree-level courses were not sampled.

References

Barlow-Jones, G., & van der Westhuizen, D. (2018). Examining the correlation between educational background and academic performance of first year computer programming student's in South Africa. In L. Morris, & C. Tsolakidis, (Eds.), *The proceedings of the International Conference on Information Communication Technologies in*

Education (ICICTE) 2018 (pp. 312-323). Crete, Greece: ICICTE.

Bisseker, C. (2019, May 16). Is Ramaphosa's education plan set to fail? *Business Live*. Retrieved from https://www.businesslive.co.za/fm/features/2019-05-16-is-ramaphosas-education-plan-set-to-fail/

Calitz, A., Evert, C., & Cullen, M. (2015). Promoting ICT careers using a South African ICT career portal. *The African Journal of Information Systems*, *7*(2), 40-61.

Coldwell-Neilson, J. (2018). Digital literacy expectations in Higher Education. In *Open oceans: Learning without borders: ASCILITE 2018 Conference Proceedings* (pp. 103-112). Geelong, Australia: ASCILITE.

Hart, S.A. & Laher, S. (2015). Perceived usefulness and culture as predictors of teachers attitudes towards educational technology in South Africa. *South African Journal of Education*, *35*(4), 1-13.

Kardefelt-Winther, D., Livingstone, S., & Saeed, M. (2019). *Growing up in a connected world*. Florence: UNICEF Office of Research – Innocenti.

Mabuza, E. (2019, July 25). Stealing SA's future: 250 computers stolen from Gauteng schools in 2019. *Times Live*. Retrieved from https://headtopics.com/za/stealing-sa-s-future-250-computers-stolen-from-gauteng-schools-in-2019-7114010

Macupe, B. (2017, October 5). Laptops just ornaments for Eastern Cape teachers who are not trained to use them. *Mail & Guardian*. Retrieved from https://mg.co.za/article/2017-10-05-00-laptops-are-ornaments-teachers/

Mkhonza, T. (2019, August 27). Laptops, smartboards and tablets worth millions stolen from Gauteng schools. Independent Online. Retrieved from https://www.iol.co.za/news/politics/laptops-smartboards-and-tablets-worth-millions-stolen-from-gauteng-schools-da-31378468

Nash, J. (2009). Computer skills of first year students at a South African university. In *Proceedings of the 2009 Annual Conference of the Southern African Computer Lecturers' Association (SACLA)* (pp. 88-92).

Pather, S., Norodien-Fataar, N., Cupido, X., & Mkonto, N. (2017). First year students' experience of access and engagement at a University of Technology. *Journal of Education (University of KwaZulu-Natal)*, *69*, 161-184.

Schlebusch, C.L. (2018) Computer anxiety, computer self-efficacy and attitudes towards the internet of first year students at a South African University of Technology. *Africa Education Review*, *15*(3), pp. 72-90.

Shezi, L. (2016, March 7). SAIRR: Only 4 in 10 SA public schools have a computer facility. *Hypertext*. Retrieved from https://www.htxt.co.za/2016/03/07/sairr-only-4-in-10-sa-public-schools-have-a-computer-facility/

South Africa Department of Basic Education. (2011). Curriculum and

Assessment Policy Statement Grade 10 – 12 Computer Applications Technology. Retrieved from https://www.education.gov.za/Portals/0/CD/National%20Curriculum%20Statements%20and%20Vocational/CAPS%20FET%20_%20COMPUTER%20APPLICATIONS%20TECHNOLOGY%20_%20GR%2010-12%20_%20Web_6AC6.pdf?ver=2015-01-27-154348-193

South Africa Department of Basic Education. (2011). Curriculum and Assessment Policy Statement Grade 10 – 12 Information Technology. Retrieved from https://gifs.africa/wp-content/uploads/2020/05/Grade-10-12-Information-Technology-Notes-2.pdf

South Africa Department of Basic Education. (2020). Report on the 2019 National Senior Certificate Examination. Retrieved from https://www.ecexams.co.za/2019_Nov_Exam_Results/2019%20NSC%20Examination%20Report.pdf

Statistics South Africa. (2017). *Statistical release: General household survey 2017*. South Africa: Stats SA. Retrieved from http://www.statssa.gov.za/publications/P0318/P03182017.pdf

Stuurman, N. (2017, December 19). Skills shortage in the ICT sector critical to businesses development. *Business Report*. Retrieved from https://www.iol.co.za/business-report/skills-shortage-in-the-ict-sector-critical-to-businesses-development-12320060

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DIFFERING PERSPECTIVES OF IT STUDENT EXPECTATIONS AT HEI'S: A SOUTH AFRICA AND UK NARRATIVE

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Abstract

Research directed at students' expectations when entering a higher education institution (HEI) is becoming more widely investigated, as there is a direct link between expectations and retention. This paper provides insights into the expectations of information technology (IT) students within a South African context as well as a UK context, to determine whether IT students' expectations across institutions align or differ. It is hoped that such collaboration between institutions stimulates constructive dialogue in relation to the gap between students' expectations across two continents; as well as knowledge sharing on how unmet student expectations can reasonably be met in the future.

Introduction

The first year of study for students within an HEI are critical and can shape the future of academic success (Pather & Dorasamy, 2018). It is therefore in every institution's best interest to spend considerable planning and effort to ensure that first-year students are introduced to the institution through a number of support initiatives. Regardless of whether students are entering HEI's in South Africa or the United Kingdom, the importance of caring about students' expectations has a tangible influence on student engagement and retention.

This paper provides additional insights into the expectations of IT students, by comparing expectations across continents, within a developing and a developed world. In particular, it highlights the similar and different expectations between IT students studying at different institutions across continents, as well as providing educators with insights of how some student expectations can – in the future – be met, where they are not currently being taken into consideration. Collaboration between universities can lead to a dialogue about how to manage students' expectations as well as reflect on which expectations can be met and how to meet them.

Students Expectations of Studying at University

Although there has been a great deal of investigation and research of the first year-experience of students (Crisp et al., 2009) fewer studies have focused on the expectations of students entering HEI's. Tinto (1987) reported that students who felt more certain about their futures and had long-term career goals were more likely to quickly transition and adapt to university life. However, focusing on employability often leads to a shallow learning approach, with students not developing mature learning models. Passing coursework, assessments, and exams becomes the focus, instead of trying to understand abstract concepts and developing a deeper approach to learning (Hassel & Ridout, 2018). Balloo, Pauli and Worrell (2017) also found that career prospects affected students' expectations about whether or not to attend university in addition to students gender, age, caring responsibilities, fees, and whether or not English was their first language.

Research indicates that there is a gap between students' expectations prior to attending university and the reality of university life. Lowe and Cook (2003) found that between 20% to 30% of students consistently found academic and social adjustment to university life difficult and never managed to close the gap. This continuous dissatisfaction places these students at risk of failing modules and potentially dropping out of higher education. Smith and Hopkins (2005) found that there was a mismatch between students' expectations of studying English and the reality of being part of an English department. Crisp et al. (2009) conducted a student survey to highlight areas of students' expectations that did not align with the realities of a university's resources and standard practices. The study found that the mis-conceptions arose from time management, social engagements, turnaround time on assessments, draft feedback of assessments, and personal tutoring. This enabled staff to be informed about the mis-conceptions and for a positive dialogue to ensue between staff and students. Money et al. (2017) found that students' expectations were concerned around four areas, namely directed time, non-directed time, support, and relationships. They also found that students were concerned by the lack of face-to-face contact time, and the value of their experience was influenced by contact time with academics.

Information Technology courses are often recognised as being difficult and having a high dropout rate. Many studies show that students who drop out of an IT course, do so within the first year of study. Where previously the focus was on trying to understand the factors leading to students' academic performance in IT courses (Barlow-Jones & van der Westhuizen, 2017) the question now is how can Higher Education Institu-

tions (HEIs) support IT students in their academic journey (Lars, Madsen & Holmegaard, 2010). One attribute that has not been given much attention is the question of what students expectations are upon entering a university IT course. The answer to this question could help to identify the factors that have a significant influence on an IT student's experience as well as help educators to better prepare students for their IT course and support the students who are struggling (Kinnunen et al., 2018).

Authors' Narratives

Both authors teach IT modules within their respective departments and engage regularly with students, as Author 1, Glenda Barlow-Jones, is the facilitator of peer mentoring and Author 2, Jacqui Chetty, is the project lead for student success. The following is an account of their experiences of students' expectations.

Author 1 Narrative: South Africa – University of Johannesburg

I have lectured at a higher education institution in South Africa since 1997. Due to apartheid being disbanded in 1994, higher education has been more accessible to students of all races, cultures, backgrounds and schooling. In my 23 years of lecturing experience I have found that students who are previously disadvantaged and attended less than adequate schools, on entering university, face challenges such as under-preparedness, academic overload, and social adjustment. The pass mark at a secondary school in South Africa for a diploma entry is a minimum of 40% for home language, 40% for three other subjects excluding Life Orientation, and 30% for two other subjects. Over the years I have found that students are shocked when they learn that the pass mark at university is 50%. Students expect to be "spoon fed" at university in the same way that they were at school: they also feel that it is the lecturer's responsibility to distribute notes and provide them with summaries. Students have also voiced that they find the lecturer to student ratio impersonal due to large class sizes. The majority of the students enrolled at the University of Johannesburg are not English first language speakers, even though they have been taught and assessed in English at school. Many of the students are black, and as a result speak an African language as a first language. South African universities also have an influx of foreign nationals from neighbouring countries and further afield, where English is deemed a foreign language, yet the language of instruction at the University of Johannesburg is English. I have found that all of these attributes contribute to students lacking confidence in their academic abilities.

Author 2 Narrative: United Kingdom – University of Kent

After teaching within a South African context at HEIs for more than two decades I made the transition to teach at a HEI within the UK. I have found that students within the UK are generally confident about entering university. They have much insight about the various HEIs that are available to them and they visit more than one HEI on open days, scheduled across the UK at different times of the year. They are aware of bursaries and government subsidies and often choose to go to university away from where they attended school and lived. Having achieved the results they require to enter an HEI, they are confident in their abilities to cope and perform well. They have high expectations of their institutions and expect a high quality of education. From my experience, they expect to be challenged and presented with concepts that are engaging. They are up to date with business practices such as specific processes, procedures, and technology implemented within the business sector. They expect such practices to be taught to them as part of the curriculum. They expect academics to engage with them and personal tutoring is important to them. They question why their assessments are incorrect and expect feedback about their work. Although they appear to be confident and in control of their academic lives, it is clearly visible that they struggle to plan and spend sufficient time on tasks, assuming that they understand.

Participants

The researchers collected data from a Students Expectations Survey (SES), which produced numerical descriptions from a total of 341 students enrolled for a first year Information Technology (IT) degree or diploma at either the University of Johannesburg (UJ), in South Africa or the University of Kent (UK), in the United Kingdom respectively. Sampling for this study was based on convenience sampling, as both the researchers in Kent and Johannesburg included students that were accessible to them and formed part of their lecturing classes. Fourty Six percent were from the University of Johannesburg and 64% of the students were from the University of Kent.

Data Analysis

The data were scrutinised for irregularities and cases were removed where data were incomplete. A combination of descriptive statistics and inferential statistics were used to analyse the quantitative data from the Students Expectations Survey. A Likert-type scale was used to help render responses as objective as possible.

In response to the overall average mark students expected to receive for their course at the end of the first academic year, students at the UJ (63%) were more confident of receiving an average of between 70% to 100% as opposed to students at the UK, where only 55% of students expected to receive an average of between 70% to 100%. See Table 1.

Table 1

Overall expected average mark

Group	By the end of this academic year at the University, what overall average mark do you expect to receive?				
	Statistic	**50 - 59%**	**60 - 69%**	**70 - 100%**	**Total**
University of Kent (UK)	Count	11	56	83	150
	% within Group	7.3%	37.3%	55.3%	100%
University of Johannesburg (UJ)	Count	7	52	99	158
	% within Group	4.4%	32.9%	62.7%	100%
Total	Count	18	108	182	308
	% within Group	5.8%	35.1%	59.1%	100%

Table 2

Confidence level of achieving expected mark

Group	**How confident are you that you will achieve that mark?**						
	Statistic	**1 Not Confident**	**2**	**3**	**4**	**5 Confident**	**Total**
University of Kent (UK)	Count	5	9	22	34	30	100
	% within Group	5.0%	9.0%	22.0%	34.0%	30.0%	100%
University of Johannesburg (UJ)	Count	2	4	24	54	74	158
	% within Group	1.3%	2.5%	15.2%	34.2%	46.8%	100%
Total	Count	7	13	46	88	104	258
	% within Group	2.7%	5.0%	17.8%	34.1%	40.3%	100%

When students were asked how confident they were that they would achieve the overall average mark expected, the UJ students were 47% confident that they would achieve their expected mark compared to only 30% of the UK students. Table 2 shows UJ students' expectations being higher than UK students.

Students were also presented with a range of skills that they would have to rely on throughout the academic year. When identifying how confident they were in each skill, the UJ students were less confident in their critical thinking skills and in being independent learners than the UK students. However, UJ students were more confident in their exam preparation and exam performance skills.

These skills were subjected to an exploratory factor analysis (EFA) using SPSS. Prior to performing an EFA the suitability of the data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of several coefficients of .3 and above. The EFA, seen in Table 3, revealed the presence of 2 factors, namely Internal Skills and External Skills.

Table 3
Internal Skills and External Skills

Internal Skills	External Skills
Essay writing	Attending classes
Critical thinking	Organising workload
Presentations and speaking in front of others	Meeting assessment deadlines
Being an independent learner	Exam preparation
	Exam performance

The boxplot (Figure 1) below shows that the UK (identified as Kent University in the figure) students' confidence in their external skills is lower than the UJ students' confidence in their external skills. The confidence level of both UK and UJ students in their internal skills is comparative.

The UK and UJ differ in their external confidence (See Table 4). There was a difference in the scores for UK (M=0.26, SD=0.97) and UJ (M=0.97, SD=1.01). A repeated-measures t-test found the University of Kent's difference to be $t(142) = 3.21$, $p < 0.002$ and the University of Johannesburg's difference to be $t(156) = 12.09$, $p < 0.000$. These results suggest that the UJ students may have unrealistic expectations of themselves.

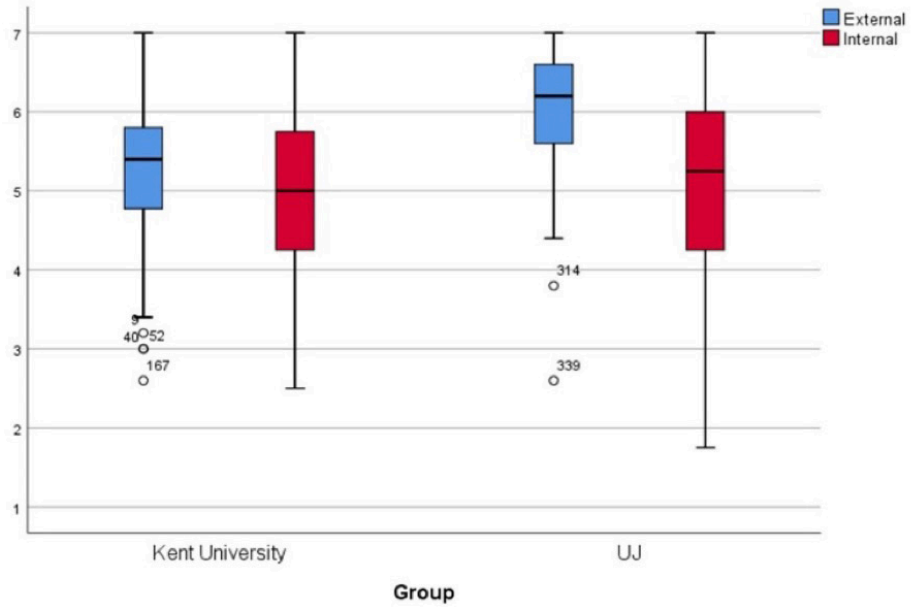

Figure 1. Internal and external skills confidence levels.

Figure 1 illustrates a box-and-whisker plot, with the first two plots showing the University of Kent's students external and internal skills confidence levels on a scale of 1 to 7 and the last two plots showing the University of Johannesburg's students external and internal skills confidence levels. 1 = not at all confident and 7 = extremely confident. The external median score for UK was 5.4 and UJ 6.2 a difference of 0.8. The internal median score for UK was 5.0 and UJ 5.2 a difference of 0.2.

Table 4
Paired Samples Test

Group			M	SD	t	df	p
University of Kent	Pair 1	External/Internal	0.26	0.97	3.21	142	<0.002
University of Johannesburg	Pair 1	External/Internal	0.97	1.01	12.09	156	<0.000

Students were asked which of the factors below (Table 5) influenced their decision to study the IT diploma/degree they chose at their respective university.

The majority of students from both universities indicated that it was their personal interest in the subject that influenced their choice of study.

Table 5
Factors influencing students' choice of study

Factors influencing choice of study
Personal interest in subject
Encouragement from family
Help achieve chosen career
Future earning potential

Finally, the students were asked which career path they were intending to follow once they had graduated. Figure 2 shows that 20% of the UK students and 24% of the UJ students were unsure. These results are, however, not surprising, as many first year students feel the pressure to study a university degree/diploma but are still unsure about their futures. For the five specific career choices, the UJ students were more sure than the UK students.

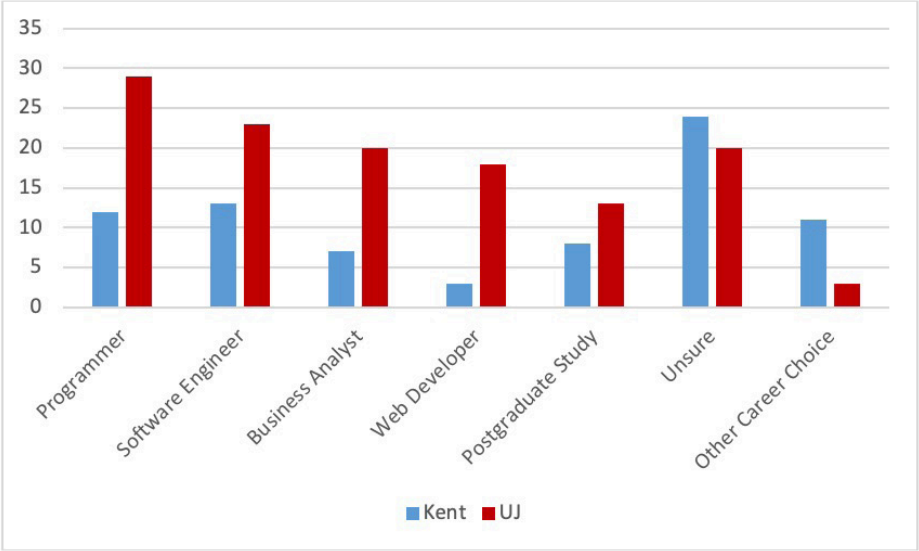

Figure 2. Career choices.

Discussion

Overall, both the UK and UJ students were confident that they would obtain an average of above 60% for their IT course. These positive expectations may suggest that students feel they are ready for the demands of university life. However, there was a small percentage of students in both groups that did not feel confident in their ability to perform well. It is imperative that these students do not become despondent before they have even started their studies. The study also showed that the South African students were more confident in achieving a distinction in their IT course than the UK students. South African students also had elevated confidence in their external skills (attending classes, organizing workload, meeting assessment deadlines, exam preparation and performance). These results were significant, UK $p<0.002$ and UJ $p<0.00$, suggesting that UJ students may have unrealistic expectations of themselves and have a low expectation of the work commitment required of them. The findings from UK and UJ further suggest that the majority of students have a personal interest in IT and this influenced their choice of study. Research has shown that students who are interested in their coursework are more likely to attend classes, be more motivated, and spend more time on their studies, resulting in better academic performance than those who are uninterested (Kahu et al., 2017).

Limitations

The selection of the questions in the survey that represented student expectations may not be representative of all possible expectations that affect students in their first year. The data was self-reported. Therefore, there may be misalignment in the conceptual understanding of students of items related to their expectations. The sample was comprised of students who enrolled for IT courses at the diploma level and degree level. Students who enrolled for other courses were not sampled. Students' expectations were explored but not their reality. In an extension of this study, an exploration of the relationship between students' confidence, expected performance, and actual performance will provide valuable feedback. Furthermore, the study relied only on quantitative data. Engaging students in focus group interviews may have provided for a richer data set for an enhanced and more complete understanding of their expectations.

Conclusion

This paper is the result of a study that was conducted at the UK and the UJ campuses to determine IT students' perceived expectations of university studies. The quantitative results indicate that students have high expectations and in some cases unrealistic expectations of themselves.

UJ students, in particular, are very confident in their abilities. The paper highlights that by having insight into students' expectations, educators can derive a plan to manage these expectations. In doing so, students may form a realistic grasp of what the university has to offer; otherwise, the gap between students' expectations and the reality of the university may be damaging to both the institution and the students. Furthermore, a healthy grip on reality will also assist students in setting realistic goals of themselves.

Further research will compare the same IT students' expectations with their reality, by including additional quantitative as well as qualitative analysis to provide a richer, more complete, data set.

References

Barlow-Jones, G. & van der Westhuizen, D. (2017). Pre-entry attributes thought to influence the performance of students in computer programming. In J. Liebenberg and S. Gruner (Eds.), *ICT Education: 46th Annual Conference of the Southern African Computer Lecturers' Association (pp.* 217-226).

Balloo, K. B., Pauli, R., & Worrell, M. (2017). Undergraduates' personal circumstances, expectations and reasons for attending university. *Studies in Higher Education*, *42*(8), 1373-1384.

Crisp, G., Palmer, E., Turnbull, D., Nettelbeck, T., Ward, L., LeCouteur, A., Sarris, A., Strelan, P. & Schneider, L. (2009). First year student expectations: Results from a university-wide student survey. *Journal of University Teaching and Learning Practice,* 6.1, 11-26.

Hassel, S. & Ridout, N. (2018). Students' and lecturers' expectations of university education. *Frontiers in Psychology*, *8*(2218), 1-13.

Kahu, E., Nelson, K., & Picton, C. (2017). Student interest as a key driver of engagement for first year students. *Student Success, 8*(2), 55-66. DOI: 10.5204/ssj.v8i2.379

Kinnunen, P., Butler, M., Morgan, M., Nylen, A., Peters, A., Sinclair, J., Kalvala, S. & Pesonen, E. (2018). Understanding initial undergraduate expectations and identity in computing studies. *European Journal of Engineering Education 43*(2), 201-218. DOI: 10.1080/03043797.2016.1146233

Lars U., Madsen, L.M. & Holmegaard, H.T. (2010). What do we know about explanations for drop out/opt out among young people from STM higher education programmes? *Studies in Science Education, 46*(2), 209-244. DOI: 10.1080/03057267.2010.504549

Lowe H. & Cook, A. (2003). Mind the Gap: Are students prepared for higher education? *Journal of Further and Higher Education, 27*:1, 53-76. DOI: 10.1080/03098770305629

Money, J., Nixon, S., Tracy, F., Hennessy, C., Ball, E. & Dinning, T. (2017). Undergraduate student expectations of university in the United Kingdom: What really matters to them? *Cogent Education*, 4(1), 1301855. Retrieved from http://dx.doi.org/10.1080/2331186X.2017.1301855

Pather, S. & Dorasamy, N. (2018). The mismatch between first-year students' expectations and experience alongside university access and success: A South African university case study. *Journal of Student Affairs in Africa*, 6(1), 49-64. DOI 10.24085/jsaa.v6i1.3065

Smith, K. & Hopkins, C. (2005). Great expectations: Sixth-formers' perceptions of teaching and learning in degree-level English. *Arts and Humanities in Higher Education*, 4(3), 304-318. Retrieved from https://doi.org/10.1177%2F1474022205056173

Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago, IL: University of Chicago Press.

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STUDENTS' PERCEPTIONS OF CONSTRUCTIONIST ASSESSMENT

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Abstract

With the growing demand for 21st century skills, dynamic teaching methods, and accessible, flexible learning opportunities, in both industry and academia, a constructionist approach to assessment was undertaken at a South African university. Assessment was conducted on twenty nine students enrolled for a Computers and e-Learning course. Qualitative data was collected in the form of a survey. The findings of this study indicate a multitude of emotions, personal growth, technical identity development, and learner agency. Constructionist assessment through designing and social interactions improves metacognition and students start to reflect and see the value in their experiences with different technological tools.

Background

The current and approaching society demands adaptive, flexible skills and abilities. In order to cater to these demands, our workforce need to be able to reason critically, solve unknown problems, make informed decisions, and work collaboratively to address unanticipated priorities (Lee & Hannafin, 2016). Therefore, it has become of critical importance that educational systems prepare students to resolve future uncertainties and have the skills to negotiate unanticipated problems. We have moved away from the traditional teacher-centred approaches to more dynamic teaching methods that are learner-centred (Educational Broadcasting Corporation, 2004) and promote 21st century skills of critical thinking, collaboration, creativity, and communication. Therefore, students no longer passively receive information but need to engage and interact with content. Students as the discoverer and maker slowly accept knowledge as being constructed and reconstructed, through self-directed exploration.

Problem

As teaching approaches have changed, assessment has also had to change. Students can no longer be assessed using traditional methods as assessments need to align to the new achievable outcomes. The inclusion of technology in education has exposed learners to collabora-

tive platforms, freedom of exploration, and 21st century skills that cater to their needs. Assessment plays a critical role in the teaching and learning process (Tosuncuoglu, 2018). The constructionist approach to assessment allows students to learn from assessment and learn for assessment. Even though several learning theories have been used to design assessment and align it to measurable outcomes suitable for 21st century educational standards, there remains a dearth of research on the students' perspectives of a constructionist approach to assessment.

Significance of the Study

This study aims to investigate the students' perspectives of constructionist assessment during a blended learning course. Their perspectives are shaped through the experiential learning and incidental learning that took place during the course. Student perspectives provide feedback on the design and development of constructionist assessment and will inform future practice.

Literature Review

Both constructionism and constructivism are learning theories that are similar, but it is said that constructionism adds additional value and skills (Rob & Rob, 2018). Constructivism arose from the cognitive learning theory of Piaget (1971), based on the assumption that knowledge is transmitted from teacher to student but is constructed by students when they interact with the environment (Tangdhanakanond, Pitiyanuwat, & Archwamety, 2006). The constructivist learning theory has had a wide ranging impact and reshaped teaching methods in education (Bada, 2015). In 1980, Seymour Papert introduced the theory of Constructionism. He proposed the student-centred approach, enabling discovery learning, where students use prior knowledge, collaborative learning, and critical thinking to develop artefacts (Lee & Hannafin, 2016). "Students are particularly likely to make new ideas and construct knowledge when they are engaged in building objects or making the products themselves" (Tangdhanakanond et al., 2006, p.25).

Students are therefore on a path in which they acquire knowledge and skills through active engagement and interaction. They develop information skills, literacy skills, and technology skills often through incidental learning. Constructionists argue that students effectively construct knowledge when they have the opportunities to create, make, and choose things they are interested in (Tangdhanakanond et al., 2006). Students' confidence improves as they gain more experience in doing something (Cocciolo, 2011). Lee and Hannafin (2016) claim that through failure, reflection, and iterative revisions, many skills and practices are

refined. This changes a student's self-efficacy and there is a direct correlation between confidence and experience gained.

An overview of assessment and how it has changed to suit the constructionist approach is given in Table 1. The table was adapted from the work of Bada (2015) and Rob & Rob (2018).

Table 1
Comparison of Classroom Assessment

Traditional classroom	Constructivist classroom	Constructionist classroom
Dissemination of knowledge to students	Inherent knowledge of students	Inherent knowledge of students
Teacher-centred learning	Student-centred learning	Student-centred learning
Teacher is directive, rooted in authority	Teacher initiated work	Teacher facilitated work
Learning based on repetition	Learning is interactive and based on constructing of personal artefact	Learning is based on constructing a meaningful artefact
Knowledge is seen as inert	Knowledge is seen as individual creation	Knowledge is seen as a collaborative creation process
Assessment through testing	**Assessment** through individual creation, observation, and process	**Assessment** through sharing of artefacts, use of tools, media, and context

The role of assessment in teaching and learning is undoubtedly seen as crucial to education (Khan et al., 2012; Jones, 2015). Capraro et al., (2012) define assessment as "a process for documenting, in measurable terms, the knowledge, skills, attitudes, and beliefs of the learner" (p. 1). Assessment as we know it takes two main forms: formative and summative assessment. Assessment can be done *for* learning or *of* learning (Jones, 2015). Cognitive components such as skills and strategies and affective dimensions such as attitudes, motivation and experiences are assessed through formative assessment (Capraro, et al., 2012). This form of assessment usually indicates strength and impediments in learning. Formative assessment for learning involves active and effective feedback. This provides students with information of how to improve on their past performance and also gives them the chance to reflect and review their own progress (Jones, 2015). Summative assessment is assessment of learning (Stiggins & Chappuis, 2006). It is a culmination of student achievements and does very little or nothing to shape any future teaching as it does not always provide feedback for improvement (Capraro et al., 2012; Jones, 2015).

Assessment through constructionism caters to both formative and summative assessment. It involves several assessment techniques: facilitator assessment, peer assessment, self-assessment, and computer-based as-

sessment. Cole, Ryan, Kick, and Mathies (2000) indicate that traditional computer-based assessment such short answers, multiple choice, true-false, etc. are not suitable for constructionist assessment. Testing needs to enable students to demonstrate what they have learnt in a multidimensional manner (Tangdhanakanond et al., 2006). Constructionist assessment activities include tangible products, observations, points of view as well as tests (Rob & Rob, 2018). In order for assessment to be viewed as authentic it should involve real-life tasks and should not appear to be rigid or static (Cole et al., 2000). Portfolios are an example of such assessments as they provide multiple opportunities for performances and growth. The evidence of created products and artefacts demonstrate the individual's ability and progress. Student involvement in assessment has increased globally (Falchikov & Goldfinch, 2000). During self-assessment, students are making judgements and inferences on their own work and reflect on the criteria so that they can revise accordingly (Andrade & Valtcheva, 2009). The words self-evaluation, self-reflection, self-monitoring, self-grading, self-rating and self-appraisal are common constructs used in analysing self-assessment (Brown & Harris, 2013). Peer assessment allows students to make judgement and inferences on the work of their peers. Since peer assessment involves active learning and the joint construction of knowledge through discourse, it is seen as a manifestation of constructionism. Peer assessment often provides useful and detailed feedback that has formative benefits to improve students' learning. Teachers that fear the reliability and validity of peer assessment often deprive students of these benefits (Falchikov & Goldfinch, 2000). Even though marks are not a valid indicator of achievement, teachers' main concern is with the agreement of their marks and those that are given by peers (Falchikov & Goldfinch, 2000). In some instances poor or lack of understanding of criteria can lead to inaccurate marking. The basic assessment principles cannot be neglected when designing assessment (Tosuncuoglu, 2018). Facilitator assessment involves the teacher making judgement based on evidence of the students' learning. It provides feedback to students and informs practice.

There are several factors that contribute to effective assessment. In this paper we focus on how to create assessment plans and how to communicate assessment effectively. Jones (2015) emphasizes the need for teachers to share assessment criteria with students to provide opportunities for learning. Criteria should be decided upon prior to students commencing with work and should be clear. In order for students to commit to tasks, they need to understand from the onset what is required of them. The criteria need to be communicated using the correct language and terminology that students are familiar with. Rubrics are often

used in constructionist assessment to provide a simple and easy to follow format for students and outline the criteria and expectations clearly (Wolf & Stevens, 2007). Rubrics are not only used by facilitators but are also often used for peer and self-assessment so that students are able to evaluate and assess the task based on the criteria provided and make informed decisions and judgements. This promotes accurate and fair assessment. Assessment plans should clearly outline the alignment of assessment to the learning outcomes and methods of achieving outcomes (Wolf & Stevens, 2007). This information should be shared with students together with assessment criteria, marking procedures, and feedback methods. Assessment should be conducted using diverse methods to cater to all learning styles and provide multiple assessment opportunities (Jones, 2015).

Constructionism allows students to learn through social skill development. Papert (1993) claims that students show, discuss, examine, and reflect collaboratively on the cognitive products or artefacts that they create. This allows them to develop in terms of content, social skills and thinking processes (Stager, 2001). The constructionist pedagogical approach enables students to solve problems situated in meaningful activities, and develop skills, confidence, and overall understanding (Cocciolo, 2011). They do this by collaborative teamwork, facilitator guidance, and individual effort.

Theoretical Framework

According to Sekaran & Bougie, (2013) the theoretical framework forms the foundation for a research study and emphasizes how perspectives in the study were interpreted. A number of e-learning frameworks were considered (Khan, 2004; Sun, Tsai, Finger, Chen & Yeh, 2008) as suitable for the constructionist approach to assessment. Factors that contribute to successful e-learning implementation were considered, as the students in the study would need to understand design and development of content with technology. This study draws from the theoretical framework of Haw, Ong, Wong, & Wong (2017). In their study they identify the LearnCube, which consists of 6 dimensions. Each dimension relates to a different aspect involved in the Critical Success Factors for e-Learning. The dimensions are suitable for this study as it provides a holistic outlook to the design and development of e-learning content and the attributes for each dimension. Seventeen attributes were assigned to the critical success factors. These attributes do somewhat differ from the original LearnCube, and therefore the model has been adapted to form a new conceptual framework that will frame this study.

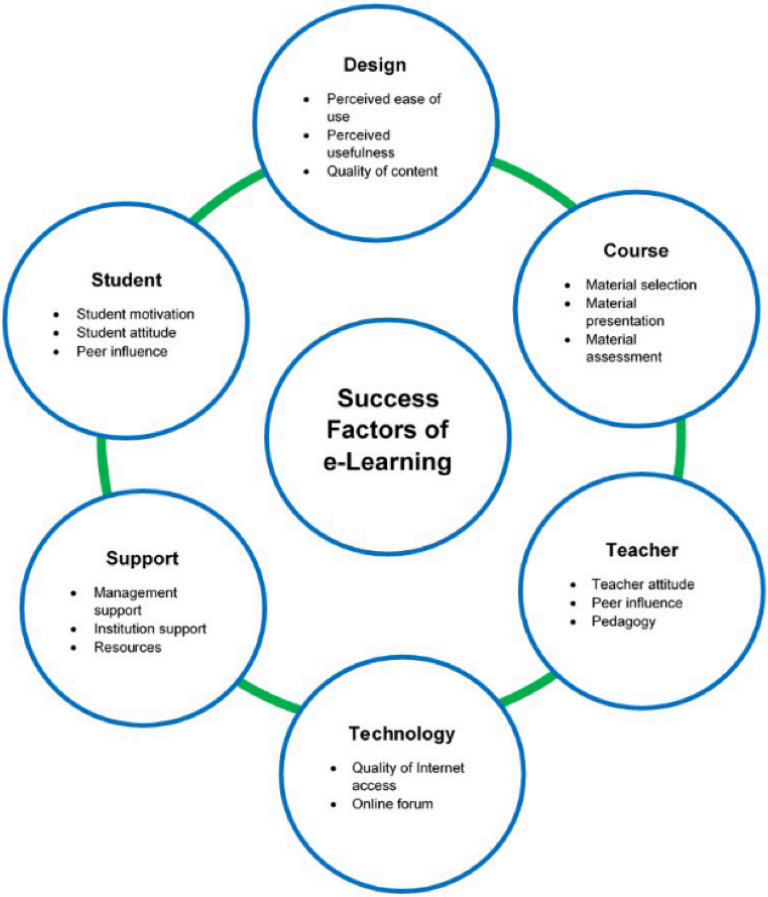

Figure 1. LearnCube for e-learning (adapted from Haw et. al., 2017).

Methodology

A qualitative case study approach was applied within the interpretative paradigm. A sample of twenty nine students completing a Post Graduate Certificate in Higher Education were enrolled in a module in Computers and e-Learning. All the students were from different disciplines holding some role of facilitation within their scope of work. They taught through both blended and online modes of teaching. This included the design and development of instructional units that their students would participate in. It was therefore crucial that the students learnt how to design and develop content using technology and be able to facilitate this content using modern teaching methods to promote 21st century skills such as creativity, collaboration, communication, critical think-

ing, information literacy, media literacy, technology literacy, flexibility, assessment, social skills, problem solving, and analytical skills. In doing so, a constructionist approach was employed to design the activities to ensure self-directed learning and assessment that improves metacognition through social interactions. Students reflected on the value of their experiences with different technological tools and critically evaluated their own skills and the skills of their peers. The content of this module exposed students to a range of different teaching and learning tools, applications, software, and pedagogies needed to facilitate in an online or blended environment. They also needed to design assessments and experience the affordances of constructionist assessment. Assessment was conducted in several forms to include facilitator assessment, self-assessment, peer assessment, and computer-based assessment. Activities were structured to allow for online participation and face-to-face participation. Rubrics were provided by the facilitators to share the criteria of assessment with the post grad students prior to their submissions. A final assessment that took the form of the development of a website as a Portfolio task was used. A combination of all the activities, skills, artefacts, and knowledge gained during the course was now assessed as a summative assessment and gave students the opportunity to improve on what they had previously done and received feedback on. This course provided a platform for experiential learning.

The course was designed in a blended mode with five contact session and approximately 18 weeks of online delivery. Data was collected using a survey that was designed to align with the conceptual framework (See Figure 1). The purpose of the survey was to identify what experiences students had whilst completing activities, all of which contributed to their assessments. These experiences would then give insight on students' perspective of the constructionist approach to assessment.

The data was then extracted from the Learning Management System and sorted using MS Excel. A deductive content analysis of the data revealed emerging themes. These themes were analysed against the conceptual framework. In this paper, only the attributes that contributed to the students' perspective of constructionist assessment are discussed.

Findings

This unfamiliar approach to both learning and assessment was not initially well received. However, as the students progressed with the activities, they started to understand what was expected of them and how this constructionist approach worked.

Design of Activities for Assessment

Many students expressed how the activities provided bite size learning and that this allowed for multiple learning opportunities. The activities allowed them to apply their knowledge practically and test their understanding. The activities were fun, enabling students to be creative, and it would appear that they did not realise they were being assessed: as student P27 commented, "Practicing what you preach was very encouraging as you facilitated in the way in which you were advocating". Students also liked that they could consult their peers if they were unsure about any task [P26]. Students found that by completing all the activities it assisted them with the final assessment.

Materials for Assessment

Six of the students made special mention of the rubrics and how they found them to be helpful, precise and guided them to reach the outcomes. Student P5 explains that "the rubrics made this course so easy to follow and clear in terms of what is expected and what I am supposed to know at the end". Student P14 emphasised that rubrics should not just cover the ideal but be able to cater for the variables in all tools. This is aligned to the research done by Jones (2015) on the importance of using rubrics in constructionist assessment. Student P29 highlights the guidance it provided: "The assessment rubrics were very clear. Whether it was for lecturer assessment or the peer assessment. It helped me to understand and implement e-learning well," suggested the value of feedback for improvement.

Facilitators' Role in Assessment

Students found the assessment instructions to be clear and simple to follow [P20]. Student P6 emphasised the importance of formative assessment and how her experience of it enforced her understanding: "In my field of work we don't really make use of formal assessment very much, so it was good to see and experience the different ways it was done in this course". Students perceived the facilitator's role in assessment to be guiding and positive. Student P8 highlights that, "Opinions from peers and facilitators gave another perspective than your own and assisted in improving."

Students found comfort in working with their facilitators and peer as expressed by P12, "having to work with my peers and have my facilitator along my side to explain and clarify have been amazing". The attitude of the facilitator seems to have played a great role in encouraging student performance as expressed by Students P24 and P29:

- "Facilitators have a very positive attitude towards us as adult students and the try to explain where we did not understand" [P24].
- "The facilitators had a very positive vibe, it made all the hard work worth it. It made me want to do well. The fact that there was a test before each lecture forced me to read." [P29].

Peer Role in Assessment

The role of peer assessment was well accepted. Students really benefitted from sharing their work, and they saw the value of learning and questioning, as explained by student P11, "I liked the part where we had to give feedback on our assignments". Student P6 expressed the benefits of peer assessment as "doing peer assessment and learning together helped cover more content quicker." This is also perceived by Student P21: "I must admit the group work and peer assessment and being given opportunities to co-operate and collaborate with peers helped me learn."

Student P25, raises concern similar to that found in the literature by Falchikov & Goldfinch, (2000).

> Most of the assessment strategies were fine, although I feel peer assessment is unreliable at times for the assessor because we are kinder to each other as peers. However, it builds far less stress and anxiety, if you know that a tool or activity will be assessed by your peers. [P25]

This shows that there are motivating aspects to peer assessment and it allows students freedom to demonstrate their knowledge and skills. It gives them a sense of comfort and confidence. Students are in fact aware of the possible unreliable assessment. Similar thoughts are expressed by P29, who feels peer assessment is subjective.

The importance of peer assessment is again emphasised by Student P28,

> Face-face was very necessary still as a lot of online instruction and content left you with questions. Therefore class scheduled times were very important for questions as well as peer assessment and grading and group work. Time was never wasted and at the end of every session it felt as though it was time used productively.

This student expresses the value of not just peer assessment but the collaboration and communication between peers that is a primary component of constructionism.

He goes on further to say, "Most of the time you learned the most by peer assessment in class and learning from what others learned during their instructions." [P28]

Role of Self and Technology in Assessment

The self-assessment was designed in the form of computer-based assessment. This proved to be the least effective method for constructionist assessment, as the students did not find it valuable. Student P5 highlights that, "the tests were also not effective, I don't think I learned anything from these tests, but rather from the practical work." This was also found by Cole et al. (2000), where he highlighted that such assessment does not work well in constructionist assessment.

Student Attitude towards Constructionist Assessment

Students felt encouraged to discover on their own. P26 emphasizes that, "in assignments, even when I preferred sticking to what I know, using the alternative tools expanded my abilities." Six students mention that their attitude toward technology use has changed since they are now able to complete activities more easily. Two students express how the attitude of their peers has influenced their attitude and made them want to continue trying. One student said his attitude did not change as he always enjoyed e-learning activities, and this has just confirmed it.

Conclusion

It is evident that there is a very close relationship between constructionist learning and assessment. Since much of the assessment is done for learning, it is important to consider that experiences of learning are also experiences of assessment and these experiences shape student perceptions. The idea of constructionist assessment is so deeply intertwined in constructionist learning that it is almost impossible to have the one without the other. With careful design of material and explicit details of assessment, constructionist assessment can be very fruitful as students do understand the value in the nature of activities. All forms of assessment need to be carefully structured to provide students with the confidence and comfort to share with their peers and facilitators. To alleviate subjectivity and promote reliable, authentic, and fair assessment, rubrics that clearly and precisely outline the criteria need to be provided. A working environment that allows students the freedom to explore, share, create, and critically solve problems in a practical way really demonstrates the affordances and benefits of constructionist assessment. Students want to have an active role in assessment, where they can demonstrate their abilities and share their knowledge. Computer-based assessments do not always provide this. Student attitudes can be influenced by peers,

facilitators, and their own experiences. Positive experiences lead to positive attitudes, and thus positive perspectives and vice versa.

Limitations and Recommendations

A limitation to this study is that it focused on adult students that would really benefit from constructionist assessment, as they wish to practice it in their disciplines. Therefore, there is an openness to experiential learning of constructionist assessment from the onset. Another limitation is that the content lends itself well to constructionism as a whole and this may not always accommodate all disciplines. It is recommended that future studies focus on using constructionist assessment in other disciplines and amongst different groups of students to reveal the benefits and confirm the affordances of this approach to the development of 21st century skills.

References

Andrade, H. L., & Valtcheva, A. (2009). Promoting learning and achievement through self-assessment. *Theory into Practice, 48*(1), 12–19. DOI:10.1080/00405840802577544

Bada, S. O. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education, 5*(6), 66-70.

Brown, G. T. L., & Harris, L. R. (2013). Student self-assessment. In J. H. McMillan (Ed.), *The SAGE handbook of research on classroom assessment* (pp. 367–393). Los Angeles, CA: SAGE. doi:10.1207/s15327752jpa8502

Capraro, R. M., Roe, M. F., Caskey, M. M., Strahan, D., Bishop, P. A., Weiss, C. C., & Swanson, K. W. (2012). *Research summary: Assessment*. Portland, OR: Association for Middle Level Education, 1-6.

Cocciolo, P. (2011). Situating student learning in rich contexts: A constructionist approach to digital archives education. *Evidence Based Library and Information Practice 2011,* 6(3). 4-15.

Cole, D.J., Ryan, C.W., Kick, F., & Mathies, B.K. (2000). *Portfolios across the curriculum and beyond.* Thousand Oaks, CA: Sage.

Educational Broadcasting Corporation. (2004). Constructivism as a paradigm for teaching and learning. *Concept to classroom: A series of workshops*. Retrieved from www.thirteen.org/edonline/concept-2class/constructivism/

Falchikov, N., & Goldfinch, J. (2000). Student peer assessment in higher education: A meta-analysis comparing peer and teacher marks. *Review of Educational Research, 70*(3), 287-322.

Haw, S-K., Ong, S-T., Wong, C-O, & Wong, M.S. (2017). Conceptualize the e-Learning framework for the secondary school curriculum. In

Proceedings of the International Conference on Digital Technology in Education 2017 (pp. 18-22). New York: Association for Computing Machinery. DOI: https: //doi.org/10.1145/3134847.3134851

Jones, C.A. (2015). *Assessment for learning*. London, K: Learning and Skills Development Agency. ISBN 1 84572 064 4.

Khan, B. H. (2004). 3IGNOU (STRIDE Handbook 8). In Mishra, S., Ed. (2009). E-Learning, Karan Press, New Delhi: ISBN: 978-81-266-4451-3

Khan, A.I., Qayyum, N-U., Shaik, M.S., Ali, A.M., & Bebi, C.V. (2012). Study of blended learning process in education context. *International Journal of Modern Education and Computer Science, 4*(9), 23-29.

Lee, E., & Hannafin, M.J. (2016). A design framework for enhancing engagement in student-centered learning: own it, learn it, and share it. *Education Technology Research and Development* 64(4), 707–734. Retrieved from https://doi.org/10.1007/s11423-015-9422-5

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

Papert, S. (1993). *The children's machine: Rethinking school in the age of the computer.* New York: BasicBooks.

Piaget, J. (1971). *Psychology and Epistemology: Towards a Theory of Knowledge.* New York: Grossman.

Rob, M., & Rob, F. (2018) Dilemma between constructivism and constructionism: Leading to the development of a teaching-learning framework for student engagement and learning. *Journal of International Education in Business, 11*(2), 273-290. DOI: 10.1108/JIEB-01-2018-0002.

Sekaran, U., and Bougie, R. (2013). *Research methods for business, 6th Edition*. UK: John Wiley & Sons Ltd.

Stager, G.S. (2001, June). Constructionism as a high-tech intervention strategy for at risk learners. Paper presented at the National Education Computing Conference, Chicago, IL. (ERIC Document Reproduction Service No. ED 462959)

Stiggins, R., & Chappuis, J. (2006). What a difference a word makes: Assessment FOR learning rather than assessment OF learning helps students succeed. *Journal of Staff Development, 27*(1), 10–14.

Sun, P.C., Tsai, R.J., Finger, G., Chen, Y.Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers and Education, 50*(4), 1183-1202

Tangdhanakanond, K., Pitiyanuwat, S., & Archwamety, T. (2006). A development of portfolio for learning assessment of students taught by full-scale constructionism approach at Darunsikkhalai School. *Research in the Schools, 12* (2), 24-36.

Tosuncuoglu, I. (2018). Importance of assessment in ELT. *Journal of*

Education and Training Studies, 6(9), 163-167. Doi:10.11114/jets.v6i9.3443Wolf, K., & Stevens, E. (2007). The role of rubrics in advancing and assessing student learning. *The Journal of Effective Teaching, 7*(1), 3-14.

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USE OF ICT IN HIGHER EDUCATION INSTRUCTION: THE CASE OF THE UNIVERSITY OF LJUBLJANA

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Abstract

Slovenian higher education institutions are increasingly relying on information communications technologies (ICT) in the belief that technology may improve teaching and learning. This study attempts to map the current state of instructional ICT use at the University of Ljubljana (UL). Quantitative analysis of data obtained from a survey of 428 teachers at the UL was conducted to examine the type, frequency, and purpose of ICT use. The results show the teachers have adopted several ICT tools and use them not only to substitute for the traditional ones but, to some extent, also to enhance their practices aimed at promoting higher-order thinking.

Introduction

Information communication technologies (ICTs) are now widespread, with their use having become an integral part of numerous everyday activities. Practices which involve ICT have reached a stage of normality, namely, ICT no longer represents just an object of consumption but constitutes one of many material elements of everyday practices, e.g. reading news, home banking, socializing, etc. This is particularly true for young people for whom ICT plays a substantial role in a range of activities, e.g. communicating with peers, socializing, playing games (Christensen & Røpke, 2010, pp. 233, 253).

This trend is seen in higher education (HE) institutions, which are increasingly implementing ICT in the teaching/learning process to adapt to the demands of today's students. Being immersed in digital technology and constantly 'on', such students expect their study will also involve ICT (Bates, 2019). Prensky (2001) labelled them 'digital natives' (p. 1) and claims they speak a different language that educators ('digital immigrants') have to learn, rather than assuming that the methods that worked in the past will work with students these days. Thus, like in other everyday practices, ICT use in HE must reach the stage of 'normaliza-

tion'. This is the stage when ICT forms an integral part of instruction and its use is as normal as a "pen or a book" (Bax, 2003, p. 24).

The imperative to implement ICT in HE also results from the need to deal with increased numbers and diversity in the student population. Bates (2019) observed that enrolment numbers are higher due to universities' goal to provide the knowledge and skills required for success in a knowledge-based society to more members of society. He states that students today come from different socio-economic and cultural backgrounds, and also vary in age since some enter university at a later stage in life. For this reason, what is required now is a different approach to teaching along with better use of technology to help HE teachers increase their effectiveness with respect to a more diverse student body.

ICT is thus making its way into HE teaching practices, albeit it seems it is only gradually and largely as a blended mode of delivery. For example, in an international study from 2002 that included HE institutions in Germany, the Netherlands, Norway, the United Kingdom, Finland, the USA, and Australia, Collis and van der Wende (2002) found that HE instructors commonly used ICT in their teaching. However, ICT did not substantially change the way they teach and instead complemented the established delivery. Blending traditional teaching with ICT became the norm, mainly entailing the use of email, presentation slides, word processing, the Web, and online systems. Another study conducted more than 10 years later by the European Universities Association (EUA) mapped ICT use in 249 HE institutions from 38 European countries (Gaebel, Kupriyanova, Morais, & Colucci, 2014). It found that almost all HE institutions recognized the usefulness of e-learning because it added greater flexibility to instruction with regard to time and space. The study also established that they mostly implemented ICT as blended learning (BL), and the majority also offered online courses. In Slovenia, Bregar and Puhek (2017) conducted a large study including the responses of 45 out of 101 Slovenian HE institutions. Their results show that e-learning (whether fully online or blended study programs) was the primary educational modality in only 15% of the institutions. The authors also found that digital technology was generally used to substitute a traditional medium and only rarely substantially modified or redefined learning.

To promote and enhance the quality of ICT-supported instruction, the University of Ljubljana (UL) launched the project "Digital UL – with innovative use of ICT towards excellence – DiUL" in 2017. The project aimed to introduce flexible approaches to teaching that involve ICT in all fields of study at its 23 faculties and 3 academies. As part of the DiUL project, a survey was conducted to reveal how ICT are used in the UL.

The present study relies on certain data from the mentioned DiUL survey and attempts to shed light on UL teachers' self-reported educational ICT use. Given this focus, the following research questions were developed:

- Which ICT tools do UL teachers use?
- What is the frequency and purpose of their ICT use?

This paper first reviews the theoretical frameworks that informed the analysis of UL teachers' ICT adoption. Next, it outlines the methodology applied while researching the UL teachers' ICT use, and presents the data analysis and an interpretation of it. A discussion of the findings and future implications follow in the final section.

Literature Review

Two models provided the analytical framework for exploring examples of UL instructors' self-reported ICT use: the innovation adoption model and the model of four adoption cycles. Both models are common in studies on ICT use in HE (e.g. Bates, Manuel, & Oppenheim, 2007; Elgort, 2005; Kirkup & Kirkwood, 2005).

The Innovation Adoption Model

In his seminal work *Diffusion of Innovations*, Rogers (1962) divided people into six categories with regard to how they adopt innovations: 1) *Innovators:* representing 2.5% percent of the population, they are characterized by eagerness to try new things, the ability to take risks, and not being set back by the uncertainty which innovations involve; 2) *Early adopters:* 13.5% percent of the population falls into this category. They are considered opinion leaders, role models, and a respected and credible source of information about innovation for many people; 3) *Early majority:* 34% of people may be classified as this type of adopter, representing the link between people who adopt innovations early and those who are late adopters; 4) *Late majority:* representing 34% of people and characterized by skepticism. They will adopt an innovation if necessary or under outside pressure, such as established norms; 5) *Laggards:* They account for 16% of the population, are traditionalists, suspicious, and accept innovations last. They must be sure that an idea will be successful before they adopt it.

Innovators and early adopters are the first to adopt innovations, followed by the early majority who need a longer time to decide. The skepticism of the late majority and the laggards makes them the last ones to use innovations. Figure 1 shows percentage shares of adopter types, indicating that at first the number of adopters rises slowly (innovators and early

adopters). The trend then accelerates with the early majority and the late majority adopting an innovation. It again slows down when the laggards adopt it and the innovation has reached the stage of 'normalization' (Bax, 2003, p. 24), with 100% of the population using it. In this stage, according to Paiva et al. (2016, p. 230), a technology becomes "invisible". They illustrate this with the example of email which has become so common in the Western world that when one says "I wrote to you", the recipient expects to receive an email more than a letter on paper.

Rogers' model is useful for identifying types of ICT users among HE teachers and students (Hunt, Eagle, & Kitchen, 2004) which, in turn, can help determine the kind of pedagogical and technical support most appropriate for each type.

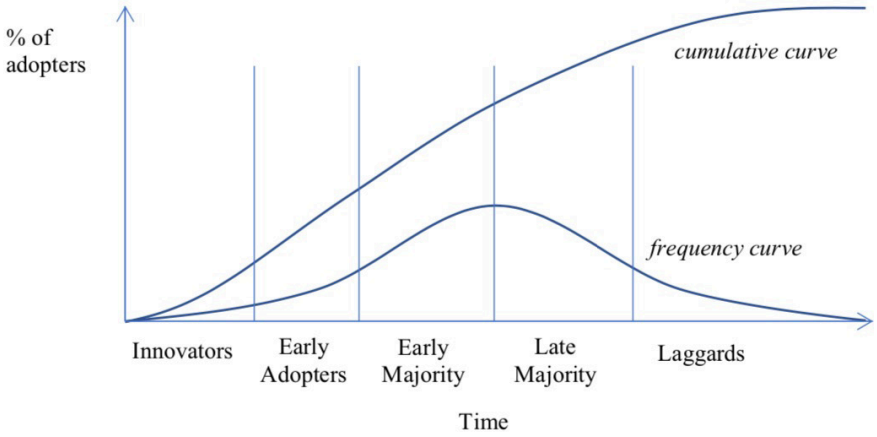

Figure 1. Technology adoption frequency curve and cumulative curve (adapted from Rogers, 1962, p. 243).

The Four Adoption Cycles Model

The next model focuses on ICT type rather than user type. It was developed by Zemsky and Massy (2004, p. 11) who explored how ICT are applied in colleges, universities, and for-profit organizations in the United States (U.S.). They broke ICT adoption up into four cycles: 1) *Use of ICT to enhance traditional face-to-face teaching*, such as relying on email for correspondence, publishing information online, using PowerPoint for presentations, etc.; 2) *Use of learning management systems (LMS)*, which provide better student interaction and communication, easier access to study materials, and offer administration and grading support; 3) *Use of imported course objects*, which offer the faculty an opportunity to em-

bed a greater variety of materials, such as interactive simulations. One can now find online organizations that host and support the distribution of such course objects; and 4) *Adoption of new course/program configurations*, which involves the pedagogical and institutional restructuring of the teaching and learning process so as to optimally apply ICT. This involves new approaches to teaching, new teacher and student roles, and active learning.

These four cycles differ with regard to the innovation stage and do not always follow one another but may occur simultaneously. They can be used as a framework for determining the ICT adoption stage of an HE institution, and can inform the type of change most suitable for that institution's existing pedagogical practices (Zemsky & Massy, 2004, p. 10). Zemsky and Massy (2004, pp. 11–12) took Rogers' five categories of adopters and applied them to the four cycles in the on- and off-campus teaching and learning context of the U.S. They found that cycle 1 was in the early majority stage. Cycle 2 was moving into the early majority stage mostly due to the percentage share of instructors and students who were in courses that used them. Cycle 3 and cycle 4 were still in the innovation stage. In practical terms, this means that HE institutions generally used presentation slides, course management systems infrastructure, digital assessment, and online discussion forums, and used only very basic learning objects and virtually no new course/program configurations.

Method

The purpose of this study was to explore current patterns in the use of ICT in instruction at the UL. To accomplish this research objective, we relied on data collected in a survey conducted as part of the DiUL project in 2017. Participants were academic staff (academic positions ranging from assistants to full professors) of the 23 faculties and three academies at the UL, which are independent institutions and differ in terms of their strategy, provision, and support for ICT-supported instruction since the UL does not issue any common guidelines. Consequently, ICT-supported teaching is developed and performed mostly by individual enthusiasts. Almost none of the faculties and academies has an established formal evaluation framework for online teaching.

The invitation for survey participation was sent via email by the general UL office to the work email addresses of all 2,682 teachers employed by the UL, with a link to the questionnaire and some explanatory text with information about the DiUL project. The survey comprised 68 questions concerning technology use in the form of individual statements, measured with ordinal scales using a 5-point Likert-type scale where a rating

of 1 = low use ("never") and a rating of 5 = high use ("very often"). A total of 960 individuals responded to the survey. Incomplete responses were removed and the final sample for the analysis included 428 responses, representing a response rate of 16%. It was calculated that 337 responses are required to achieve a confidence level of 95% for the measured value to be within ±5% of the true value (Taherdoost, 2017) and, therefore, our sample size satisfies this condition.

Results

The data show that teachers rely on different digital technologies in their instruction (Figure 2). The most frequent is their use of presentation slides (*M* = 4.37, *SD* = 1.180), most often supported by Microsoft PowerPoint. The use of recorded video lectures available online is less common (*M* = 2.62, *SD* = 1.296) and mostly depends on the teaching/learning context of the course. With respect to online resources, such as online books and articles, and the use of bibliographic databases available to teachers and students, greater use is detected (*M* = 3.76, *SD* = 1.095 and *M* = 3.61, *SD* = 1.274, respectively). Considering the use of LMS (most faculties use Moodle), the distribution of the results (*M* = 3.33, *SD* = 1.604) reveals a dividing line between UL faculties where an LMS is used.

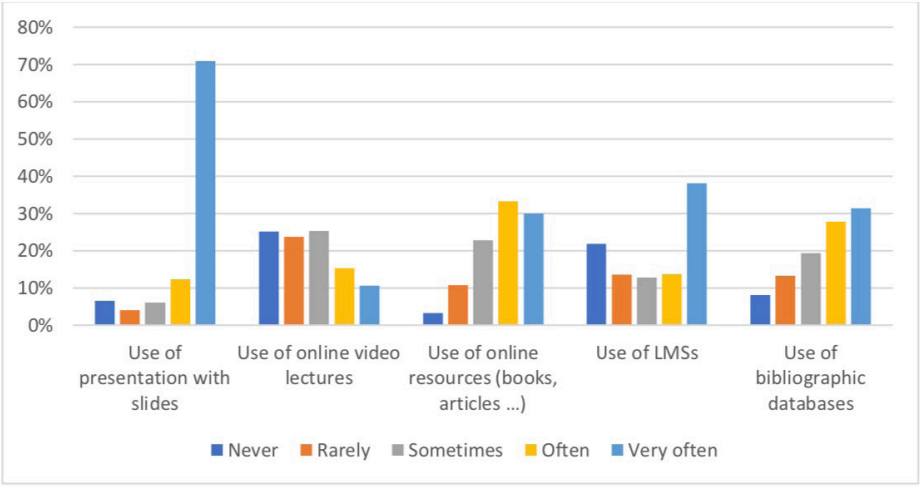

Figure 2. Instructional use of ICT – teaching tools.

Teachers rely on different digital tools and services to support their communication and collaboration (Figure 3). The most frequently used communication tools are email or online forums and the like (*M* = 4.46, *SD* = 0.910), while social networking services, such as Facebook, Twitter or

Instagram, are only used rarely as teacher–student communication tools (*M* = 1.18, *SD* = 1.245). Digital tools for collaboration rank somewhere in the middle (*M* = 2.91, *SD* = 1.295).

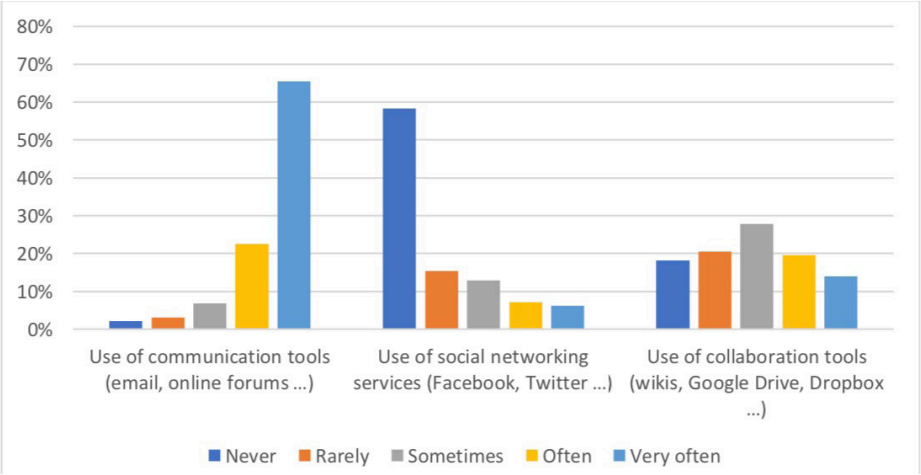

Figure 3. Instructional use of ICT – communication, social networking and collaboration tools.

Respondents also use ICT outside of work in their free time (Figure 4). The majority uses email every day (*M* = 4.81, *SD* = 0.577), which is similar to the use of ICT to obtain information (*M* = 4.25, *SD* = 1.037). Personal use of social networking tools is less frequent (*M* = 2.70, *SD* = 1.591), as is the personal use of ICT for entertainment (*M* = 3.19, *SD* = 1.355).

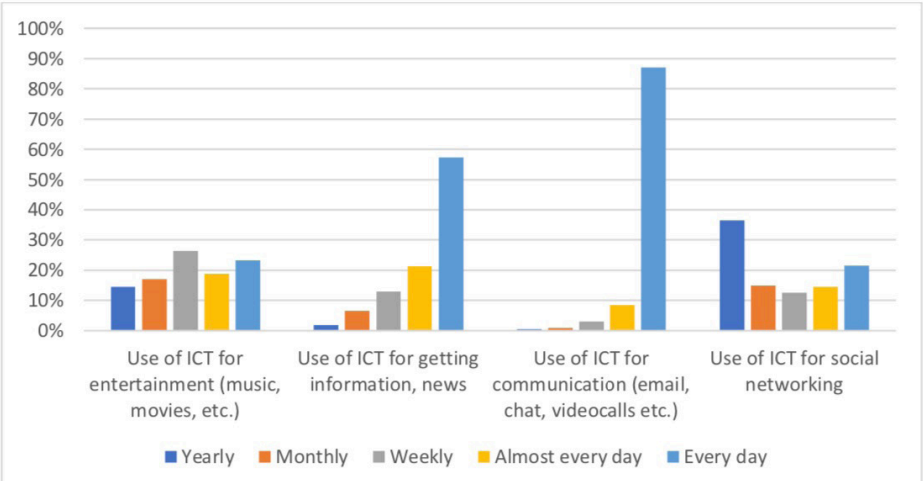

Figure 4. Personal use of ICT.

In addition, the respondents' ICT-supported pedagogical activities were analyzed (Figure 5). The results show that ICT is most often used to introduce the lesson content (M = 4.04, SD = 1.119) and in delivering the lecture (M = 4.02, SD = 0.998). It is less often used for revising knowledge (M = 3.40, SD = 1.163) or motivating students (M = 3.52, SD = 1.052). Participants use it the least for activities such as prior knowledge evaluation (M = 2.44, SD = 1.162), knowledge testing (M = 2.42, SD = 1.182), and assessment (M = 2.19, SD = 1.225).

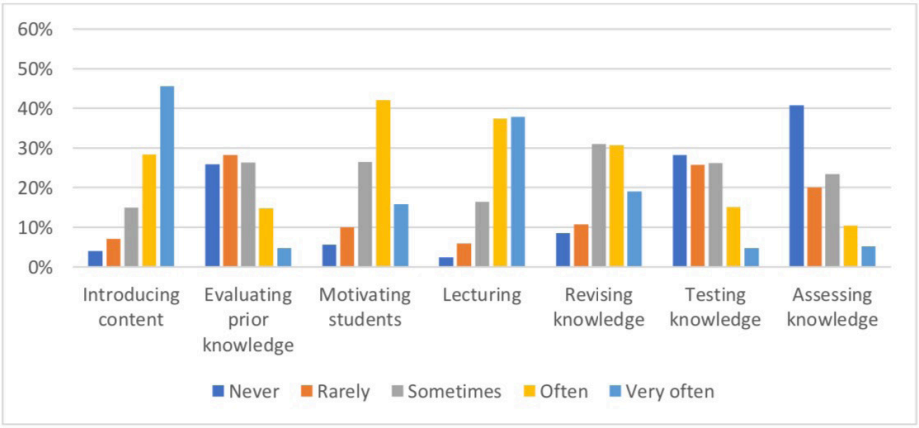

Figure 5. Pedagogical activities supported by ICT.

Discussion and conclusion

The main objective of this study was to examine current patterns in UL teachers' use of ICT instructional tools in terms of their type, purpose, and frequency of use. To uncover which stage of adoption individual ICT tools are in, we related our results with Rogers' innovation adoption model (1962) and considered "adopters" to be all teachers who at least rarely use a certain ICT tool.

As for the adoption of tools in the teaching process, presentation slides seem to have reached the normalization stage (Bax, 2003). With over 93% of UL teachers using them at least rarely, they may be regarded as an innovation that has reached the laggards. Similarly, the use of online resources and bibliographic databases may be viewed as having become ubiquitous and almost invisible at the UL. The use of LMS has reached the late majority (78% use LMS at least rarely), which may include, on one hand, the teachers who are required to use them since they are mandatory at their faculties and, on the other, those teachers who may be enthusiastic pioneers in faculties where LMS use is not obligatory. One reason explaining why there are laggards might be the

fear that the extra hours spent making preparations for e-learning will be done for free because – in the absence of any top-down university strategy – some faculties do not currently reward preparation for LMS teaching. Social networking services have only reached the early majority (42% of teachers use it). The use of online video lectures seems to still be in the late majority stage (75% of users). All in all, one may say that UL teachers have mostly adopted these ICT tools in their instruction. However, we must take into account that 100% adoption might never be achieved because this may not be due to teachers who lag behind, but more to the specific teaching contexts in which it is unreasonable to use ICT.

Online tools such as email, online forums, or chatrooms that support student communication are used by almost all UL teachers. We may assume that all of them use email, which resonates with the observation of Paiva et al. (2016) that email has become "invisible". Yet, the affordances of email do not support group networking very efficiently. Accordingly, it was expected that a bigger share of teachers would use social networking tools and services. Their adoption, however, is still in the early majority. Unlike social networking services, online collaboration tools have attracted the late majority.

UL teachers are aware of the possibilities offered by ICT to support and enhance pedagogical activities. The use of ICT to introduce lecture content, support lectures, motivate students, and revise knowledge is in the late majority stage. The teachers who use them for evaluating, testing, and assessing knowledge are mostly early adopters.

The results also show that, according to the four adoption cycles model (Zemsky, & Massy, 2004), the UL is past cycle 1. Most respondents use ICT to substitute traditional tools, e.g. email for correspondence, PowerPoint for presentations, publishing resources online for students to study, etc. Cycle 2 has been reached only partially since a smaller number of teachers use LMS in a way that promotes higher-order cognitive processes, most often at those faculties with good ICT support and a centralized institutional LMS. The last two cycles have been reached only to a very small degree. This might be because it is more challenging to substantially modify teaching and learning. Thus, knowledge assessment, active learning, and collaboration online are in still the earlier stages.

There are a few ways to support the digital immigrant UL teachers to bridge the gap and move closer to their digital native students (Prensky, 2001). Drawing on Bregar and Puhek (2017, p. 33), we suggest increasing

funding for ICT to provide the necessary ICT infrastructure and appropriate ICT for specific teaching contexts, e.g. interactive simulation programs. Next, we suggest providing technical and pedagogical support and continuous training opportunities. This is in line with the DiUL project's aim to provide a university-wide framework for training and assistance for teachers. What also needs to be acknowledged is the fact that teachers need extra time for learning and testing new ICT. Therefore, their effort needs to be formally recognized and awarded. This could motivate the laggards and late majority adopters to implement more advanced ICT tools in their teaching practice. We also suggest encouraging ICT use beyond the classroom. This is because our results demonstrated that teachers' personal ICT use is significantly linked to their ICT use at work. Thus, future research may examine in detail the relationship between patterns of teachers' instructional and personal ICT use.

To fully reach higher ICT adoption cycles, the UL needs to create strategic guidelines for ICT implementation. We hope that our research will prove useful in that process. Future studies may explore how the patterns of ICT use at the UL have changed during the recent COVID-19 pandemic and whether these changes are reflected in the ICT adoption cycles.

Acknowledgments

The research was supported by the University of Ljubljana within the project "Digital UL – with innovative use of ICT towards excellence – DiUL" (Digitalna UL – z inovativno uporabo IKT do odličnosti). The project was financed by the Republic of Slovenia and the European Union under the European Social Fund.

References

Bax, S. (2003). CALL–past, present and future. *System*, *31*(1), 13–28.

Bates, T. (2019). *Teaching in a digital age*. Open Textbook. Retrieved from https://opentextbc.ca/teachinginadigitalage/

Bates, M., Manuel, S., & Oppenheim, C. (2007). Models of early adoption of ICT innovations in higher education. *Ariadne*, *50*.

Bregar, L. & Puhek, M. (2017). *Analiza stanja na področju digitalizacije in e-izobraževanja v visokem* šolstvu *v Sloveniji*. Maribor: DOBA Fakulteta.

Christensen, T.H. & Røpke, I. (2010). Can practice theory inspire studies of ICTs in everyday life? In B. Bräuchler & J. Postill (Eds.), *Theorising Media and Practice* (pp. 233–256). New York: Berghahn Books.

Collis, B. & van der Wende, M. (2002). Models of technology and change in higher education. *Report of the Center for Higher Education Policy Studies*. Twente, The Netherlands: University of Twente.

Elgort, I. (2005). E-learning adoption: Bridging the chasm. *Australasian Society for Computers in Learning in Tertiary Education 2005 conference proceedings* (pp. 181-185). Tugun: ASCILITE. Retrieved from https://www.ascilite.org/conferences/brisbane05/proceedings.shtml

Gaebel, M., Kupriyanova, V., Morais, R., & Colucci, E. (2014). *E-learning in European higher education institutions: Results of a mapping survey conducted in October-December 2013*. Brussels, Belgium: European University Association. Retrieved from http://www.eua.be/Libraries/publication/e-learning_survey

Hunt, L., Eagle, L., & Kitchen, P. (2004). Balancing Marketing Education and Information Technology: Matching Needs or Needing a Better Match? *Journal of Marketing Education*, *26*(1*)*, 75–88. https://doi.org/10.1177/0273475303262350

Kirkup, G. & Kirkwood, A. (2005). Information and communications technologies (ICT) in higher education teaching – a tale of gradualism rather than revolution. *Learning, Media and Technology*, *30*(2), 185–199.

Paiva, J., Morais, C., Costa, L., & Pinheiro, A. (2016). The shift from "e-learning" to "learning": Invisible technology and the dropping of the "E." *British Journal of Educational Technology*, *47*(2), 226–238.

Prensky, M. (2001). Digital natives, digital immigrants Part 1. *On the Horizon*, 9(5), 1–6. https://doi.org/10.1108/10748120110424816

Rogers, E.M. (1962). *Diffusion of innovations*. New York: The Free Press.

Taherdoost, H. (2017). Determining Sample Size; How to Calculate Survey Sample Size. *International Journal of Economics and Management Systems*, *2*, 237–239.

Zemsky, R. & Massy, W. (2004). *Thwarted innovation: What happened to e-learning and why*. Philadelphia: The Learning Alliance for Higher Education at the University of Pennsylvania.

TEACHING ENVIRONMENTAL SCIENCE AND MATHEMATICS. USE TECHNOLOGICAL INSTRUCTIONAL MATERIAL BY TRAINEE TEACHERS, IN LESSON PLANS

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Abstract

This paper investigates what types of technological material trainee teachers select to use in the sessions they carry out in their training. There is a paucity of research around this topic. The data came from lesson plans of trainee elementary school teachers from a University in Greece in the subjects of Environmental Science and Mathematics. The selection of technology types is relevant to the equipment available in the classrooms, the use of supervising teachers, the attitudes towards ICT in each subject and the general school context. The findings therefore give significant insights into these topics.

Introduction

This research examines the type of technologically-oriented instructional material that student teachers, also called trainee teachers, select in their teaching session. This refers to sessions they plan and implement as part of their research training program. It focuses specifically on the student teachers who attend courses in elementary education and in two subjects, namely elementary science and mathematics.

The effective use of technological instructional material is an essential skill for contemporary and future teachers. The development of this skill is multifactorial and complex. This led Mishra and Koehler (2006) to introduce the concept of Technological Pedagogical Content Knowledge (TPACK), which reflects different dimensions of teachers' background. These are pedagogical knowledge, technological knowledge, and subject content knowledge, and their impact on the implementation of technology in teaching. TPACK certainly relates to the use of technological instructional material.

The development of TPACK depends highly on teacher training. Indeed

Kirschner & Selinger (2003) as well as Tondeur, Hermans, van Braak, & Valcke (2008), claim that for future teachers to become familiar with the use of ICT in their classroom, there should be appropriate preparation during their studies or pre-service courses. Research has also demonstrated that it is frequent for challenges to arise while trying to include technological material in teaching.

However, limited seems to be the research that tries to identify what types of instructional material student-teachers actually select. Even more limited is the research that specializes in elementary subjects, such as environmental science and mathematics (Khvilon & Patru, 2002; Tondeur et al., 2008; Sussane, 2020). At that point lies the rationale of this particular research project.

The Topic

The topic of this research is linked to the concepts of technologically-oriented instructional material, TPACK, and teacher training. It is important therefore to point out the main research points for each of these concepts.

Technologically-oriented Instructional Material

The use of Information and Communication Technologies in the Classroom (ICT) is an important skill that teachers need to develop. The basic reason is the strong influence of ICT in society and rapid on-going development. ICT has been linked to fundamental changes in the patterns and channels of communication and knowledge acquisition. These changes affect teachers' work (Khvilon & Patru, 2002; Tondeur et al., 2008; Sussane, 2020).

Current pedagogy supports the student-centered approaches in learning. The wider social context and environment provides people, including students, with opportunities that enhance learning, e.g., to obtain information, interact with others, and engage in authentic real-life experiences. ICT can greatly assist students to gain knowledge in these realistic experiences, since they help the teachers and learners interact and exchange messages, information, or knowledge through text, images, sound, or video. The influence of ICT in learning depends on the type of instructional material (Khvilon & Patru, 2002).

The types of technologically-oriented instructional material that can be observed or implemented in the classroom are various. The interactive whiteboard is one example. Moreover, there are slides such as those in PowerPoint presentations. There is also audiovisual material, such as

movies from sites such as YouTube or animation files and videos of any kind. Furthermore, tablets and laptops are also used in classrooms. In addition, there are simulations and virtual experiments available as web-based applications. Lastly, there are websites of general interest that can provide information and other activities (Wagner et al., 2005; Hora, Oleson, & Ferrare, 2013).

TPACK

According to Mishra and Koehler (2006), the use of ICT in classrooms depends on many factors. Firstly, knowledge of ICT is necessary. Secondly, knowledge of pedagogy is important as well. Thirdly, it is important for teachers to understand basic principles of using ICT in education, in order to take full advantage of them. Fourthly, there is need to understand curriculum and assessment content and principles. Fifthly, a clear picture and awareness of classroom and school management matters. Finally, professional learning and development with regards to ICT and teaching are crucial. These factors are interwoven and influence a teachers' decision whether or not to use ICT in teaching (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2011). Mishra and Koehler (2006, p. 1029), defined the Technological Pedagogical Content Knowledge (TPACK) as

> a class of knowledge that is central to teachers' work with technology. This knowledge would not typically be held by technologically proficient subject matter experts, or by technologists who know little of the subject or of pedagogy, or by teachers who know little of that subject or about technology

This approach is based on the finding that for teachers to effectively use ICT or technologically-oriented material in the classroom, they should have clear knowledge of pedagogy, technology, and content knowledge. This links to the assumption that no means of ICT applies for every teacher, every subject, every context, or every practice. This implies that the teacher should identify what ICT application or teaching material to use, depending on the context, the topic of the session, the subject which is being taught, and the practice selected. In the same way, the selected material can give insights on these topics. The rationale behind TPACK is that ICT can be linked to different teaching approaches. In other words, even though it is important for teachers to know about ICT, websites, the Net, and technological instructional material, it is not enough to implement it effectively in schools, take advantage of its potential, and qualify pupils to become familiar with it (Mishra & Koehler 2006; Tondeur et al., 2008).

As concluded from the above, technological instructional material might be used differently in different subjects. For example, in science as well as mathematics, the interactive white board and slides enhance the opportunities for visual representations, which can make the session more interesting and interactive for the learners (Karsenti, 2016). The video files can provide the opportunity to demonstrate phenomena and figures with motion and animation and sound, which are sometimes difficult to be presented as effectively in texts or static images (Wagner et al., 2005; UNESCO, 2011; Karsenti, 2016). Tablets can be useful, as in environmental science where they can help present topics when combined with software tools such as virtual or augmented reality (Fokides, 2018; Fokides & Zachristou, 2020) whereas in mathematics they can assist in complicated calculations and models. Simulations are justified to assist in science teaching as they help showing and experimenting with concepts that are difficult to be approached otherwise, such as the microworld. They can also be used in calculations and representations in mathematics sessions. Finally, the websites can provide up-to-date information and data for inquiry-based activities, which are highly recommended by contemporary approaches in mathematics and science classes (Wagner et al., 2005).

All these applications and types of technological material are justified to be compatible to particular types of practices and teaching approaches (UNESCO, 2011). Combining knowledge of these approaches and practices along with the use of the types are basic dimensions of TPACK (Mishra & Koehler, 2006).

Teacher Training

According to research, even though the technological material is considered effective and necessary in teaching, many teachers still seem to be reluctant to use it in class. The reasons might be lack of appropriate skills, insufficient time, limited and restricted access, and generally inappropriate conditions. This has stimulated interest from teacher preparation programs and institutions such as universities to prepare future teachers. Indeed, student teachers can benefit by relevant subjects in their studies. Such subjects could be about ICT, their applications, including technologically-oriented material, generally and specifically for each subject, pedagogy theory, and practice images (Wagner et al, 2005; UNESCO, 2011; Karsenti, 2016).

However, effective use of technological instructional material does not solely depend on the preparation in studies. It may also link to the context where students will teach, in other words the schools. If the schools do

not provide appropriate conditions, no matter how prepared the trainee teachers are, they might not be able to implement the knowledge and skills they have gained form their subjects. These conditions mostly relate to the attitudes of teachers at schools and the general equipment available (Tondeur et al, 2008; Kopcha, 2012).

More specifically, it is important for the trainee teachers to collaborate with peers who are experienced teachers and understand more deeply how to actually use technological instructional material in classroom. They can learn by seeing how the experienced teachers work and use it in the classroom. This cooperation and collaboration should also focus on understanding values, regarding this type of material. These values can be linked to the ideas that the experienced teachers have adopted towards ICT and potential educational benefits. It will also help developing the appropriate flexibility to arrange the lesson plan in such way that the material will be used effectively despite the possible challenges (Khvilon & Patru, 2002; Tondeur et al, 2008; Sussane, 2020).

Apart from that, there are social, health, security, and ethical issues that the trainee teachers should familiarize themselves with. These issues are usually defined in detail in the school. The trainee teachers should know how to use the technological instructional material in such a way that it will not compromise the security of school members and not touch into sensitive issues that may arise. These issues might be linked to beliefs towards computers. They may also have to do with safety measures concerning the pupils using technology generally. Since each school might deal with such topics differently, trainee teachers are expected to learn that in context.

Lastly, there are technical issues to be taken into consideration. The trainee teachers should understand what types of resources are available and generally being used in the school, as well as how familiar the teachers and pupils are with them. This will help them plan appropriately and use them during the teaching sessions (Khvilon & Patru, 2002; UNESCO, 2011).

In short, for future teachers to use technological instructional material, it is important to see that is used in the actual context, which is the school. This way, they will be informed, confident, and able to include it in their teaching and they will keep doing it throughout their teaching career. The context is an important factor (Tondeur et al, 2008). This relates to the knowledge and background of how to use computers and specific

ICT application while teaching, which is an important dimension of the TPACK (Mishra & Koehler, 2006).

The influence of the context in the trainee teacher's decision to use such material is bilateral. By examining their decision and selection of technological instructional material, it is possible to draw interesting conclusions about the context and whether this context can promote the use of technologically oriented material and TPACK (Mishra & Koehler, 2006; UNESCO, 2011).

The Research

The use of technological material by trainee teachers, which relates to the development of TPACK, depends highly on the context of the schools that they are expected to work in (Mishra & Koehler, 2006; UNESCO, 2011). Bearing that finding in mind, this research examines what types of such materials trainee teachers use.

The sample

The participants of the research were students of a Department of Elementary Education in a University in Greece. These students were completing their teacher training course. During this course, the students are expected to plan and carry out teaching sessions in elementary schools, in various subjects, such as Mathematics and Environmental Science. These take place within units of the teacher training program. The sessions on Mathematics were part of unit called 'Applied Mathematics Education'. The sessions on Environmental Science were part of subject called 'Applied Science Education'. In each subject, they would probably plan two one-hour sessions. In certain cases, they might do a single two-hour session, instead.

The data for this research came from the plans they submit prior to the sessions. A total of 425 lesson plans have been examined. Among them, 235 were on environmental science and 190 were on mathematics.
The students were expected to prepare these lesson plans according to their knowledge of the subject, ICT, teaching practices, and the context of the schools in which they have to teach. These are the main dimensions of TPACK. These students have taken multiple and various units around mathematics and mathematics education, science and science education, pedagogy, ICT, and ICT in teaching. Successful completion of these courses is required before moving to their teacher training units. This guarantees that these students acquire most of the basic dimensions concerning TPACK (Mishra & Koehler, 2006). They have been taught and examined on how to use technological instructional

material. This means that the only condition left to be satisfied so that the trainee teachers include such material during their sessions, is the school context. If the school context encourages them, they will use it; otherwise they will probably not. This encouragement would probably involve many factors. These could be existence and provision of the appropriate equipment, use on behalf of the teachers, and appropriately prepared classes of pupils (UNESCO, 2011).

In particular, as far as the general context is concerned, the Greek Educational system is considered as highly centralized. Schools and teachers have limited autonomy. Greek teachers are expected to use specific teaching packages distributed from the Ministry of Education, designed by central policy-making bodies. These packages include pupils' books, work-books, and teachers' books with already prepared lesson plans. Teachers therefore are found to be relying on these and find no motivation in using technological instructional material (Organization for Economic Cooperation and Development (OECD), 2017).

Certain efforts by the Ministry of Education to promote technological instructional material have been undertaken. For example, sets of software and educational websites on each subject have been designed and promoted (Greek Ministry of Education (MINEDU), 2020). Even though there has been encouragement by the curricula to do so, usually as extra activities, since it is not included in the lesson plans, teachers tend to avoid its use (OECD, 2017). This is likely to influence trainee teachers, as well, in their lesson plans (Tondeur et al, 2018).

Data Analysis

The data for this research came from lesson plans. As soon as these were collected, they were examined as to whether they included technological instructional material in the activities and phases of the sessions. Additionally, the types of technological material were identified in each session. These could have been interactive whiteboard, presentation software, internet websites, simulations, other software, digital tablets, and videos (Hora et al., 2013).

Analysis was based on a quantitative approach (Cohen, Manion, & Morrison, 2013). The absolute value for each type in each subject, separately for environmental science and mathematics, was calculated. This helped identify the relevant frequency, the mean, as well as the standard deviation, which gave insights into which types are preferred and to what extent. Thanks to the calculation of the standardized residuals, it was possible to identify if there was significant statistical difference for

each type between the two subjects. This statistically significant difference would be proved if the value of standardized residuals exceeded 2. In order to identify if there is generally a statistically significant difference, the t-value and p-value of the relevant frequencies were calculated. The case of this research fits as a one-tailed test. The range of values in this sample are the same, as the focus was on whether student teachers use a type of technological instructional material or not (Swift & Piff, 2014).

Findings

As seen in Table 1, the number of sessions where technological instructional material was included appears to be limited, both in Environmental Science as well as Mathematics. The percentage in both subjects is around 40%. This can be attributed to restricted availability of the appropriate equipment in the classroom or rather limited use on behalf of the educators This can be strengthened by the fact that no significant difference in the percentage between the two subjects is observed (UNESCO, 2011; Tondeur et al, 2018). It might also be linked to the highly centralized culture of Greek schools, within which teachers are tempted to rely on the distributed teaching package. They have no strong motivation to include technological instructional material (OECD, 2017). Apparently, these factors can influence the students in their decisions about the instructional material and TPACK (Mishra & Koehler, 2006).

Table 1

The relevant frequency types of technological instructional material observed in elementary school classes

	Environmental Science	**Mathematics**
Projector	37.69%	40.30%
Slides	7.46%	4.48%
Internet	33.22%	30.39%
Tablet	0.00%	0.00%
Video	32.27%	5.97%
Simulation	0.75%	0.00%
Software	5.22%	1.49%
Type of technology total	37.69%	40.30%
MEAN	0.17	0.12
SD	0.16	0.15

With regards to what types of technological instructional material were used, the most common were found to be the projector and the internet, in both subjects. This might be attributed to the context factor too. More specifically, this might be related to availability (Karsenti, 2016). Perhaps the particular students who included those types taught in classrooms with projectors and internet access, which the teachers would use as well. In fact, it might be the case that they used the digital form of the textbooks, which also exist online (MINEDU, 2020). This implies that there is a dependence between the teaching package and the prepared lesson plans (OECD, 2017), but occasionally they can be implemented with the assistance of technological instructional material. The fact that this material is selected, even only whenever possible, proves the development of TPACK on behalf of the students (Mishra & Koehler, 2006; Tondeur et al, 2018).

Apart from whiteboards and the internet, there is use of video, software simulation, and slides. This might also be attributed to factors of accessibility and compatibility to the lesson plans. In other words, there are a limited number of students who can use these technologies in the classroom and can link them to the concepts or topics taught.
The only type that does not appear at all in either subject is the tablet. This might have to do with the generally limited use of tablets in Greek schools (Fokides, 2018). In addition, in mathematics there was no use of simulations as well, which can be attributed to the nature of the subject (Tondeur et al, 2018).

Differentiation between the two subjects, is presented in Table 2, as identified by the calculation of the standardized residuals in most of the types of technologically oriented instructional material. The differences are not statistically significant, since the values are no greater than 2. The only exception is the use of video.

A possible explanation is that generally the trainee teachers do not consider that ICT and technological material is more appropriate in one subject and less in the other. Instead, they are equally appropriate and useful for both. It might also be a matter of availability. The trainee teachers have taken into consideration the overall conditions of the classroom where they have to teach, which are common for the two subjects (Khvilon & Patru, 2002; Kopcha, 2012; UNESCO, 2011).

Probably, however, they hold the opinion that the subject of environmental study can be more assisted by the use of videos. This might be because they believe videos can demonstrate phenomena, processes,

and actions of an environmental nature. This demonstration is probably considered very useful by the student teachers. It is probably easy for them, as well, if they can have the necessary equipment such as the interactive whiteboard (Karsenti, 2016). On the other hand, in mathematics this might not be the case. In this subject, they focus more on actions, calculations, and problem solving, where videos might not be as required. Therefore, they opt less for this type of material. In other words, the statistically significant differentiation in the use of video can be attributed to the nature of the subject taught (Wagner et al, 2005; UNESCO, 2011).

Table 2

Unstandardised and standardised residuals in use of technological instructional material in elementary school: Environmental Science vs. Mathematics

	Unstandardized residuals	**Standardized residuals**
Projector	-3.20	-0.31
Slides	-2.97	-0.29
Internet	0.76	0.07
Tablet	-6.62	-0.64
Video	20.6	2.00
Simulation	-5.88	-0.57
Software	-2.67	-0.26

Generally, there seems to be no statistically significant difference between the two subjects, since the t-value is 0.29311 while the p-value is 0.385882. The result is not significant at $p < 0.05$ (Swift & Piff, 2014).

Consequently, the data reveal that even though all students have been prepared to use technological instructional material in the classroom, few decided to take advantage of it. This is probably because of the lack of appropriate equipment in the classrooms, in combination with limited use from the teachers (Kirshchner & Selinger, 2003). The highly centralized culture of Greek Schools might also be related to low technology usage, since it motivates teachers to use the distributed print material rather than designing and seeking other materials (OECD, 2017). This discourages future teachers from using such material and hinders the further development of TPACK (Mishra & Koehler, 2006). Overall, these attitudes were similar for the subjects of environmental science and mathematics. There was only a differentiation in the use of videos, which were found to be utilized comparatively more frequently in environmental science, probably due to the content and the possibility to demonstrate key concepts with the appropriate equipment (UNESCO, 2011; Karsenti, 2016; Tondeur et al, 2018).

Conclusions

This research aimed to point out what types of technological instructional material student teachers select for sessions they have to carry out. These types are considered to be very useful in teaching (Khvilon & Patru, 2002; Hora et al, 2013). The research examined lesson plans that students in an Education Department at a University in Greece submitted for the subjects of Environmental Science and Mathematics. Research around the types of instructional materials used in teaching is rare. Research that specializes in student teachers is even more rare.

The use of technological instructional material depends highly on the development of TPACK, as it has to do with learning about technologies, their potential in education, content knowledge, subject taught, and classroom management issues (Mishra & Koehler, 2006). By investigating the types of material, it is possible to gain insights into these parameters. The student teachers in this particular sample are trained to have sufficient knowledge concerning ICT, technological material, and content knowledge. Therefore, any impediment in using such materials in classroom should be attributed to the context, which is a major factor (UNESCO, 2011; Tondeur et al, 2018). In particular, the Greek Education system is known to be highly centralized and the teachers usually feel restricted to rely on teaching packages that are distributed by the central authorities (OECD, 2017; MINEDU, 2020).

Two hundred thirty five lesson plans in Environmental Science and 190 lesson plans in Mathematics were collected and analyzed with the use of descriptive and inferential statistics (Swift and Piff, 2014). The findings show that, overall, few students include technological instructional material in their lesson plans. The interactive whiteboard was the type observed more frequently. This indicates that the context does not help. That could be because teachers that the students had observed relied, as stated in the literature, on the textbook, or that the classrooms lacked appropriate equipment to facilitate technology use. This does not assist the development of student teachers' TPACK (Mishra & Koehler, 2016). With respect to differential use of technologies in teaching different subjects, namely Environmental Science and Mathematics, it was observed that there was a statistically significant difference in the use of video, which probably student teachers consider more useful in the subject of environmental science (UNESCO, 2011). These conclusions can be strengthened if more relevant research is carried out examining perhaps a greater sample or in combination with interviews with student teachers or classroom teachers (Cohen et al, 2013).

References

Cohen, L., Manion, L., & Morrison, K. (2013). *Research methods in education (7th Ed.)*. London: Routledge.

Fokides, E. (2018). Tablets in primary schools: Results of a study for teaching the human organ systems. *International Journal of Smart Education and Urban Society*, *9*(3), 1-16. https://doi.org/10.4018/IJSEUS.201807010

Fokides, E., & Zachristou, D. (2020). Teaching natural sciences to kindergarten students using tablets: Results from a pilot project. In S. Papadakis & M. Kalogiannakis (Eds.), *Mobile learning applications in early childhood education* (pp. 40–60). IGI Global. https://doi.org/10.4018/978-1-7998-1486-3.ch003

Greek Ministry of Education (MINEDU). (2020). Νομος ΥΠ' αριθ. 1566¨ Δομή και λειτουργία της πρωτοβάθμιας και δευτεροβάθμιας εκπαίδευσης και άλλες διατάξεις (*Law 1566/1985S: Structure and function of primary and secondary education)*. Athens: Ministry of Education. Retrieved from https://www.minedu.gov.gr/publications/docs2018/EPAL_N_1566_1985.pdf

Hora, M. T., Oleson, A., & Ferrare, J. J. (2013). *Teaching dimensions observation protocol (TDOP) user's manual*. Madison: Wisconsin Center for Education Research.

Karsenti, T. (2016). *The interactive whiteboard (IWB): Uses, benefits, and challenges. A survey of 11,683 students and 1,131 teachers*. Montreal: CRIFPE. Retrieved from https://www.researchgate.net/publication/298348102_The_Interactive_Whiteboard_IWB_Uses_Benefits_and_Challenges_A_survey_or_11683_students_and_1131_teaacher

Khvilon, E. & Patru, M., (2002). *UNESCO information and communication technologies in teacher education: A planning guide*. Paris: UNESCO Division for Higher Education. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000129533

Kirschner, P., & Selinger, M. (2003). The state of affairs of teacher education with respect to information and communications technology. *Technology, Pedagogy and Education*, *12*(1), 5–18.

Kopcha, T. J. (2012). Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development. *Computers & Education*, *59*(4), 1109–1121. https://doi.org/10.1016/j.compedu.2012.05.014

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

Organization for Economic Cooperation and Development (OECD). (2017). *Education at a glance 2017: OECD indicators*. Paris: OECD Publishing. https://doi.org/10.1787/eag-2017-en.

Swift, L., & Piff, T., (2014). *Quantitative methods for business, management & finance* (4th ed.). London: Palgrave Macmillan

Susanne, W. (2020). Embracing digital technology in science classrooms—Secondary school teachers' enacted teaching and reflections on practice. *Journal of Science Education and Technology*, *29*(3), 431-441. https://doi.org/10.1007/s10956-020-09828-6

Tondeur, J., Hermans, R., van Braak, J., & Valcke, M. (2008). Exploring the link between teachers' educational beliefs profiles and different types of computer use in the classroom: the impact of teacher beliefs. *Computers in Human Behavior*, *24*(6), 2541–2553. https://doi.org/10.1016/j.compedu.2011.10.009

Wagner, D. A., Day, B., James, T., Kozma, R. B., Miller, J., & Unwin, T. (2005). *Monitoring and evaluation of ICT in education projects. A handbook for developing countries*. Washington DC: InfoDEV.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2011). *UNESCO ICT competency framework for teachers*. Paris: UNESCO. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000213475

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TEACHING TEACHERS WITHOUT TEACHING: CONSTRUCTIONISM AT WORK IN AN e-LEARNING MODULE

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Abstract

Universally there is an outcry for change in education. Many industries have changed their modus operandi yet education remains mostly unchanged. This study focuses on the experience of twenty-nine students at a South African university enrolled in a postgraduate certificate in higher education. A blended learning, e-learning module was developed where the teaching method relied heavily on the use of technology and constructionism. Students reflected weekly on their experiences and completed a survey at the end of the module. The analysis of the results indicated that, after initial discomfort, students found the module rewarding and fulfilling.

Introduction

The digital revolution not only challenges the business world to change, but also the education sector. It is predicted that technology will change the future of education (Davis, 2019; Francis, 2018). Although technology such as the computer, internet, video or mobile phones, was not developed with education in mind (rather science, communication or entertainment), much has increasingly been adapted for teaching and learning (Davis, 2019), and, therefore, it creates new possibilities for educational use (Francis, 2018). Digital online lessons and classes have become more popular (Davis, 2019). However, how much of this change is visible in the classroom? While teachers are the facilitators of change, they are often prevented from changing because of the expectations of the current system, which focuses on marks and grades (Francis, 2018). Consequently, students often struggle to complete their courses at higher education institutions for various reasons, which results in high dropout rates (Moodley & Singh, 2015).

New entrants to the job market often lack crucial 21st century skills, and politicians, educationalists, and futurists call for education to prepare students for the 4th industrial revolution, enabling adaption to the rapidly changing job markets. Many jobs (as we know them) will be replaced by more heavily digitized and automated jobs, creating numerous 'novel'

job opportunities (Davis, 2019). To prepare students for jobs that will only exist in the future demands a change in how we teach students. A paradigm shift needs to drive the change from students memorizing facts, to where they become critical thinkers and problem-solvers (Davis, 2019). To achieve this, skills-based and experiential learning becomes crucial, as well as taking the needs of the individual into consideration (Bates, 2019; Davis, 2019).

Technology and the fact that students have greater access to technology might be seen as a possible driver for change in education. I therefore believe that in order to survive in the 4th industrial revolution, teachers must embrace technology, while adopting a new mindset when it comes to education. To facilitate these changes in education and emphasize 21st century skills, a constructionist-based module was developed and tested in a teacher education course. The objective of this study was to gather information on how students experienced the constructionist approach in a blended learning environment while constructing their own e-learning material.

Literature

As a background to this study, literature about the skills students need to survive in the 4th industrial revolution will be discussed. The focus will move to constructionism with a short discussion of what it is and its characteristics. The literature ends with commentary on the role of technology in a blended learning, flipped classroom environment.

4th Industrial Revolution and 21st Century Skills

The rapid development of technology infiltrates many aspects of our lives. Products are becoming multidisciplinary, intelligent, smart and agile (Abramovici, Gobel, & Neges, 2015). The explosion of the Internet of Things (IoT) and access to big data has given way to the 4th industrial revolution (Rose, 2018).

According to Carruthers (2018), the 4th industrial revolution has significant implications for education. To make individuals employable, skills such as critical thinking, collaboration, and creativity become essential (21st century skills). Access to real world problems and potentially working across all global cultures requires students to be exposed to a curriculum that advocates transferable skills (Carruthers, 2018). To facilitate this change, the role of the teacher will need to be redefined and teachers should facilitate the learning of the skills that students need to survive in the 21st century (Kang, 2018). This learning shift will include thinking skills such as creativity, open mindedness and self-awareness (Martin, 2018).

Constructionism

Constructionism is an established theoretical framework based on the work of Papert (1980). For Papert, learning takes place through discovering, knowledge construction, and the making of objects in the real world while using what is already known. When teaching from a constructionist perspective, the teacher becomes a facilitator and reviewer (Paramaxi, Zaphiris, Michailidou, Papadima-Sophocleous & Ioannou, 2013), while the students control and manage their own learning. The student takes on the role of a designer and creates tangible artifacts in a social environment (Cocciolo, 2011) and taking advantage, for example, of available computer technology (Papert & Harel, 1991; Resnick, 1998). In doing so, the process of thinking become visible (Papert & Harel, 1991).

Constructionism theory should not be confused with constructivism. While both constructivism and constructionism advocate that knowledge is built by the student, constructionism stresses the idea of building a tangible knowledge artifact that can be shared. Because of the nature of constructionism, classes are structured around the design of a tangible object (Cocciolo, 2011). According to Noss & Clayson (2015), in a constructionist environment "we build with things - not just ideas" (p. 286). To build an artifact, students start at the design, and they learn through the design process (Resnick, 1998). Resnick (1989) claimed that the designing of activities encourages students to be involved, share interdisciplinary knowledge, think in a variety of ways, and reflect while socially involved with others. These shared activities encourage people to learn (Walton, Childs, & Jugo, 2019).

While participating in constructionist activities, students' collaboration, engagement, and reflection leads to better learning and powerful thinking (Papavlasopoulou, Giannakos, & Jaccheri, 2019; Noss & Clayson, 2015; Resnick, 1998; Papert & Harel, 1991). When students reflect, the process of iteration, reflecting and debugging becomes an integral part of their building process (Noss & Clayson, 2015). In this student-centered approach, students not only learn by doing but they are involved in real world tasks, while improving their critical thinking skills (Cocciolo, 2011; Parmaxi et al., 2013; Papert, 1980; Sirisopon & Sopeerak, 2013). As students became the designers, and the teacher the facilitator, rubrics play a valuable role and are used in self-, peer-, and facilitator assessment (Ioannidou, Repenning, Lewis, Cherry & Rader, 2003).

Influenced by the thoughts of Papert, Jha (2012) claims that in today's world it is not about the accumulation of information or other people's ideas, but about finding your own voice and exchanging it with oth-

ers. Finding your own voice could be a time-consuming process. When designing for a constructionist approach, teachers should bear in mind that for students to be invested and involved in an activity, sufficient time needs to be made available (Papavlasopoulou et al., 2019; Papert, 1980).

Blended and E-learning

Blended learning, also called hybrid learning, refers to the combination of face-to-face classes and e-learning (Picciano, Dziuban & Graham, 2014). Research has shown that blended learning has a positive effect on learning and teaching.

Many benefits of blended learning have been reported. For example, students appreciate the flexibility to learn anywhere or anytime (Smyth, Houghton, Cooney, & Casey, 2012). Additionally, students experience that in a blended learning environment, they are more focused, self-driven, receiving quicker feedback from the teacher and are more prepared for the future, than during traditional learning (Giarla, 2020). Not only do examination results improve, but students have a better understanding of their learning materials (Bawaneh, 2011; Delaney, McManus, & Ng, 2010; Hiralaal, 2012).

Classrooms are not the only learning space anymore (Milne, 2006). The omnipresence of digital technology and mobile devices makes it possible for students to learn anywhere, anytime. Although Giarla (2020) emphasized the heavy investment on infrastructure, technology creates multiple opportunities in a blended learning class. For example, learning can occur out of sequence, and social interaction is possible without being in the same space at the same time. Students can construct their own content through videos, animations, and presentation (Milne, 2006). Additionally, this access to technology has made other practices such as the flipped classroom possible.

The flipped classroom model is used to create a more flexible, active and student-centred learning. In this model, students prepare for the class (usually through augmented e-learning activities) and the discussion, interactions, relations to real world examples, are then discussed in class. In doing so, students come prepared and ready to engage and ask questions (Nouri, 2016). In other words, the lower cognitive work is done at home, while in class where they have their peers and facilitator, the focus is on the higher order forms of cognitive work (Brame, 2013).

Methodology

This research study was exploratory in nature, and the design in line with a qualitative case study. The students' feedback was part of the evaluation done at the end of the e-learning module.

Participants

Twenty-nine students enrolled in a *Computers for e-learning* module as part of the Postgraduate Certificate in Higher Education (PGCHE) at the University of Pretoria. The students came from diverse backgrounds but all of them were either teaching or training at the University, other educational institutions, or private companies. All the students (n=29) completed the module and the survey.

The Constructionist E-learning Class and the Research Design

To prepare students to be able to create their own e-learning content, a constructionist approach was adopted, with a strong focus on the use of a range of technologies. The learning designers agree with Noss & Clayson (2015), who recommend that what you do in an environment can be used in designing the very same environment. With this in mind, the module was created in a blended learning environment where students attended evening classes of three hours at a time, every second week. They had four face-to-face contact sessions with one final evening class to present what they had created (a website) during the semester. This was their final assessment. In addition to the face-to-face classes, a virtual classroom was created on the learning management system (Blackboard), where all the readings, videos, and activities were uploaded. The weekly sessions were structured according to the flipped classroom principle. In this flipped classroom, students had reading material to complete before the class and then the contact session was structured around group and individual activities, which were either peer-, self-, computer- or facilitator-assessed. During the sessions, students experienced a variety of educational technology that encouraged engagement and led to the creation of animated videos, presentations, games, applications, and customized learning units. At the end of each week, they reflected on what they had learned, achieved, or struggled with. The start of the next session was used to present their artifacts and receive feedback so that they could improve and adapt their artifacts for their final assessment. The final assessment (creation of a website) was on a topic of their choice. At the end of the module, students completed an online survey with 18 open-ended questions on a variety of aspects of the module, such as the design, the presentation, the tools used, and peer interaction.

Data analysis

Deductive content analysis (Elo & Kyngäs, 2008) was used to analyse the survey data, focussing on the research question, while reading the responses to identify common keywords that relate to the themes, recurring patterns, and/or related themes. To triangulate data, the participants' weekly reflections were used. Pseudocode was used to mark the participant's responses where [P2], for example, means participant 2.

Results and Discussion

To answer the question "*How do students experience a constructionist e-learning class*?" the survey results are discussed according to three themes, namely the design of the module, presentation and teaching strategies, and the role of student peers while participating in the module.

Design of the Module

Participants used 41 keywords to describe their experience about the design of the module, and 83% of the response keywords indicated that they had a positive experience. *Good, well thought through, interesting, interactive,* and *fun* were some of the words used to describe the experience. Participants also mentioned that the short activities, rubrics, and reading lists were useful.

Conversely, 17% of the response keywords indicated a negative experience in relation to the design of the module. The main reason given for this related to a perceived overload of the module. Participants reiterated that there were too many activities, their workload was not taken into consideration, and the time reserved for weekly activities was too conservative. Because of the lack of time, participants expressed feelings like being *confused*, *frustrated,* and *pressurized,* while they suggested that the weekly quizzes should be removed, activities reduced, and the time allocated to the activities revised.

In addition to the overall positive experience in terms of the design of the module, participants expressed their appreciation for the constructionist approach. They liked that they were challenged, that the activities were organized into weekly activities and each activity that they completed was a building block for their final assessment, their creativity was stimulated, and that the work was practical and related to what they were teaching in their own practices. When they accomplished their tasks, they felt empowered and amazed that they got it right. As a bonus, skills that were learned in one activity could be transferred when attempting another. These qualities relate to the 21st century skills students so des-

perately need to survive in the world of work. As one participant stated, *"you get to create your own applications in your own style"* [P14].

Presentation and teaching strategies of the module

The participant experience of this constructionist blended learning module was viewed as overwhelmingly positive. From the 86 keywords used to describe their experience in relation with the presentation and teaching strategies of the module, 84% relate to a positive experience. A summary of participant feedback with regards to the presentation and teaching strategies is given in Table 1 below.

Table 1

Feedback with Regards to Presentation and Teaching Strategies

Category	Participant Experience
Presentation in general	• The module was well presented, well planned, clear and easy to understand.
Presentation of content	• Content was released just in time but early enough. • The reading list provide the information they needed.
Blended learning	• Combination of the face-to-face class and the online activities resulted in positive experience. • Blended learning contributed positively to their learning experience. • Both face-to-face and online activities were engaging and interactive.
Constructionism	• Although the constructionist approach was different or not their style, they did mention that after the initial confusion they adapted and were able to complete the module with a sense of accomplishment.
Assessment	• Rubrics guided them to understand what was expected to do.
Peer interaction	• The peer interaction was valuable and the group work was not daunting.

Not surprisingly, some participants did express their concern about the lack of traditional teaching. They felt lost, needed more guidance, and saw the content as too much. These participants perceived this constructionist approach as the lack of teaching, and that they were responsible to teach themselves. The following quote from a participant expresses what they collectively felt: "*… a bit vague, I felt we had to do almost all the work ourselves* ..." [P12].

In contrast, one participant saw the lack of teaching as an advantage. Because lesser teaching took place and lesser guidance was given, students had creative freedom, could progress and experiment, and could apply what they had learned. This aligned with one of the outcomes of

the module: students becoming independent lifelong learners.
With regard to the teaching strategy followed, participants strongly felt that it influenced their attitude. From their feedback, they stated that the teaching strategies kept them motivated and inspired to learn and use technology. In addition, their ideas about ways of teaching were challenged to change. They commented on how they valued working with and learning from their peers as this excerpt demonstrates:

"*I appreciate group learning more, especially in the context of peers teaching topics to each other*" [P24].

Role of the Peers

With regards to their peers' attitudes influencing their own experience in the module, a minority of the participants (31%) indicated that others did not influence their attitudes. However, the remaining participants (69%) suggested that others did influence their experience of the module. Only two participants from this cohort indicated that their peers' attitudes had a negative influence on their experience, while the rest welcomed the support of peers. They indicated that when working with peers, they learned more, were able to share information, and found the interactions helpful. One participant mentioned, "*I honestly do not think I could have made it without them*" [P9].

While the participants experienced the activities in a fun and positive way, they emphasized appreciation that their peers helped them when they were stuck and having someone whom they could learn from and share information with. The participants described a feeling of group cohesion, which was manifested in being motivated and encouraged to keep on participating. As one participant mentioned "*[my peers]motivate me to know that it's possible, I can also do it*" [P13].

Although participants viewed the module positively, some demonstrated resistance to change initially (14%). In spite of initial reluctance, all participants indicated that after this blended learning constructionist module on e-learning, they are more inclined to implement e-learning in their teaching practice. They were proud of the new skills they acquired and wanted to use them to make classes more engaging and enjoyable for their students. As one participant mentioned, "*The course has forced me to rethink the way I do things in and out of the classroom*" [P19]. They valued what they had learned and were very excited to implement what they had learned. As one student mentioned:
"*I have already started implementing the things I have learned*" [P12].

Conclusion

The quest for change in education, the digital revolution, and the lack of 21st century skills of many graduates, gave birth to this attempt to change the status quo of teaching an e-learning module. A constructionist approach was followed to give students an opportunity to combine what they already knew with newly acquired knowledge so that they could construct and implement a teaching module in a real-life context. The classes were structured around a final artefact (website) that they had to develop.

During the analysis of the data I realized that we, as learning designers, need to be more sensitive to time issues when designing in a constructionist way. Background knowledge, speed, and comprehension differ from student to student. This is also confirmed with what Papavlasopoulou et al. (2019) found: that enough time needs to be given to students when participating in constructionist activities.

The students experienced the design and teaching strategies as positive, engaging, and contributing to their learning. They expressed their appreciation of their peers both in positively influencing their attitude and participation in the module.

While participating in the construction of knowledge and artifacts, the interaction between peer, individual and facilitator became visible. Participants felt confident when the facilitator is available, they could get help from their peers and had the chance to work individually, all while building their artifacts. Confirming what Carruthers (2018) found, this interdependent relationship created opportunity for them to develop their communication, creativity, problem solving and critical thinking skills.

References

Abramovici, M., Göbel, J. C., & Neges, M. (2015). Smart engineering as enabler for the 4th Industrial Revolution. In M. Fathi (Ed.), *Integrated systems: Innovations and applications (pp.* 163-170). Switzerland: Springer.

Bates, A. W. (2019). *Teaching in a digital age*. Open Textbook. Retrieved from https://opentextbc.ca/teachinginadigitalage/

Bawaneh, S. S. (2011). The effects of blended learning approach on students' performance: Evidence from a computerized accounting course. *Interdisciplinary Journal of Research in Business, 1*(4), 43-50.

Brame, C., (2013). *Flipping the classroom*. Vanderbilt University Center for Teaching. Retrieved from http://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom/

Carruthers, H. (2018, August 13). Education in the fourth industrial revolution. In Relocate Global (Ed.), *International Guide to Education & Schools*. Kent, England: Relocate Global. Retrieved from https://www.relocatemagazine.com/articles/education-schools-relocate-global-international-guide-education-in-the-fourth-industrial-revolution

Cocciolo, A. (2011). Situating student learning in rich contexts: A constructionist approach to digital archives education. *Evidence Based Library and Information Practice, 6*(3), 4-15.

Davis, N. (2019, May 1). How will education change in the next ten years? *International Policy Digest*. Retrieved from https://intpolicydigest.org/2019/05/01/how-will-education-change-in-the-next-ten-years/

Delaney, D., McManus, L. & Ng, C. (2010). A blended learning approach to teaching first year accounting. In L. G. Chova, D. M. Belenguer, & I. C. Torres, Proceedings of the *International Conference of Education, Research and Innovation 2010 Conference* (ICERI2010) (pp. 4019-4026). Madrid, Spain: International Association of Technology, Education and Development (IATED)

Elo, S., & Kygäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing, 62*(1), 107-115.

Francis, J. (2018, August 21). How schools can drive change in education. *Business Technology Media Company TechForum.* Retrieved from https://www.itweb.co.za/content/LPwQ57lyapwMNgkj

Giarla, A., (2020). *The benefits of blended learning*. Retrieved from https://www.teachthought.com/technology/the-benefits-of-blended-learning/

Hiralaal, A. (2012). Students' experiences of blended learning in accounting education at the Durban University of Technology. *South African Journal of Higher Education*, *26*(2), 316-328.

Ioannidou, A., Repenning, A., Lewis, C., Cherry, G., & Rader, C. (2003). Making constructionism work in the classroom. *International Journal of Computers for Mathematical Learning, 8*(1), 68-108.

Jha, A. K. (2012). Epistemological and pedagogical concerns of constructionism: Relating to the educational practices. *Creative Education*, *3*(2), 171-178.

Kang, S-Y. (2018, September 18). How technology can bridge the skills gap it created. *World economic forum on ASEAN 2018.* Retrieved from https://www.weforum.org/agenda/2018/09/how-smartphones-can-close-the-global-skills-gap-for-billions/

Martin, J. (2018, June 26). *Learning in the fourth industrial revolution*. BBN Times. Retrieved from https://www.bbntimes.com/society/learning-in-the-fourth-industrial-revolution.

Milne, A. J. (2006). *Designing blended learning space to the student experience*. In D. Oblinger, (Ed.), *Learning Spaces* (pp. 11.1-11.15). Educause. Retrieved from https://www.educause.edu/ir/library/pdf/PUB7102k.pdf

Moodley, P., & Singh, R. J. (2015). Addressing student dropout rates at South African universities. *Alternation Special Edition*, *17*, 91-115.

Noss, R., & Clayson, J. (2015). Reconstructing constructionism. *Constructivist Foundations, 10*(3), 285-288.

Nouri, J. (2016). The flipped classroom: For active, effective and increased learning – especially for low achievers. *International Journal of Educational Technology in Higher Education, 13*, 33. https://doi.org/10.1186/s41239-016-0032-z

Papavlasopoulou, S., Giannakos, M. N., & Jaccheri, L. (2019). Exploring children's learning experience in constructionism-based coding activities through design-based research. *Computers in Human Behavior, 99*, 415–427.

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

Papert, S., & Harel, I. (1991). Situating constructionism. *Constructionism*, *36*(2), 1-11.

Parmaxi, A., Zaphiris, P., Michailidou, E., Papadima-Sophocleous, S., & Ioannou, A. (2013). Introducing new perspectives in the use of social technologies in learning: Social constructionism. In P. Kotzé, G. Marsden, & G. Lindgaard (Eds.), *Interact* 2013, Part II, LNCS 8118 (pp. 554–570).

Picciano, A. G., Dziuban, C. D., & Graham, C.R. (Eds.). (2014). *Blended learning: Research Perspectives Volume 2*. New York: Routledge.

Resnick, M. (1998). Technologies for lifelong kindergarten. *Educational Technology Research and Development*, *46*(4), 43-55.

Rose, A. (2018, May 18). *The fourth industrial revolution*. CadM. Retrieved from https://www.cadm.com/the-fourth-industrial-revolution/

Sirisopon, N., & Sopeerak, S. (2013). Web-based instruction model under constructionism for critical thinking development. *Procedia - Social and Behavioral Sciences, 103*, 1309-1318.

Smyth, S., Houghton, C., Cooney, A., & Casey, D. (2010). Students' experience of blended learning across a range of postgraduate programmes. *Nurse Education Today, 32*(4), 464-468.

Walton, G., Childs, M., & Jugo, G. (2019). The creation of digital artefacts as a mechanism to engage students in studying literature. *British Journal of Educational Technology, 50*(3), 1060-1086.

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TEXT PRODUCTION IN L2: THE INFLUENCE OF HYBRID DIGITAL MEDIA IN ARGUMENTATIVE CONSTRUCTION IN SPANISH

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Abstract

This paper aims to study the means by which text production in second language (L2) can take place after the cyber revolution. The study of Spanish, official language of the Southern Common Market (Mercosur), is a foreign language for L2 students in Brazil. Previous research has found that textual productions break down linguistic and cultural barriers, suggesting that traditional methodologies be reconfigured. Therefore, a 20-hour Spanish course based on discussions via a Whatsapp® group was developed for undergraduate students at the Federal University of São Paulo, in São José dos Campos, Brazil. Comparing the activities used, including traditional face-to-face classroom sessions as well as asynchronous Whatsapp conversations, it was observed that the Whatsapp activity encouraged the students to use more organic and cohesive written argumentation in their study of a second language, Spanish.

Introduction

In the educational area, the school institution has undergone a transfiguration of its traditionally knowledge-centering character and, with the advancement of new technologies, it has become an increasingly supportive role in the (re) construction of information and communication theories (Kellner & Share, 2007). It has initiated a more organic process that advocates independence: the hybridization of communication.

The categories of verbal and non-verbal texts have undergone an increase in categories never once imagined. Gifs, emoticons, stickers, memes, audio messages, stories, and so many other resources have started to promote a more intense flow of information, closer to the globalizing ideal predicted by the communication theorists of the 20th century (Kellner & Share, 2007).

During this organic informational connection, there has been a sharp rupture in what was considered a major obstacle to universal communication: the Babylonian myth of languages.

Multiple and simultaneous translation software has already met the demand for increasingly accurate and effective communication. In seconds, an academic article can be translated, by Google Translator, into more than 300 languages (Kellner & Share, 2007). However, it is known that such systems do not integrate the context necessary to understand more complex communications, such as cultural and religious differences - often ignored by algorithms that are not sensitive to these nuances. Based on this information, it becomes necessary to reflect on the vastness of the Internet and to consider how to apply its resources more effectively in the classroom - in particular, analyzing the influence of this cultural hybridity on the identity formation of a people whose language permeates the robustness of translation algorithms.

Experiences in Brazil

In Brazil, it is estimated that more than 80% of the population have a cell phone with an internet connection (BNIC, 2018). On average, each Brazilian spends 5-6 hours per day on social networks, such as Whatsapp® and Facebook (BNIC, 2018).

According to Kellner & Share (2007), this technological boom has made possible the use of more instantaneous research tools by communities from the vast and different regions of the country, breaking the idea of geographic archipelagos. In public schools, it is estimated that more that 85% of students use the cell phone practically every day, the use of social networks being their main activity (Brazilian Network Information Center (BNIC), 2018).

The Use of 'Internet(ese)' in the Classroom

Textual production has undergone significant changes (BNIC, 2018). Instant reading, promoted by the intensity of short dialogues with little structural complexity, started to guide students in their identity construction, in the classroom.

According to López García (2005), in addition to the precariousness of cohesive resources necessary for effective textual communication, the texts that have been produced lack reliable sources of information, being, several times, carried away by the inconsistency of fake news (Araújo & Costa, 2007).

A research study completed in a college in São Paulo (BNIC, 2018) led to the conclusion that many students do not yet have the mastery of using technologies in their teaching-learning process, eventually promoting a

contrary movement to what was expected to be experienced: a digital alienation (Araújo & Costa, 2007).

Spanish as a Foreign Language in the Brazilian Context

By law, Spanish must be offered in the school curriculum as a component of curriculum enrichment (Barbosa-Paiva, 2010). In Brazil, in this context, since the government became invested in Spanish-language instruction for economic reasons, this need has increased based upon Brazil's social, economic, and political reality regarding South America.

As a member of the Southern Common Market "Mercosur" (Barbosa-Paiva, 2010), the country started to give indications that the Spanish language would have more significant space in the process of formation and placement in the labor market of its population. Since 2009, Enem, the National High School Exam, has considered the Spanish language as a foreign language option to be evaluated. In addition, several *stricto sensu* graduate programs require proficiency in English or Spanish as a prerequisite for admission (Araújo & Costa, 2007).

Regarding Hispanic culture in Brazil, it can be said that the telecommunications media are responsible for sharing cultures from other Spanish-speaking countries in Brazilian territory, such as "consecrated" soap operas and Caribbean rhythms, a process influenced by hybrid digital media (Barbosa-Paiva, 2012). Acquisition of Spanish can therefore aid Brazilians in participating in these Spanish-speaking cultures.

Textual Production in L2: Possible Interventions

As a way to influence the conscious use of communicational tools of digital hybridism in Spanish language text production, considering its relevance to Brazilian reality, a short course was proposed as part of the Universade Federal de São Paulo (UNIFESP) Languages project - São José dos Campos. It was aimed at internal undergraduate and graduate students, as well as students from the external community.
Entitled *Español Académico*, the course was organized in weekly one-hour meetings for an initial group of 18 students (16 interns and two externals, with Brazilian Portuguese as a mother tongue). Having as selection criteria the availability of time and the proof of level B1 of proficiency in Spanish, the course had as its main objective to promote written practice in Spanish in discussion groups using Whatsapp®.

Course Structure

Each week (20 in total), the group, guided by the teacher-conductor, discussed current social topics in person, such as news inside and outside

the University. Under the socio-constructivist approach, students had the opportunity to verify the veracity of the information in the selected news through their own cell phones (Internet), seeking to analyze the context in which such texts were transmitted.

The discussion system was based on the following structure:

- title of the news story;
- listed problems for discussion;
- building hypotheses;
- use of connectors necessary for argumentation, such as conjunctions;
- raising complementary questions in class;
- discussion via Whatsapp® group after the face-to-face class in a mixed way (asynchronous and synchronous);
- sharing links to other sources of information; and
- final check, in the classroom, of the sources used and the knowledge built by the group (see Figure 1 for an example of such messages).

Figure 1. Final Schedule – oral presentation and discussions through Whatsapp® group.

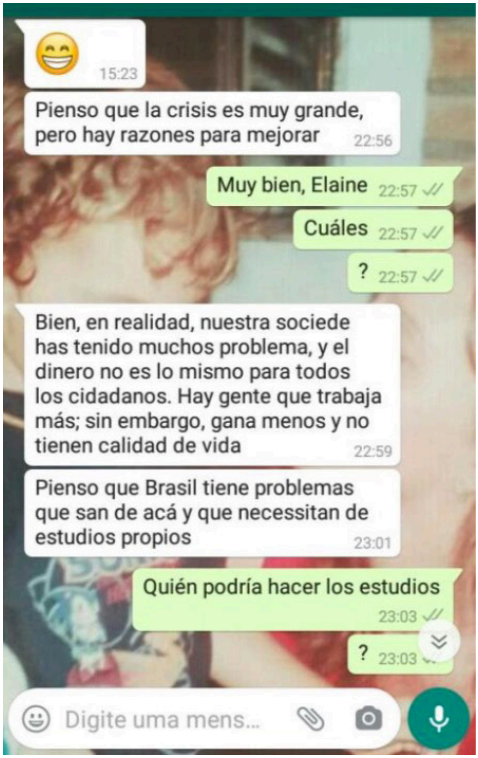

Figure 2. Discussion on specific topics – focus on argumentative structure.

Responses to Attempts at Argumentation by Digital Hybridity

The group of 18 students, during the proposed activities, showed a certain mastery in the construction of their argumentation by using common connectors for instantaneous argumentation:

- About 80% of students used arguments of authority in their texts, the result of research complementary to the information brought by the news discussed;
- The connectors that had the highest incidence in their productions were: *mas*, *así, sin embargo,* and *además*;
- During classroom discussions, students used a blend of oral and written speech to build their arguments;
- In the Whatsapp® group that followed the face-to-face discussions, there was a more active contribution to the proposed discussions. It was necessary for each member to formulate, through typed text, their considerations, and each student had to contribute (see Figure 2); and
- The use of 'internetese' was also observed, such as abbreviations / contractions (*para* > *pa*) and acronyms, in Spanish.

Written practice occurred throughout the process, but more precisely during group discussions. In addition to the typed texts, the students used, in their arguments, other visual resources, such as Gifs and stickers, based on metonymies and metaphors that were not felt with the same precision by the texts written in the classroom. (See Figure 3 for an example of a Gif and a meme).

With this use, the group still managed to know and recognize idioms and characteristics from the mainstream culture of different Spanish-speaking countries through memes, enabling the construction of a richer repertoire when it comes to argumentative hypertextualization. Deviations from the standard grammar were observed, but in small quantities and, whenever detected by the group administrator teacher, there was instructor intervention within the Whatsapp conversation by simply providing a correction (without an explanation). These interventions were sometimes then discussed during the following face-to-face class sessions.

Digital hybridity, previously considered as a disastrous influence regarding textual production in L2 (Barbosa-Paiva, 2010), started to occupy an essential space for the students themselves to perceive the linguistic mechanisms in other languages, in a more dynamic way and closer to

their communicational reality (see Figure 4).

Figure 3. Example of memes applied to the conversation so that students could practice the understanding of metaphors

Final Considerations

Based on the reported experience, it can be said that the fruitful relationship between technological tools and language learning for specific purposes is possible. Through the socio-constructivist approach and the use of digital resources, the much-feared influence of hybrid digital systems on written production in L2 can bring satisfactory and even positive results, such as greater understanding of the reality in which the language is inserted, its nuances and its organicity, often invisible to translation/software algorithms. Therefore, through the use of digital hybrid systems, students built a more effective, organic process with which they could experience significant conversation. They were free to utilize not only words but also their own realities and previous experiences with tech-

nology to enrich their interactions and increase their engagement with language learning, more specifically with writing in a second language.

References

Araújo, J. C., & Costa, N. (2007). Momentos interativos de um chat aberto: A composição do gênero. In J.C. Araújo (Ed.), *Internet & ensino: novos gêneros, outros desafios* (pp. 21-34). Rio de Janeiro: Lucerna.

Barbosa-Paiva, C. L. (2010). *Estratégias de construção textual do chat escrito em espanhol como língua estrangeira*. 238 f. Dissertação (Mestrado em Linguística e Língua Portuguesa) - Faculdade de Ciências e Letras, Universidade Estadual Paulista Júlio de Mesquita Filho, Araraquara.

Barbosa-Paiva, C. L. (2012). A correção como procedimento de reformulação em chat educacional escrito em espanhol por brasileiros: Tipos de operacionalização e marcas. Trabalhos em Linguística Aplicada, 51(1), 119-151. Retrieved from https://doi.org/10.1590/S0103-18132012000100007

Brazilian Network Information Center (BNIC) (Ed.) (2018). *Survey on the use of information and communication technologies in Brazilian schools*: ICT in education 2017. Núcleo de Informação e Coordenação do Ponto BR, (Ed.). São Paulo: Brazilian Internet Steering Committee. Retrieved from https://www.cgi.br/media/docs/publicacoes/2/tic_edu_2017_livro_eletronico.pdf

Kellner, D., & Share, J. (2007). *Critical media literacy, democracy, and the reconstruction of education*. In D. Macedo & S.R. Steinberg (Eds.), Media literacy: A reader (pp. 3-23). New York: Peter Lang Publishing.

López García, G. (2005). *Modelos de comunicación en Internet*. Valencia: Tirant Lo Blanch.

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STUDENT TEACHERS´ EXPERIENCES OF AN IMMERSIVE VIRTUAL REALITY BULLYING SIMULATION

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Abstract

In this study, 19 student teachers (of years 7-12) experienced a three-minute long VR simulation offering a first-person perspective of bullying by multiple 'classmates'. Their experiences were observed and afterwards five focus group interviews were conducted, with 3-4 student teachers per group. The results show that they experienced the VR simulation as immersive, albeit to varying degrees depending on their previous experiences and personality traits. Issues related to what they experienced, learned and reflected on, their thoughts about the potential educational uses of VR, and the challenges and opportunities with using VR in different subjects are discussed.

Introduction and Research Questions

As the use of head mounted displays (HMDs) for experiencing virtual realities (VR) has become more affordable, immersive, and easier to use, explorations of the advantages and disadvantages of VR simulations in K-12 schools and teacher education have been initiated (cf. Fransson, Holmberg, & Westelius, 2020; Billingsley, Smith, Smith, & Merrit, 2019). This paper reports the findings from such a research initiative involving student teachers in teacher education. The following research questions are posed:

> **Research Question 1:** How do the student teachers experience an immersive Virtual Reality (VR) bullying simulation, and how can these experiences be understood?
>
> **Research question 2:** Based on their VR bullying experiences, what kinds of opportunities and challenges do the student teachers identify in the use of immersive VR technologies and simulations in K-12 educational settings?

Research Overview

The use of HMDs has contributed to an increase in the immersive dimension of VR simulations (Lorenzo, Lledó, Arráez-Vera1, & Lorenzo-Lledó,

2019). Here, *immersive* draws attention to the phenomenon of "a perception of being physically present in a non-physical world by surrounding the user of the VR system created with images, sound, or other stimuli" (Freina & Ott, 2015, p 134.). However, the quality of the technology and the VR simulation can influence the immersive feeling negatively (Jensen & Konradsen, 2018). Other issues that may influence the immersive experience are physical reactions like dizziness or what is called 'cyber sickness', i.e. headaches and nausea resulting from a mismatch of the sensory systems (Kawai & Häkkinen, 2019).

The potential of using VR in educational settings has been researched and many of its benefits have been highlighted. However, the benefits need to relate to a specific context and be evaluated accordingly. For instance, regarding the advantages of using VR in teaching and learning, Häfner, Dücker, Schlatt, & Ovtcharova (2018) identified the following seven categories : (1) enhanced motivation, (2) communication and evaluation becoming more effective, (3) a better understanding of complex phenomena that can be visualised or repeatedly trained, (4) adaptability and flexibility to individual needs, for instance visualised processes can be slowed down or additional information can be added, (5) an increase in safety and health aspects when dangerous tasks are simulated instead of experienced in reality, (6) the environmental friendliness of simulations, e.g. reduction of material consumption and (7) a focus on the time and cost effectiveness for certain kinds of training and on a shorter preparation and debriefing time (Häfner, Dücker, Schlatt, & Ovtcharova, 2018, p. 105).

With regard to teacher education and the use of VR simulations, a research overview by Billingsley et al. (2019) identified eight empirical articles focusing on immersive VR in pre-service and in-service teacher education. One of the uses and benefits that was identified was that when student teachers practised how to instruct pupils and manage their behaviour, opportunities for multiple risk-free rehearsals emerged. For instance, learning about dyslexia through a VR simulation as opposed to simply watching a video greatly improved the students' awareness of the cognitive experiences of pupils with dyslexia (Passig, 2011). However, the research overview observed that in some articles it was not clear what kind of technology was used (for example HMDs) to achieve what was described as immersive virtual reality.

Stavroulia et al. (2019) explored a VR simulation with student teachers in which they viewed an animated situation of a teenager experiencing a so-called "bad trip" when taking drugs with a friend. In the scenario,

the drug user also tried to convince his friend to use drugs. In this VR simulation, the student teachers were able to view the scene from three different perspectives – the drug user's, the friend's, and a teacher perspective. Their heart rates and EEGs were measured and indicated that the student teachers became stressed and reacted emotionally. However, in the article there is no indication that this VR event was used as a starting point for discussing, for instance, different perspectives on drug use or how the teachers might have reacted in this situation.

In another study, Stavroulia et al. (2016) explored an animated VR simulation aimed at training teachers to identify bullying activities. It was found that most of the teachers failed to recognise every bullying behaviour that was shown. The possible reasons for this outcome were unfamiliarity with navigating and interpreting this kind of animated virtual scenario or that the student teachers' awareness of signs of bullying was very limited. Again, in the study there was no indication that this VR simulation was used as a starting point for discussing how the teachers might have reacted in this situation.

The research on immersive VR simulations in teacher education indicated above was mainly based on animated VR simulations. But what happens when the VR event is not animated, but more realistic and based on a 360°-filmed classroom situation with teenagers acting in a bullying situation? That is the kind of VR simulation for teacher training purposes that is the focus of this study.

Method

The empirical data for this study consists of interviews with student teachers. Nineteen student teachers aiming at a teaching certificate for years 7-12 studied a course in their teacher education programme on leadership and values. In the course, issues related to bullying were presented and in order to give them a first-hand experience of a bullying situation, the student teachers were offered a three-minute long, first-person VR bullying simulation involving multiple 'classmates' (Swedish Educational Broadcasting Company, 2016). The VR simulation was based on a 360°-filmed classroom situation with teenagers acting as bullies. The student teachers were seated and unable to interact with others in the setting, although they were able to look around and see different parts of the classroom and different students talking to or gesturing at them. The students experienced the VR simulation with head mounted displays (HMDs) and headphones individually in groups of four to six students to which they were randomly assigned.

The student teachers were briefly told about the content, a bullying situation, how long it would last, and that if they wished they could decide not to enter the VR simulation. For ethical reasons they were also told that they could stop the 'film' or take the HMD or headphones off if they found the experience too uncomfortable. None of the student teachers did that.

Their experiences were observed and after the session five focus group interviews were carried out with three to four student teachers in each group. The interviews were semi-structured and focused on how they experienced the VR simulation and their views of the opportunities, challenges, and pedagogical potential with this technology in K-12 schools and teacher education. The interviews lasted between 22-32 minutes and were transcribed and analysed with the aid of NVivo 11®. The interview quotes used in the paper have been translated from Swedish by the authors and have been *slightly* corrected to provide more accurate written language, given that spoken language can be fragmentary and appear less cohesive when put into writing.

Results

In this section the results are presented and organised in relation to the two research questions.

Research Question 1. How do the student teachers experience the immersive Virtual Reality (VR) bullying simulation and how can these experiences be understood?

Every student teacher described that the use of VR provided an immersive experience in some way, for example that it: "felt real", "was immersive", "scary" or "provided a sense of presence". However, as we further discuss, the feeling of immersion varied and was not always apparent:

- But it feels more as if you are…, *in it* than watching a regular video. [Group 1: Male]
- ery clear that we were there [in the classroom]. Compared to looking at it on a screen. And I felt, as you said, that I kind of wanted to speak up and get up. I was sort of: "But what are you doing?" I could not…I mean I felt so exposed. I understood that it wasn't real, but I really felt: "Why are you doing this?" So I think it was very [true to life]…. [Group 4: Female]

The experience of the bullying situation may have been reinforced by the fact that the VR simulation was not interactive, in that the student

teachers could not interact with the VR environment by talking, moving, or protecting themselves. This seems to have reinforced the feeling of helplessness as a bullied victim for some of the student teachers:

- The feeling that you really can't do anything but are stuck in the situation, that's something you can only get with VR. I mean, I wouldn't have the same feeling if I was watching it on a large screen with good quality sound or something, but I really need to feel that I am exposed. In that way I can have some idea of what it really feels like, and experience that feeling of freezing up, that you can't do anything and are pretty helpless. I don't think you'd get the same effect if you just made a video. [Group 2: Woman]
- I think it was really scary. I had no problem identifying myself as that person at all. I thought it was really awful. [Group 5: Woman]

The use of VR technology contributed to feelings of immersion, although the individual user's characteristics also influenced the student teachers' reactions to the bullying simulation. Having a real immersive experience and a feeling of 'being in' the situation and experiencing it seemed to be a matter of mindset, previous experiences, and being able to identify with the VR simulation. Two of the student teachers highlighted this by commenting that the feeling of immersion depended on the extent to which they were able, willing, or prepared to *accept the lie* (i.e. of being a victim of bullying in a classroom):

- It feels a bit as though it's about whether you buy the lie or not… The lie that: "I'm the one experiencing this"…. I found it difficult to imagine that I was being bullied. To me it felt more as though I was being roasted by little kids, and that I wasn't really affected by what they said (laughs). It all felt a bit comical to me, but I have never been bullied, so I guess that's why. [Group 1: Male]

The statement above, about not being able to take the experience seriously, was reinforced by the fact that he was observed giggling and smiling during the VR experience. Another factor may have been that this male student was tall and not used to others looking down on him. Another male student expressed similar challenges to identifying with the situation as he himself had never been in that situation or experienced it as part of his daily life:

- Partly because I have never been exposed to such situations, and I would never treat anyone like that either. So, but I mean who do you

think you are who can treat someone in that way…I think that's it, it's not something I'm used to. [Group 3: Male]

It also seemed to be a matter of being in the right mindset prior to and during the VR event in order to take it seriously:

- I think that it comes down to your approach to the situation. Do I want to identify with it? Or don't I? Do I try to distance myself? (Group 5: Female)
- I went in thinking: "I'm now going to experience being the bullied student", so I identified with [the situation] and that's probably why it felt more real for me. [Group 5: Female]

A lack of preparation or adjustments to the VR technology can prevent users from getting into the right mindset. This was mentioned by a student teacher who tried to change the focus on her HMD and another who started the VR simulation before the others. Another student teacher became annoyed about what he thought was "non-convincing acting" by some of the teenagers in the VR simulation:

- The focus wasn't great. I couldn't see clearly and tried to fix it and that might have contributed to making it harder to feel that: "this actually feels real". But of course, it still felt…distressing, but that it wasn't all that deep either. I have not been exposed to….experienced [bullying]. [Group 3: Female]

Learning about Being Bullied

The VR simulation seemed to give the student teachers more understanding at a deeper emotional level about what it felt like to be bullied:

- I experienced it as being quite uncomfortable but also educational. When I was the student who was exposed I felt slight discomfort but it was also educational because I've never been in that situation myself and exposed in that way. And even if I can feel empathy and sympathy for people who are exposed, it's not the same as having the experience yourself. [Group 4: Female]
- Just this about not, not having your back free. That feeling was hard, because as I described I thought, in comparison with my other experiences in life, that when I've been confronted with something I have always been able to react to it. To now become.., I so completely acted the part that I felt frozen, like a block of ice. And that was a completely new feeling for me in a situation like this. … I've never experienced anything like it before. So it was, it was pretty educational,

I think. To be able to feel, and see, that this is probably what many people who are exposed [to bullying] feel.. [Group 5: Female]

The VR simulation seemed to give the student teachers who had no previous experience of being bullied or seeing others being bullied new insights. Even for those who had experienced bullying, the VR simulation deepened their insights into the matter.

Two of the 19 student teachers shared that they had been bullied at school. One described this as being "just a little exposed", while the other seemed to have had a really difficult time. The VR simulation brought these earlier bullying experiences back to the following interviewee and helped her to be specific about what could be learned from a VR simulation like this:

- …as I'd already been exposed to it [bullying] I was thrown back into it, it's like …psychological processes. And…what you said about not being able to do anything about it, that's exactly the situation you're in. And that's what you don't get when watching a video. That feeling, it's *exactly* [student teacher's emphasis] that feeling that you can't access…which is why I think it was good [with the VR experience]. [Group 4: Female]

Research Question 2: Based on their VR bullying experiences, what do the students regard as the opportunities and challenges with using immersive VR technologies and simulations in K-12 educational settings?

When the students reflected on the pedagogical use of this VR bullying simulation in K-12 schools, they listed several challenges and opportunities. The challenges were related to a lack of technological VR hardware and software in the schools, a lack of financial resources, a fear that they would have to be expert 'ICT-technicians', and a lack of knowledge and time for finding and preparing suitable VR events that complemented their other content. Here, it was suggested that teachers would benefit from some kind of support in terms of a web-based platform and companies or ICT technicians that could find, evaluate, and list suitable VR simulations for them:

- So that it would be a VR classroom that you can just go into and pick themes like religion, history, or…, or other subjects and themes within subjects. That would be good. [Group 4: Female]

However, regarding teachers' digital competence, some of the student

teachers claimed that they already had a rather high level of digital competence so that they would be able to use VR technologies with very little need for professional development:

- We [student teachers] are probably already familiar with the digital world that the learning curve probably wouldn't be all that steep [if we wanted to use VR technologies]. [Group 1: Male]

Another challenge that the students mentioned was related to the immersive impact of the VR simulation and that it is not always possible to know how such simulations will impact pupils. Here, they stressed that teachers really had to know their pupils very well so that they did not initiate bad feelings or conflicts:

- We meet people in our work as teachers. And every person has a unique story…and history. I mean you don't know, and especially in this day and age, so I can imagine that, religion could raise, I mean it's loaded [as a subject]. It's not just…it's political as well, …I mean I see more advantages than disadvantages [with using VR] but I think that you have to be very selective when working with [VR]. [Group 4: Female]

When asked about their views about the potential pedagogical opportunities of using VR in their own teaching, the student teachers referred to the bullying simulation and how this could be used with their pupils when teaching ethics and values. Here, the pedagogical potential would be that the pupils have an opportunity to experience bullying in the classroom and make use of this shared experience in discussions. Moreover, the student teachers mentioned that, at least initially, the use of VR technology as a new and cutting-edge technology could interest the pupils and increase their motivation, especially if they were already interested in technology. Some of the student teachers went as far as to say that schools with this type of technology might even gain a reputation as being modern and attractive, which could lead to more pupils applying to such schools.

In addition, VR simulation were described as a potential substantial benefit for pupils with special needs who needed other ways of experiencing and learning than the more traditional methods. The opportunities for teachers to vary their teaching and use VR as a complement to other teaching materials and methods was also stressed.

The possibility for pupils to learn and remember "more" or "deeper" through the use of VR was also mentioned. Here, being able to see, visit and experience times and cultures that were unfamiliar was also highlighted. One example that was brought forward was women's rights and that VR could potentially be used to simulate the experience of being discriminated against:

- But if they were able to both read about it and see what society was like then, it might be easier for them [the pupils] to understand it. [Group 4: Female]

When the students reflected on the possible opportunities for teaching and learning based on the VR simulation they all gave examples related to their own subjects, such as using VR to practice debating, or explore historical situations or places of importance in the student teachers' own subjects. Many of the examples related to the potential of supporting memory retention and an increased understanding through VR simulations, such as experiencing Jesus' crucifixion on Golgotha:

- What a wonderful way of getting the pupils to remember things. I mean, when you experience something for yourself you don't forget it easily. But if I read something, I can forget it almost straight away, because I have no image of it maybe, or no experience. … but then imagine in religion for example being able to step into a situation, let's say the crucifixion of Jesus. If you are there on Golgotha when they drag him there and see. I mean, do you get it? It's… "wow". A pupil will never forget that. [Group 4: Female]
- Well I mean value-wise as well as subject-wise. Being able to imagine yourself in…different situations. Instead of just reading about World War II, you could show a short film about what it was really like during the war. I think that you'd be able to access reality in a different way. So, I also think that in terms of subject matter you could use VR. [Group 3: Male]

Many of the VR simulations that the student teachers reflected on as having potential and being desirable already existed. For instance, one student teacher imagined a situation in which pupils with speech difficulties could use VR to practice speaking in front of a 'VR-filmed' audience instead of their peers in a real-life situation. This VR-simulation already exists, as do VR simulations where you find yourself in the role of a soldier subjected to some of the horrors of war.

Discussion

In line with previous research (cf. Loup et al., 2016), most of the participating student teachers described in different ways how the VR simulation created feelings of engagement. They also expressed that engagement, as a motivational factor for increased task involvement, was a major part of the identified pedagogical potential of VR. However, we know that different factors affect students' feelings of immersion and engagement in VR (cf. Jensen & Konradsen, 2018). From a pedagogical standpoint, it is therefore important to understand more about these factors.

In this study some of the student teachers said that the use of VR gave them a sense of experiencing bullying (as opposed to simply reading about it), and that this gave them a deeper understanding of what it could mean to be bullied. However, the types of engagement and feelings amongst the student teachers varied. Factors that can influence people's sense of presence and immersion are their *personality traits and previous experience* (Janssen et al., 2016). In this study, the student teachers with personal experience of bullying became emotionally immersed in and were strongly affected by the experience, while others were less so. This study also shows how the actual VR situation can conflict with a person's self-view. In the described scenario the bullied VR user is sitting down passively with others towering over them physically. This could be a difficult scenario to 'accept' for those who see themselves as people of action, or for a very tall person such as one of the male student teachers.

Other factors that affected the student teachers' feelings of immersion and engagement were related to *the VR hardware*, in that some of them had difficulties adjusting the lenses of the VR headset, which resulted in blurred vision (see also Pan et al., 2016), *the environment 'outside' the VR-experience,* such as noises made by others that disturbed the feeling of being 'inside' the VR event, and *the quality of the VR simulation* if some of the actors were not completely convincing.

From this study, it is possible to conclude that VR simulations and the use of HMDs have a *potential* for teaching and learning. A similar conclusion is drawn in much of research on the advantages and disadvantages of different kinds of technology or methods. However, it is important to critically scrutinize *the extent to which* VR simulations really do contribute added pedagogical value in these studies. Even if the technology and the VR simulations exist, is it worth using them if the cost, time for finding and evaluating VR simulations, preparation time for charging and

updates, expected learning outcomes, and so on are too high or too much? These and other considerations need to be taken into account in order to find the *true* benefits of VR use in teaching and learning in K-12 schools and teacher education. In this study, the major added value of the bullying VR simulation would seem to be the strong emotions of a first-person bullying perspective, which in turn could provide new insights and understanding and be a shared point of reference in discussions about the possible effects of bullying and how it can be prevented.

References

Billingsley, G., Smith, S., Smith, S. & Meritt, J. (2019). A Systematic Literature Review of Using Immersive Virtual Reality Technology in Teacher Education. *Journal of Interactive Learning Research, 30*(1), 65–90.

Fransson, G., Holmberg, J. & Westelius, C. (2020). The challenges of using Head Mounted Virtual Reality in K-12 schools from a teacher perspective. *Education and Information Technologies*, *25*, 3383–3404. DOI: 10.1007/s10639-020-10119-1

Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education: State of the art and perspectives. *Proceedings of the 11th international scientific conference eLearning and software for education* (Vol. 1, pp. 133-141). Bucharest: Carol I NDU Publishing House. Retrieved from https://proceedings.elseconference.eu/index.php?r=site/index&year=2015.

Häfner, P., Dücker, J., Schlatt, C., & Ovtcharova, J. (2018). Decision support methods for using virtual reality in education based on a cost-benefit-analyses. In A. Bruzzone, E. Ginters, E. González Mendívil, J. M. Gutierrez, & F. Longo (Eds.), Proceedings of t*he 4th International Conference on Virtual and Augmented Reality in Education* (VARE 2018) (pp. 103-112). Budapest, Hungary: VARE 2018. Retrieved from http://www.msc-les.org/proceedings/vare/2018/VARE2018.pdf

Janssen, D., Tummel, C., Richert, A., & Isenhardt, I. (2016) Towards measuring user experience, activation and task performance in immersive virtual learning environments for students. In C. Allison, L. Mogado, J. Pirker, D. Beck, & J. Richter, J., & C. Gütl (Eds.), *Immersive Learning Research Network* (iLRN 2016, Communications in Computer and Information Science Vol. 621, pp. 45–58). New York: Springer, Cham. DOI: 10.1007/978-3-319-41769-1_4

Jensen, L., & Konradsen, F. (2018). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technologies, 23(4)*, 1515–1529. DOI: 10.1007/s10639-017-9676-0.

Kawai, T. & Häkkinen, J. (2019). Ergonomic guidance for virtual reality content creation. In: S. Bagnara, R. Tartaglia, S. Albolino, T. Alexan-

der, Y. Fujita (Eds.). Proceedings of the 20th Congress of the International Ergonomics Association (IEA 2018). IEA 2018. *Advances in Intelligent Systems and Computing*, Vol. X. (pp. 417–422). Springer Nature Switzerland. DOI: 10.1007/978-3-319-96059-3_47

Lorenzo, G., Lledó, A., Arráez-Vera, G., & Lorenzo-Lledó, A. (2019). The application of immersive virtual reality for students with ASD: A review between 1990-2017. *Education and Information Technology, 24*(1), 127–151. DOI: 10.1007/s10639-018-9766-7.

Loup, G., Serna, A., Iksal, S., & George, S. (2016) Immersion and persistence: Improving learners' engagement in authentic learning situations. In K. Verbert, M. Sharples, & T. Klobučar T. (Eds.), *Adaptive and Adaptable Learning - 11th European Conference on Technology Enhanced Learning* (EC-TEL 2016, Lecture Notes in Computer Science, Vol. 9891, pp. 410-415). New York: Springer Verlag. https://doi.org/10.1007/978-3-319-45153-4_35

Pan, X., Slater, M., Beacco, A., Navarro, X., Bellido Rivas, A. I., Swapp, D.,…& Delacroix, S. (2016). The responses of medical general practitioners to unreasonable patient demand for antibiotics - a study of medical ethics using immersive virtual reality. *Public Library of Science One* (PLoS One*), 11*(2): e0146837. DOI: 10.1371/journal.pone.0146837.

Passig, D. (2011). The impact of immersive virtual reality on educators' awareness of the cognitive experiences of pupils with dyslexia. *Teachers College Record*, *113*(1), 181–204.

Stavroulia, K. E., Christofi, M., Baka, E., Michael-Grigoriou, D., Magnenat-Thalmann, N. & Lanitis, A. (2019). Assessing the emotional impact of virtual reality-based teacher training. *The International Journal of Information and Learning Technology*, *36*(3), 192–217.

Stavroulia, K E., Ruiz-Harisiou, A., Manouchou,E., Georgiou, K., Sella, F. & Lanitis, A. (2016). A 3D virtual environment for training teachers to identify bullying. *Proceedings of the 18th Mediterranean Electrotechnical Conference* (MELECON, pp. 1-6). Limassol, Cyprus, 18-20 April 2016. DOI: 10.1109/MELCON.2016.7495417

Swedish Educational Broadcasting Company [UR]. (2016, April 5). *Mobbning i 360⁰*. [Bullying in *360⁰*] [Video file]. Retrieved from https://www.youtube.com/watch?v=Sxd2gTWUA_k&t=77s.

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PRODUCING DIGITAL STORIES FOR LANGUAGE LEARNING AND DIGITAL COMPETENCE

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Abstract

This study shows how a small project in an SFI (Swedish for Immigrants) classroom has the power to influence larger processes in unexpected ways if acknowledged and supported. It also shows how important it becomes to think about creative possibilities making use of existing resources, enhancing the possibility to be creative without additional resources, and identifying what resources to use in new ways and why. Collaborative research was the methodological approach and Activity Theory was used as the analytical framework, emphasizing transformative agency by double stimulation. Results suggest that digital stories triggered expansive learning for multiple actors and organizations.

Introduction

There is a strong need for methods to develop language learning and digital competence through all levels of education, also including adult immigrants. In Sweden, the responsible organization for such adult education is called Swedish For Immigrants (SFI), hosted in municipalities. The education is regulated by law, emphasizing that instruction should rest on scientific principles and proven experience. Everyone who works in SFI education should also promote respect for each person's self-esteem and respect for our common environment (Swedish Ministry of Education, 2010).

Previous research on SFI education highlights the central need for the second language learner to approach the new language by understanding its contextual frameworks and possibilities in different communication situations, not only being able to express themselves with linguistic correctness (Sheikhi, 2013; Rosén and Bagga-Gupta, 2013). However, it is still more common that SFI teaching is teacher controlled, suggesting that experience-based pedagogy would benefit SFI learners, particularly those studying with time constraints (Lundgren et al., 2017). This paper will report on an initiative incorporating these suggestions that also grew to touch wider processes in the municipality and answer the following

research question: How can identified needs for language learning and digital competence across ages, actors, and professions be captured as drivers for municipality development?

The starting point of this study was the increased discomfort of a teacher who, on a series of occasions, experienced that the adult students in her classes in Swedish for Immigrants (SFI) struggled with language learning due to the available material. She also felt that they were not being prepared for an increasingly digitalized work life. Despite her concerns, her students were quickly employed in the municipality, which had a high demand for labor in the service sector, thus interrupting their studies. Therefore, the timeframe for language learning kept shrinking and she really wanted to help out. Apart from being a language teacher in adult education for immigrants, she also held a position to support digital competence in preschools as well as other levels of education in the municipality. When listening to the preschool teachers mention their difficulties in using digital tools in a useful way and also on how to reach immigrant children, she realized she was educating the parents of the preschool teachers' pupils in her SFI classes. Bearing that in mind, she re-designed her approach and created a model of learning focused on individual production of digital stories to be presented by the SFI learners at preschools to create connections between SFI and preschools. Furthermore, she contacted a researcher engaged in collaborative research to create a learning process driven by the combination of practice and research. This paper will describe and analyze a specific effort to create innovative models to not only enhance language learning but also digital competence, which is emphasized in all levels in the Swedish educational system ranging from preschool to adult education, including SFI (Swedish National Agency for Education, 2020).

Theoretical Framework

As we were interested in change at multiple levels, acknowledging individuals as well as organizations, our study was grounded in the theoretical framework of Activity Theory. Activity Theory (AT) has been prolifically used in previous research linked to organizational development and change of practice. The theory itself has undergone changes and therefore includes different generations of AT (Engeström, 2001), moving from a single view on activity systems towards a multiple view regarding interlinked organizations seen as lateral interactions among activity systems. Following the third generation of AT, actors learn new practices by creating new models manifested in social interaction with new roles. These new roles are involved in continuous negotiations and shared experiences linked to experimentation with the "new" rather than imple-

mentation of predesigned models without contextual adaptation. Furthermore, Sannino and Engeström (2018) suggest a fourth generation of AT, also incorporating multiple levels of decision-making, to grasp the dynamic complexity of contradictions within and between actors, levels, and motives for actions. Despite different scopes of analysis in AT, specific core ideas are present in the framework. The focus on work as object-oriented practice is a foundational theoretical assumption. The role of work as mediated by manifested tools and models is yet another, as is the idea that change is driven by inherent contradictions emphasizing the role of disagreement, tensions, and conflict as triggers for change (Engeström & Sannino, 2020). Transformative agency by double stimulation (Vygotsky, 1978) is another conceptual resource for the formation of expansive learning patterns (Sannino, 2015; Sannino & Laitinen, 2015; Engeström, Kajamaa & Nummijoki, 2015; Sannino, 2016; Sannino, Engeström & Lemos, 2016). Furthermore, Sannino (2020) emphasizes that identifying transformative agency by double stimulation (TADS) emerges to a large extent in subtle and mundane steps and is thus easily overlooked and initially regarded as insignificant. Therefore, it becomes crucial to acknowledge such steps and put them up for analytical investigation to enhance both practical societal impact and scholarly investigations of agency. They can range from being something trivial, such as a note on the palm of the hand as a reminder to take out the garbage can, to a movement agreement for elderly to reduce physical deterioration (Engeström, Nummijoki & Sannino, 2012; Engeström, Kajamaa & Nummijoki, 2015). The important note here is that what triggers transformative agency can be mundane but still significant for change and improvement. To find out what really works as double stimulation as a trigger for change, Sannino (2020) suggests the metaphor of warping and three modes of actions:

"A successfully implemented second stimulus in TADS [transformative agency by double stimulation, not in the original quate] may be understood as a warping anchor that hits the ground and allows the vessel to move forward. Actions of throwing the kedge anchor are made in the attempt to find suitable ground. These are search actions. Only when the kedge is hooked to the ground does the crew regain control of the situation allowing them to pull the vessel out of harm's way. These are taking-over actions: the vessel is still in the troubled area, but the crew are able to manoeuvre it. Breaking-out actions occur when the vessel is moved away from the problem area." (p. 4)

Going back to core ideas in AT, we can see that work, mediated actions, artefacts, and change become key concepts to analyze ongoing

change processes in order to capture what triggers change and how to nurture identified triggers to sustain patterns of development in preferred directions. Activity Theory as a theoretical perspective was therefore selected as useful to increase understanding of the ongoing collaborative research, driven by ambitions to increase both language learning and digital competence to support competence development.

Method

This study was designed in accordance with collaborative research. It is typical of collaborative research that practitioners and researchers jointly formulate questions and create direction in what is being studied (Nilsson and Sorbring, 2019). Over the course of time, the study has moved from being linked to the creation of digital stories towards a broader perspective, including more organizations as well as moving in an upwards direction in the municipality reaching different levels of decision making. Linked to the theoretical framework of Activity Theory presented above, we argue for a dynamic approach driven by the idea of transformative agency, i.e., that individuals should be empowered and have control over their situations while driving change and creating new practice. Therefore, it became crucial to capture voices and experiences from different actors, which this study does. We holistically address the spread of practice and change of actions that emerged during the process. During the study, we were moving from SFI education in the classroom to manifesting new practices and attitudes in the municipality in different organizations. However, the capture of change is a complex task, so we have used a variety of methods to capture subjective experiences along the way as well as actions. Participants' observations in SFI classrooms and at preschools, interviews with students and staff, e-mail correspondence with students, and teachers' diary notes with individual reflections and evaluations of conducted activities, have been the actual data capturing methods used in this paper. Interviews were held and follow-up e-mails were sent out to adult immigrant learners to capture their experiences. An important note of the method in this study is that the second authors was present at all activities reported on here as an employee of the municipality. It was interpreted as a strength to have this close relationship with all the actors involved, and a key factor for interlinked activities in the collaborative research process combining practice and theory while also sustaining the practitioner-researcher relationship.

Development of Activities During the Research Process

The study incorporates initial trials in SFI classroom practice of first translating stories from the student's native language into Swedish and then later

making a digital production using voice and image freeware functions in an app on tablets. These digital folktales were then made accessible with QR codes in both Swedish and the native language. To create an authentic situation for the adult learners in the SFI class, the teacher arranged for the learners to present their stories at preschool for both children and staff. At each visit there were four SFI students, meeting eight to ten children age three to five and eight staff members. Observations were conducted during presentations at preschool and interviews were held with the immigrant students as well as preschool staff about the experience of the visits. Yet another step in the collaborative research process was the introduction of the "blue bags" available at the public library as well as the new service to give study support to adult SFI students also at the library. The blue bags contain physical reading material such as books, and immaterial services for immigrant parents and their children, where extra language development efforts are required with special educators and librarians. The immetarial services the interprofessional team offered in a "blue bag" was three meetings with a librarian to get support in using folktales, in the native language and Swedish, and using digital tools for language development. Interviews were used to capture the staff's experiences regarding working with the blue bags.

Results

This study documents how SFI students generated short stories in multiple languages in a multimedia format, and how this authentic activity connected adult education, preschool education, professional development of teaching staff, and library outreach to the community.

SFI Education and Digital Stories at Preschool

In a short period of time the immigrants learned how to produce digital stories and QR codes in the SFI education classroom, with guidance from the teacher and later also guiding each other. During the immigrants' presentation of digital folktales at preschool, it was observed that the children were able to use their tablets to access different stories in different languages using the laminated printed QR code the immigrants brought with them. After listening to the folktales in Swedish as well as in the native language of the adult presenter starting with the Swedish version, the preschool children could ask questions about it directly to the producer of the story, including additional questions linked to the specific country the adult person came from. After the round of different stories in Swedish, the immigrants held a presentation for the preschool staff about how they had navigated the process of making the digital productions. Inspired by the immigrants in combination with the childrens' response, the staff became enthusiastic about integrating digital

competence into their own work practice rather than as a top-down demand, which they had previously experienced as a curriculum-driven need to develop digital competence for their young students. During the presentation, the observer could overhear one staff member whispering to a colleague, "If they can do it, we can too," referring to the fact that if someone who has not yet mastered the language, in fact a complete beginner, could produce digital stories, and present how to do that, the teachers certainly would be able to do so too. Shortly after the presentation, some of the preschool teachers decided to use tablets for their young children to make presentations of their walk in the forest, taking photos of what they found in order, to later talk about what the plants were called and what color they were. These talks were also recorded to be presented to the children's parents, for them to follow the language development of their children when in preschool. Some parents, who initially had been highly critical of the use of tablets in preschool, became aware of the use of tablets as a valuable pedagogical resource in preschool and not just a digital tool adding screen time.

SFI Education and Global Goals

The mission of SFI education is also to promote respect for each person and respect for our common environment. For the immigrant adult students, it was a journey in different ways linked to content and form. First, most of the students in this group were not schooled to do group work and were unaccustomed to work in groups in an educational setting. Secondly, they were schooled in teacher-centered teaching, which meant that several students initially did not see the importance and value of the collaborative work around the "Global Goals". They were not used to teachers encouraging openness to differing perceptions and encouraging them to discuss in groups. Over time, the pedagogical design created an open linguistic climate where the language was in focus. This was especially so when they sat in language groups and, based on their native language, could discuss suggestions in order to create translations to Swedish that correspond to the content of each global goal. The students who had previously made digital stories could act as teachers in their groups and pass on their digital skills in making videos of global goals. Many of the students went from being digital newbies to digital tutors during this process. They also became experts on QR codes and could act as instructors for those who did not know what they were and how to make them as part of adequate digital competence in everyday life in Sweden. The role of the teacher became to stand in the background and just be supportive. Students were also allowed to act as instructors for teachers who had not worked with digital tools before, thus increasing digital competence across actors and roles and also the

students' self-esteem. Again, role alteration was a significant new activity among both student and teachers. In concrete terms, students were prepared with concepts for the global goals through the Quizlet app. They got one week to practice the words, and each occasion started with a joint review in the form of a presentation in Microsoft Sway. All material was collected in a common Teacher Notebook. Subsequently, each "language group" had to translate a global goal into its native language. When the translation was complete, through Adobe Spark Video they created a video in which they read the goal in their native language. The teachers created a QR code guided by students on how to do so, so that videos could be shared with others. The teachers were given increased flexibility as they could move among the different classrooms, in contrast to before when each teacher had their own group of students. Teachers also gained increased familiarity with students they previously seldom met.

Learning at the Public Library

During meetings with the second author in the role of supporting digital competence among professionals in the municipality, the library staff expressed that their role as librarians had changed. They experienced a paradigm shift where it was not entirely clear what was included in their mission in relation to changed expectations and inquiries from library patrons combined with requirements of community formation and more open activities (Royal Library of Sweden, 2020). Merging two organizational missions with different yet related societal goals, such as attracting more visitors to the library and being able to disseminate and advance knowledge of adequate digital competence, was challenging for them. To both bring more people to the library and educate staff for the mission of advancing adequate digital competence, a new practice emerged. The teacher from SFI education started to run evening lectures at the library and, in parallel, as immigrant students in SFI education become educated, staff were trained at the library to use digital tools. This was appreciated by students saying things in their e-mail interviews such as: "Having the lessons in the library was a great initiative! The environment there is inspiring, and we got to get close to all my classmates. It was easy to do poem analysis and be between books and authors. It felt like a natural place to learn Swedish" [Student P]; "I think it was very nice to meet in the library instead of the school. The atmosphere was somehow more relaxed and yet we did the same work as in the school." [Student C]. However, it was not evident for the library staff that this type of model was possible to create with the available resources. The initial reactions on suggesting new ways of working included comments such as, "But where shall we apply for money to do such a project?" That initial thresh-

old of experiencing the need for added resources to alter activities gradually changed. They started on a small scale with evening lectures and, after getting positive feedback from visitors, they expanded further towards the 'blue bags' with its interprofessional model.

Analysis

In the analysis we return to the theoretical framework, with special focus on the metaphor of warping and three modes of action to identify manifestations of transformative agency by double stimulation.

Warping and Three Modes of Action

During the study, we have moved from the production of digital stories in the classroom to learning Swedish in a combined model of authentic language learning, digital competence, and communication skills. Triggered by the lecture for the preschool teachers mentioned in the introduction, the model later called DigiHow™ was created as the first attempt to find some practical activities in order to combine goals, such as relevant competence activities for preschool teachers linked to their own workplace, rather than listening to a lecture detached from context. Finding ways to try out possible models to work according to and to identify what could worked satisfactory or perhaps in need to change as a process of "anchor forward", as the warping metaphor suggests (Sannino 2020), the new DigiHow method was viably tested and refined. For example, it became important to find freeware to easily enable the production of digital folktales with the limited resources of the municipality in mind to work actively with the production of digital stories. The idea of using folktales from students' home countries was linked to the idea that we find folktales in all cultures, and using a familiar story would be helpful for the understanding of words. The story line also easily combined with writing on tablets, picture implementation, and recording of sound. The learning was also enhanced by the motivation of the students to re-write several times to get it right, to search for and find suitable pictures to implement, and also to re-record their own reading of the folktale translated to Swedish and also in their native language. This collaborative trial to find ways, without really knowing if they would work, was interpreted as the first search action while warping, following Sannino (2020). When finding the suitable form, the manifested practice was also seen as a trigger for transformative agency when the students moved from being passive receivers of predefined content to active creators of self-selected folktales presented in digital productions. Furthermore, the way students passed on their knowledge by presenting their stories to children as well as to preschool staff at local sites was interpreted as a taking over action. In that practice, despite their lack of language skills in Swedish,

they could still give their presentations so convincingly that preschool staff members were both challenged and inspired, saying "If they can do it, we can too". In this situation, SFI students were still challenged but could navigate and act in authentic situations and provide inspiration for others to enhance their own digital competence by starting to work with make digital stories with their children at preschool. Working with the global goals also became search actions and then taking over actions, since, at first, the students had a hard time understanding the mode of pedagogical set-up when discussing the global goals. However, over time this resistance changed and again in collaboration with the teachers as well as each other they could not only learn about global goals with the same digital tools they used in creating digital folktales but also pass on their knowledge to other teachers in SFI education. This is also interpreted as a taking over action since they could now move further without a teacher's assistance and use digital technologies available at the library. Breaking out actions were seen in the new practice of collaboration between teachers not present before as well as students driving digital competence among their teachers by being their instructors, and teachers' willingness to learn from their students. Such practice was a shift in practice not seen in either SFI education or preschool settings before, thus indicating a manifestation of change that broke up common but unreflective practice to allow something new and more uplifting for all involved actors in the municipality.

Using Material Artefacts Served as Catalyst Practice

The list of artefacts created during this process has been growing. It started with digital stories captured as the DigiHow method emphasizing altered roles for knowledge spread: students became teachers, yet anchored in digital tools, including tablets and free software for multimodal productions. We could see how the material practice became a common ground for language learning, digital competence development and sensemaking for further activities, such as creating videos after discussing global goals. Furthermore, students could also act as instructors for the SFI education teachers that did not know how to make videos with the same production practice as digital stories. Again, role alteration was a significant new activity among both student and teachers. The digital artefact in combination with what was being processed became important both for acceptance of role alteration and for language learning since it captured their focus and made all involved actors centered around a common goal. Still, the digital artefacts per se were not enough. They needed to be inscribed in a sense-making activity that also became a trigger for creativity in the process of learning rather than just repeating what was on the pre-printed material to

write de-contextualized sentences. The artefact and interlinked models served as catalyst practice to both trigger motivation to learn more and also to become empowered by the knowledge gained of digital competence to pass it on to their language teachers, who also accepted being instructed by their immigrant students. The blue bags were yet another material artefact that had been framed into a sense-making and role-changing practice due to its placement at the library. There, librarians became trained in digital competence at the same time as the immigrants gained access to extra language lectures at the library, a place they became increasingly fond of, thus fulfilling the library mission to increase visits from local residents. Furthermore, the blue bags also became an artefact that combined professional roles in new ways, linking librarians, special educators, and preschool teachers to promote language learning among children with a need for increased support. As emphasized in Activity Theory, the role of mediation and artefacts is crucial to understand work practice and organizational change (Engeström, 2001; Sannino & Engeström, 2018; Sannino, 2020), and we could see in our study that the key feature of change was linked to the way the artefacts triggered new practices. We also saw a change in the view of what a learner could be and how language and digital competence could be achieved to trigger self-esteem and empowerment for learners and staff in SFI education, preschool children and staff, special teachers, and librarians, also fulfilling organizational goals set by national policy documents such as Swedish curriculum, the Educational Act, and municipal policy decisions.

Conclusion

Due to the experience of how well the digital stories functioned, how motivating the blue bags were, and how well the student support at the library worked, the word spread in the municipality, and more organizational actors became interested and wanted to hear more. The learning that occurred could be seen at the individual level among students and staff at various organizations in the municipality. The lateral and sideways change movement thus started to move in upward patterns as well. Transformation could be triggered, driven by empowered individuals that simply needed to be moved by something to let go of incorporated practice and break new ground for even more novelty, which they did not even think that they could achieve so easily, with such a small budget, without losing sight of the mission of their organizations. In this case, we could clearly see promising effects from the combined effort of involving actors, from children to managers, in the municipality, interlinked by the curriculum demands of developing digital competence and language learning combined with 21st-century skills in life-long

learning for citizens in municipalities across ages and roles. Our argument is that story-driven digital production, combined with co-located presentations and cross-generational meetings and talk, is a fruitful way of collaborative effort to empower children, immigrant adult learners, and professional practice in education and beyond. Role alteration and the "pass it on" idea emphasizing inclusion can also have positive effects on involvement of the full chain of command, thus activating intentions in systematic quality work. The interconnectedness and usage of existing resources in new ways become key drivers in process innovation for municipal development. Small but concrete and societally relevant efforts might be the sparks that trigger wider forces, both sideways and upwards, that prove to be beneficial for individuals and organizations if supported and nurtured by decision makers, as this paper demonstrated. Initiative should be evaluated in what way it takes into consideration how to enact laws, regulations, and systematic quality work intentions with actual activities. However, there is need for more research regarding what might hinder such supporting attitudes in municipal settings. Such additional knowledge might help ensure that individual efforts to create models that collectively promote collaborative learning and achieve collective change, become acknowledged and not neglected due to their initial "smallness."

References

Engeström, Y. (2001). Expansive learning at work: Toward an activity theoretical reconceptualization, *Journal of Education and Work*, *14*(1), 133-156.

Engeström, Y. & Sannino, A. (2020). From mediated actions to heterogeneous coalitions: Four generations of activity- theoretical studies of work and learning. *Mind, Culture, and Activity*, 1-20. Retrieved from https://www.tandfonline.com/doi/full/10.1080/10749039.2020.1806328.

Engeström, Y., Nummijoki, J., & Sannino, A. (2012). Embodied germ cell at work: Building an expansive concept of physical mobility in home care. *Mind, Culture, and Activity*, *19*(3), 287-309.

Engeström, Y., Kajamaa, A., & Nummijoki, J. (2015). Double stimulation in everyday work. *Learning, Culture and Social Interaction*, *4*, 48-61.

Lundgren, B., Rosén, J., Jahnke, A. (2017) 15 års forskning om SFI- en överblick [15 years research on SFI- an overview]. *Ifous rapportserie 2017*(3), Stockholm, ISBN: 978-91-982841-6-4.

Nilsson, L., & Sorbring, E. (Eds.). (2019). *Samverkansforskning – att främja barns och ungas välfärdkommande*. Stockholm: Liber.

Rosén, J., Bagga-Gupta, S. (2013). Shifting identity positions in the development of language education for immigrants: an analysis of dis-

courses associated with 'Swedish for immigrants'. *Language, Culture and Curriculum, 26*(1), 66–88.
Royal Library of Sweden. 2020. Digital Education. Retrieved from https://digiteket.se/inspirationsartikel/digital-folkbildning/
Sannino, A. (2015). The principle of double stimulation. *Learning, Culture, and Social Interaction, 6*, 1-15.
Sannino, A. (2016). Double stimulation in the waiting experiment with collectives. *Integrative Psychological and Behavioral Science, 50*(1), 142-173.
Sannino, A. (2020). Transformative agency as warping: How collectives accomplish change amidst uncertainty. *Pedagogy, Culture & Society,* 1-25. Retrieved from https://www.tandfonline.com/doi/pdf/10.1080/14681366.2020.1805493?needAccess=true
Sannino, A., & Engeström, Y. (2018), Cultural-historical activity theory: Founding insights and new challenges. *Cultural-Historical Psychology, 14*(3), 43–56.
Sannino, A., Engeström, Y., & Lemos, M. (2016). Formative interventions for expansive learning and transformative agency. *Journal of the Learning Sciences, 25*(4), 599-633.
Sannino, A., & Laitinen, A. (2015). Double stimulation in the waiting experiment. *Learning, Culture, and Social Interaction, 4*, 4–18.
Sheikhi, K. (2013). *Vägar till förståelse: andraspråkstalare i samtal med en studie- och yrkesvägledare* [Pathways to understanding: second language speakers in conversation with guidance counselors]. Göteborg: Institutionen för svenska språket, Göteborgs universitet.
Swedish National Agency for Education. (2020). Swedish curriculum. Retrieved from https://www.skolverket.se/innehall-a-o/landningssidor-a-o/laroplaner
Swedish Ministry of Education. (2010). The Educational Act 2010: 800. Retrieved from http://rkrattsbaser.gov.se/sfst?bet=2010:800
Vygotsky, L. S. (1978). *Mind and society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

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EXPANDING THE USE OF DIGITAL TECHNOLOGIES IN THE SWEDISH EDUCATION SYSTEM—A STUDY ON MANAGEMENT CHANGE PRACTICE BETWEEN MUNICIPAL SCHOOL ORGANIZERS AND SCHOOL LEADERS

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Abstract

The municipal school organizers and the school leaders' collaborative efforts expanding the use of digital technologies in the Swedish educational system will be studied in the project DUVKOM, "Digitalization of the educational system in municipalities." Based on data interviews and document analysis, this paper presents some preliminary findings: low digitalization competence of school leaders leads to teachers not being given the good prerequisites for working with digital technologies; low digitalization competence of teachers leads to digital tools being used for writing and searching only; the same digital platform should be used for communication, collaboration, and administration.

Introduction

Digital technology creates changes in society worldwide. It changes the labor market and the skills that citizens should bring with them in their life. Young people need skills that can help them to use digital technologies in different situations and the possibility to connect to the Internet. To be able to use digital technologies such as computers, tablets, and mobile telephones competently is a competitive advantage in the labor market (Masters, 2018, Organisation for Economic Co-operation and Development (OECD), 2012). Digital technology in society increases the demand for different professional sectors, with or without competence in the use of digital technologies. It changes situations for work in the knowledge economy and shaping the labor market by influencing skills demands. Critical thinking, communication skills, innovation, collaboration, and creativity are some of the 21st-century skills (OECD, 2012). Digitalization may lead to the disappearance of many professions, other professions are changed, and new occupations come about.

Working life and society's needs are changing with the help of digital

technologies, and according to Susskind and Susskind (2015), "the professions in their current form will no longer be the best answer to those needs" (p. 3). These changes impose challenges on a societal level that is important to answer. To meet these challenges, the Swedish Government has developed a plan for digital strategy for sustainable digitalization work in Sweden. Like many other countries, Sweden intends to be one of the best countries in the world, using the possibilities of digitalization. To achieve the overall goal, five sub-goals are set" (Government Offices of Sweden, 2018, p. 6) for sustainable digitalization work. These sub-goals are: to develop digital competence in all citizens, to create digital security in digital social development, to support the development of digital innovations, to convert digital strategy into the process by digital management, and to give all of Sweden access to infrastructure. However, schools have an important mission in this change. In 2017, the Swedish Government decided to further develop the digitalization of the educational system and developed a strategy for 2017 to 2022. This strategy calls for all students to develop an adequate digital competence, and possibilities of digitalization in the educational system are utilized to make students' results better (Swedish National Agency for Education, 2019). The educational system needs to prepare students for these changes and strengthen their digital skills. Education is important for the development of these digital skills in formal learning. A strong digitalization of the educational system is central to having a good effect on the students' results. Still, there is a great necessity for professional development among professionals to enter the educational system. It is about how technology can be used in the educational system and not the technology itself (OECD, 2012).

The development work with expanding the use of digital technologies in the educational system must be seen as a project of change, and the most important success factor is leadership (Grönlund, 2014; Hylén, 2011; Leithwood, Harris, & Hopkins, 2020; Swedish National Agency for Education, 2019). Digital technologies are not automatically introduced into the overall structure of how education is practiced. School leaders and teachers will need support in the act of leading and teaching with digital technologies (Tallvid, 2015; Willermark, 2018). This support should come from the school organizer's strategic plans for expanding the use of digital technologies in the educational system. Without these guidelines, it becomes difficult to succeed (Mingaine, 2013). According to Tyrén (2013), the schools "need a stable, clear, and active management to provide a stable organization for learning" (pp. 200-201). Larsson (2004) argues that the school leaders' positive attitudes towards the work with digital technologies in the educational system are essential. Hansson (2013) points out that school leadership is expected to "direct itself to-

wards organisational preconditions for the school's activity as a whole" (p. 181). Håkansson Lindqvist (2015) stresses that "active and involved leadership is necessary on several levels, from municipal politicians to school leaders" (p. 26).

School leadership is essential for the use of digital technologies in learning and teaching. It is the municipal school organizer's responsibility to provide prerequisites to school leaders to create an organization that offers teachers possibilities for learning and teaching in the form of time, structure, and organization. The municipal school organizer has responsibility for continuing education of the staff and the teachers' opportunities to increase their professional competence (Swedish National Agency for Education, 2019). It is the municipal school organizer's responsibility to support the school leaders' work with expanding the use of digital technologies in their schools. Susskind and Susskind (2015) suggest that the question is if there might be "entirely new ways of organizing professional work, ways that are more affordable, more accessible, and perhaps more conducive to an increase in quality than the traditional approach" (p. 32).

According to Hedman (2017) and Lindström (2017), it is unclear how the strategy will be implemented and financed, and who is responsible for what. The strategy can be interpreted in different ways by both the municipal school organizers and the school leaders, and it can lead to increased inequality among the municipalities and the schools. Digital technologies also offer solutions to challenges in schools; for example, the difficulty of recruiting qualified teachers. By using digital technologies, students can participate in teaching by remote education, and the students and the teachers can interact in real-time (Swedish Association of Local Authorities and Regions, 2019). It can be a solution for teacher shortages for the municipal school organizer and school leaders in the future.

In order to study the management change practice, in the collaborative efforts of municipal school organizer and school leaders to expand the use of digital technologies in the Swedish educational system, the project DUVKOM, "Digitalization of the educational system in municipalities" was initiated. DUVKOM is a joint project between three municipalities in the North of Sweden as well as Mid Sweden University. The aim of this paper is to present some of the preliminary findings of the first interviews and initial analysis. The disposition of this paper will be as follows: a research review in digital technologies in the educational system, preliminary findings, and conclusions.

Digital Technologies in the Educational System

There is a relationship between education level and the use of technology: "technology usage is lower for less-educated individuals or, to say it differently, the more educated, the more intense the use of technology" (OECD, 2012, p. 44). Increased digital skills among students lead to an increase in their abilities (Grönlund, 2014). School staff has responsibility for the work in expanding the use of digital technologies in learning and teaching. However, municipal school organizers and school leaders have more responsibility than others for this expansion. The school organizer should be able to promote activities development and innovations, and to take advantage of the benefits that digitalization brings. The national digitalization plan should provide guidelines for how school organizers can work with expanding the use of digital technologies in their schools. However, schools' needs and prerequisites must stand as a starting point in the work. According to Ball, Maguire, & Braun (2012)

> …policy texts are typically written in relation to the best of all possible schools, schools that only exist in the fevered imaginations of politicians, civil servants and advisers and in relation to fantastical contexts. These texts cannot simply be *implemented*! They have to be translated from text to action – put 'into' practice – in relation to history and to context, with the resources available. (p. 3)

Digitalization in the educational system means, among other things, to develop teaching, work with support and adaptations, skills in source criticism, and to make administration more efficient and easier (Swedish Association of Local Authorities and Regions, 2019).
The Swedish educational system should be a leader in using the opportunities of digital technologies to achieve high digital competence among students and to promote professional development and equivalence. With this overall goal as the starting point, the Swedish government has devised a national strategy, "skoldigiplan" for the Swedish educational system. The digitalization strategy has three focus areas. Every focus area has a goal with several sub-goals, as depicted in Table 1 (Swedish Association of Local Authorities and Regions, 2019). Based on these three areas, the government hopes that the overall goal will be achieved.

The skoldigiplan aims to create prerequisites for the municipal school organizers to achieve the goals in the strategy and increase equality between municipalities and schools. The proposed initiatives and activities should lead to all the organizers of the educational system being given the prerequisites to achieve the goals in the strategy by 2022. The skoldigiplan describes the school organizers' overall needs, the efforts

Table 1
Focus areas in the skoldigiplan

Focus areas	Sub-goal 1	Sub-goal 2	Sub-goal 3	Sub-goal 4
Digital skills for everyone	All students must be given the prerequisites to develop adequate digital skills	Leaders shall be able to lead strategically	Educators working should be able to choose and use appropriate digital tools	
Equal access and use of digital technologies	Students, educators, leaders get access to digital technologies based on their needs and prerequisites	Access to infrastructure and technological and educational support	Technology can be utilized effectively by using digital learning resources in teaching	Digital technologies used to facilitate teaching and administration for educators
Research and follow-up on the possibilities of digitalization	Research on the impact of digitalization on teaching and learning for the educational system	Follow-up the expansion of digital technologies in the educational system		

to be taken at a national level to meet the organizers' needs, and the commitments each organizer needs to make at the local level (Swedish Association of Local Authorities and Regions, 2019).

The municipal school organizers and the school leaders have the responsibility to work on expanding the use of digital technologies in the educational system. According to Grönlund (2014), the leaders in the educational system on the municipal level have a responsibility to develop the use of digital technologies to benefit students' learning. This responsibility involves finding different ways to work. How leaders lead is a success factor for creating possibilities, which leads to beneficial conditions in schools (Grönlund, 2014). The municipal school organizer and

school leaders are responsible for the changes in the educational system that require collaboration, such as pedagogy in schools and promoting required collaboration among different organizations and departments. It is the municipal school organizer's responsibility to ensure that the prerequisites for achieving the goals of the national strategy for digitalization of the educational system are met. The changes which digital technologies imply should be beneficial for school organizers (Swedish Association of Local Authorities and Regions, 2019). Students and staff in the educational system are the target groups of the strategy. The school organizers have a general responsibility to take part in the initiatives and activities described in the skoldigiplan and to ensure it benefits the target groups. According to the skoldigiplan (Swedish Association of Local Authorities and Regions, 2019, pp. 32-34), the municipal school organizers shall:

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- Make a change in practice and link to control documents. The work must be integrated into control, monitoring, and systematic quality work.
- Prioritize and finance expanding the use of digital technologies in the educational system, and create the prerequisites for using the resources made available nationally.
- Establish an internal organization with the right expertise and capacity for digitalization work.
- Have secure access to technological and educational support that meets the needs of the educational system.
- Ensure that individuals with both competence, time, and designated responsibility for educational support are available when the need arises.
- Ensure that there is access to adequate technological support when the need arises.
- Ensure that resources, in the form of time and financial resources, are allocated for continuous and activities near to professional development efforts.

Method

The data in this study was collected using document analysis and interviews with the municipal school organizers in three municipalities in the North of Sweden. By collecting the municipality's implementation plans, quality reports, and other reports, I have analyzed where these municipalities are in their process of digitalization and how they organize their digitalization work. According to Stake (1995), "gathering data by studying documents follows the same line of thinking as observing or interviewing" (p. 68). Patton (2002) suggests that documents "provide the evaluator with information about many things that cannot be ob-

served" (p. 293). A document may be defined as evidence of a process, and it may be in written or visual forms, for example, electronic texts or photographs. Cohen, Manion, & Morrison (2011) point out that with documents, the researcher can get access to our history through what has happened in the past, to the processes of change over time, and to the explanation of current structures, relationships, and behaviors in a context. An interview is a way to gain access to the descriptions and interpretations of others (Kvale & Brinkmann, 2014). In an interview, there is the opportunity to ask additional questions, misunderstandings can be resolved, and the respondent can speak freely.

The research is connected to the project "Digitalization in the educational system in municipalities" (DUVKOM) and has a reference group consisting of representatives from the municipalities and Mid Sweden University. The project reference group has meetings about three times a year. In these meetings, every municipal school organizer describes what they have done, what they have planned to do, and what they will do in the municipality regarding implementing a digital culture. This arena is vital in collecting data because the reference group has a holistic perspective of the work. Documents produced independently of the researcher are different from the documents the researcher produces as data for the research. The documents that the municipalities have produced and documentation from the project meetings are examples of documents outside my control. To structure the data I have collected, I have used Microsoft Excel and utilized focus areas in the skoldigiplan to categorize the collected data.

Findings

In the document analysis and the interviews (see Table 2), some challenges have been identified. The document analysis is based on the municipalities' digitalization' plan as well as notes from DUVKOM meetings.

The three municipalities have different needs and prerequisites that steer how the municipal school organizer and the school leaders work with expanding the use of digital technologies in their schools. However, there are some similar challenges for the municipalities.

Changes from different directions make the municipal school organizer and school leaders' collaborative efforts to expand the use of digital technologies in the educational system go forward, stop, and sometimes go backward. The change of leaders in the school's strength chain can lead to no continuity in the development work. It is important to have a long-term perspective. There are also few arenas and networks among

Table 2

The findings are categorized based on the skoldigiplan focus areas.

Digital competence	- School leaders and teachers need digital competence. It connects to equality. The more digital competence school leaders and teachers have, the more they use digital tools in their school. The Swedish National Agency for Education offers courses for school leaders and teachers to acquire digital competence. - The municipalities use a holistic perspective for working with expanding the use of digital technologies in the educational system. - School leaders - low digital competence leads to teachers not being given conditions for working with digital technologies. - Teachers - low digital competence leads to digital tools being used for writing and searching on the Internet only. - School leaders have difficulty prioritizing their digital competence. - Students need digital competence to use digital tools in their learning and skills in how to manage the information flow on the Internet. - Personnel change slows down the development work with digitalization.
Access and use of digital technologies	- Access to tools shows an unsatisfactory picture; there is inequality among many schools. However, there is a basic level for digital technologies in schools. - Teachers' working methods have not changed through digitalization. - Access to digital tools is important, but these tools must be functional and current. - Access to a stable network is also important. When digital devices lose Internet connection, it can take a long time before the units regain network connection. Access to a good network is essential for all people in schools. - The digital platform should be used for more than one purpose, i.e., for: communication among teachers, students and parents; collaboration among teachers; and administration of assessments. - Many schools have used distance teaching in the last months. - The school leaders have participated in several digital meetings.
Research to support the activities and the efforts to contribute to the possibilities of digitalization	- The three municipalities participate in the DUVKOM project to make visible how the digitalization process contributes to strengthening the quality of the educational system. - The municipalities also have key employees who work directly with digitalization in schools and support school leaders and teachers.

the municipal school organizers as well as between the municipal school organizer and the school leaders to communicate and exchange ideas and experiences.

Conclusion

The management change practice is important for expanding the use of digital technologies in the Swedish educational system. Results show that a defined and visible digitalization effort can lead to a more positive attitude about digitalization work among school leaders, teachers, students, and parents. Having staff centralized at the municipal level, or staff at the school, who work with IT can lead to school leaders, teachers, and students being more positive about using digital technologies. For example, IT strategists can give support to school leaders and teachers when digital tools and networks do not function. They can also give pedagogic support to teachers using digital tools in teaching. Teachers need digital competence and help to go from working analogue to working in a more digital way, as many teachers still work with digital tools in an analogue way. Teachers' digital skills can also be linked to how much they can help their students use digital tools in learning. Digital competence can be acquired with the help of coursers provided by the Swedish National Agency for Education and connected to both peer learning and learning by doing. However, the daily work at the school makes it difficult for school leaders to prioritize their own digital competence. Low digital competence of school leaders can lead to teachers' not being given the conditions for working with digital technologies. Digital competence becomes a prerequisite to work with digitalization in the educational system, and thereby an important key for successful implementation work.

It is important to establish a clear division of responsibilities in the steering chain. However, it is also essential that the municipal school organizer has an overall picture of the digitalization work in the municipality and a clear picture of roles and expectations. Change of staff can also become a bottleneck for the digitalization work. Systematic digitalization work can lead to success factors such as continuity of work, even if there is a change of staff. Access and use of digital technologies are not equivalent, and there is inequality in how much digital competence school leaders and teachers have acquired. These factors influence equality among municipalities and schools. Students and teachers should be able to choose their digital learning tools. Digital skills are essential for students, both today and in the future. Many professions can disappear, and new professions may require more digital skills.

The three municipalities in the project DUVKOM contribute to research

with their work processes in expanding the use of digital technologies in their schools. Work with expanding the use of digital technologies in the educational system requires a long-term perspective with clear guidelines, a systematic approach, and leadership.

References

Ball, S. J., Maguire, M., & Braun, A. (2012). *How schools do policy: Policy enactments in secondary schools*. London: Routledge.

Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education*. London: Routledge.

Government Offices of Sweden. (2018). *För ett hållbart digitaliserat Sverige – en digitaliseringsstrategi* [For a sustainable digitalized Sweden – a digitalization strategy]. Retrieved from https://www.regeringen.se/49adea/contentassets/5429e024be6847fc907b786ab954228f/digitaliseringsstrategin_slutlig_170518-2.pdf

Grönlund, Å. (2014). *Att förändra skolan med teknik: bortom "en dator per elev" [To change school with technology: Beyond one laptop per student]*. Örebro: Örebro universitet.

Håkansson Lindqvist, M. (2015). *Conditions for technology enhanced learning and educational change: A case study of a 1:1 initiative*. [Doctoral thesis, Umeå University, Umeå, Sweden, 114]. Retrieved from http://umu.diva-portal.org/smash/get/diva2:859735/FULLTEXT01.pdf

Hansson, A. (2013). *Arbete med skolutveckling - En potentiell gränszon mellan verksamheter: Ett verksamhetsteoretiskt perspektiv på en svensk skolas arbete över tid med att verksamhetsintegrera IT* [Work with school development - a potential boundary zone between activities: An activity theory perspective of one school's work over time with integrating IT in operations]. [Doctoral thesis, Mid Sweden University, Härnösand, Sweden, 165]. Retrieved from http://miun.diva-portal.org/smash/get/diva2:649839/FULLTEXT02.pdf

Hedman, E. (2017, October 20). Här är regeringens digitala skolstrategi [Here is the Government's digital school strategy]. *Skolvärlden*. Retrieved from https://skolvarlden.se/artiklar/sa-ser-regeringens-strategi-digitaliseringen-ut

Hylén, J. (2011). *Digitaliseringen av skolan [The digitalization of school]* (2nd ed.). Lund: Studentlitteratur.

Kvale, S., & Brinkmann, S. (2014). *Den kvalitativa forskningsintervjun* [The qualitative research interview]. (3rd ed.; S.-E. Torhell, Trans.). Lund: Studentlitteratur.

Larsson, P. (2004). *Förändringens villkor: en studie av organisatoriskt lärande och förändring inom skolan* [Conditions of change: A study of organizational learning and change within the school]. [Doctoral

thesis, Stockholm School of Economics, Stockholm, Sweden]. Retrieved from https://ex.hhs.se/dissertations/221237-FULLTEXT01.pdf

Leithwood, K., Harris, A., & Hopkins, D. (2020). Seven strong claims about successful school leadership revisited. *School Leadership & Management*, *40*(1), 5–22. https://doi.org/10.1080/13632434.2019.1596077

Lindström, K. (2017, October 24). Skolan ska digitaliseras – men regeringens strategi får kritik [The school will be digitalized - but the government's strategy receives criticism]. *Computer Sweden*. Retrieved from https://computersweden.idg.se/2.2683/1.691200/skolan-digitalisering-kritik

Masters, J. (2018). Trends in the digitalization of K-12 Schools: The Australian perspective. *Seminar.Net*, *14*(2), 120–131.

Mingaine, L. (2013). Leadership Challenges in the Implementation of ICT in Public Secondary Schools, Kenya. *Journal of Education and Learning*, *2*(1), 32–43. https://doi.org/10.5539/jel.v2n1p32

Organisation for Economic Co-operation and Development (OECD). (2012). *Connected Minds: How Technology Influences Learners*. Paris: OECD Publishing.

Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3rd ed.). London: SAGE.

Stake, R. E. (1995). *The art of case study research*. London: Sage.

Susskind, R., & Susskind, D. (2015). *The Future of the professions - How technology will transform the work of human experts*. Oxford: Oxford University Press.

Swedish Association of Local Authorities and Regions. (2019). *Skoldigiplan - Nationell handlingsplan för digitalisering av skolväsendet* [Skoldigiplan - National action for digitalization of the school system]. Stockholm: Swedish Association of Local Authorities and Regions (SKR).

Swedish National Agency for Education. (2019). Leda digitaliseringen på skola och förskola [Lead digitalization in schools and preschools]. Retrieved from https://www.skolverket.se/skolutveckling/leda-och-organisera-skolan/leda-arbetet-i-skola-forskola-och-vuxenutbildning/leda-digitaliseringen-i-skola-och-forskola

Tallvid, M. (2015). *1:1 i klassrummet – analyser av en pedagogisk praktik i förändring* [1:1 in the classroom: Analyses of a pedagogical practice in change]. [Doctoral thesis, Gothenburg University, Gothenburg, Sweden, 42]. Retrieved from https://gupea.ub.gu.se/bitstream/2077/37829/1/gupea_2077_37829_1.pdf

Tyrén, L. (2013). *"Vi får ju inte riktigt förutsättningarna för att genomföra det som vi vill" - En studie om lärares möjligheter och hinder till förändring och förbättring i praktiken* ["We aren't getting the conditions we need to do want we want to do" - An investigation

of possibilities and restraints for teachers who are changing and improving their practices]. [Doctoral thesis, Gothenburg University, Gothenburg, Sweden, 337]. Retrieved from https://gupea.ub.gu.se/bitstream/2077/32755/1/gupea_2077_32755_1.pdf

Willermark, S. (2018). *Digital Didaktisk Design : Att utveckla undervisningspraktiken i och för en digitaliserad skola* [Digital Didactic Design: To develop teaching practice in and for one digitalized school]. [Doctoral thesis, University West, Trollhättan, Sweden, 13]. Retrieved from http://hv.diva-portal.org/smash/get/diva2:1174749/FULLTEXT01.pdf

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FROM "DISTRACTION" TO "TRACTION": DANCING AROUND BARRIERS TO CAPTION LIVE THEATER AND PROMOTE CULTURE CHANGE

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Abstract

Laws and policies worldwide increasingly demand that all users have equivalent ability to interact with their environment, independent of disabilities. This includes educational and work environments as well as entertainment. Technologies have greatly facilitated the development of accessible resources and processes; however, a culture of accessible design is still not fully developed, and not all solutions are affordable, so there is still resistance. This paper outlines the steps of a team effort at a small private college to provide captioning for a live theatre production, *Stepping Out,* which resulted not only in rendering the performance accessible but also helped grow the culture of accessibility at the institution.

Introduction

Educational institutions all over the world are embracing Universal Design for Learning (UDL) (Meyer, Rose, & Gordon, 2014) and accessible course design to help ensure that all learners have access to all resources, can complete all tasks, and can engage with others in every way possible. They do this because they believe, morally and philosophically, that inclusive access is the right thing to do, and, more pragmatically, because national laws require it. Compliance, however, is a complex issue and sometimes a difficult task. If courses are not "born accessible" (Goldberg & Rothberg, 2013), meaning they are designed from the outset for inclusive access, then institutions may provide accommodations only to specific students with medical documentation of a disability, and only for materials or tasks that the students cannot accomplish on their own.

Accessibility and accommodations can be viewed as the two forms of energy: potential and kinetic. Given a known quantity of energy, it can exist in potential or kinetic form, or both, but the sum is always the same.

If it is all "potential," there is no "kinetic," and vice versa. Or, there can be any combination of the two. This is a helpful metaphor when considering the balance between accessibility and accommodations. If a course or other educational experience is fully accessible, there is no need for accommodations. If it is not accessible at all, then accommodations must be provided for every component.

A serious challenge for educational institutions is how to provide support for accessible design, or accommodations, when financial or human resources are limited. At many institutions, for example, design support for faculty is only available when a student with a documented disability is registered for a class, and by then a complete "redo" might be impossible. Similarly, accommodations are also available only for students with documented disabilities who are registered with the office of disability services. But offering students access to assistive technology available only in a specific campus location and only at a specific time, or auxiliary services such as an interpreter, reader, or notetaker who is available only at a specific time, is discriminatory because it does not allow those students to manage their own time and complete all tasks independently. Thus, it perpetuates a culture that focuses on "disability" rather than "ability" and increases rather than manages barriers.

The idea that faculty members should be proactive in planning for disability by designing their courses to be fully accessible, rather than reactive by adjusting their courses only when they are notified that they have a disabled student in class, is consistent with the socio-political model of disability. The socio-political model of disability, sometimes referred to as the minority model of disability, defines disability as a social phenomenon (Nario-Redmond, 2020). According to the socio-political model, the impairment itself is not what disables a person; environmental, economic, educational, attitudinal, and political barriers that are not designed for a wide range of human differences are what really *disables* a person from participating in society (Nario-Redmond, 2020). In other words, the disadvantages associated with having a disability could be mitigated by inclusive design. The socio-political model is a contrast to another common theory, the bio-medical model of disability. Looking at disability through a medical lens implies that the disadvantages are an individual issue, rather than a societal one, and should be fixed by trying to become more able-bodied through surgeries, mobility aids, therapy, and prescription drugs (Goering, 2015). Though the medical model is quite common in public thinking, the socio-political models, which emerged from disability activists and scholars in the 1970s and 1980s (Finkelstein,

1980; Oliver, 1996), are often preferred by activists and disability scholars. The socio-political model also recognizes that although the term disability encompasses a diverse range of abilities, people with disabilities have a collective set of experiences, concerns, and interests, thus, they are considered a minority group (Nario-Redmond, 2020). Being a part of a social group can be useful for many reasons, including finding solace in shared experiences, and having more influence when it comes to lobbying for change.

The Power of Inclusive Design

Challenges and failures often lead to innovation. Disabled people[1], accustomed to living in a world not built for them, have been key proponents of design innovations throughout history. For example, architect Ron Mace, who developed polio as a child and had to be carried into inaccessible college classrooms, advocated for "universal design": "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Mace, 1985, as cited in The Center for Universal Design). Consider the existence of "curb cuts" in the sidewalk, for example: while they may have been introduced to accommodate wheelchairs, they also benefit individuals pushing strollers or shopping carts as well as those on bikes, skates, or skateboards.

There are many similar examples just within the realm of technology. Typewriters were originally designed to make letter-writing accessible to the blind (Holmes, 2018, as cited in Adams & Hollenhorst, 2018). The concept of storing data on punch cards, which lead to the invention of the computer and the founding of the company International Businesses Machines (IBM), was introduced by Herman Hollerith, who had a cognitive processing disability (Jacob, 2015). Vincent Cerf, an American developer recognized as one of the "fathers of the internet," says that knowledge of disability inspired him to develop the first email server (Solsman, 2017). Cerf is hearing-impaired and his wife, Sigrid Cerf, is Deaf (Solsman, 2017). According to an article in *The Irish Times*, Hard of hearing

[1] Throughout this paper, the authors will use identity-first language (disabled people) rather than person-first language (people with disabilities). Using identity-first language is a growing preference within the disability community, with the reasoning that disability is a central part of identity, not something to be ashamed of or fixed, and that reclaiming the term with pride decreases stigmatization. Lydia Brown, an American autistic disability rights activist and scholar, has written on this topic on their blog Autistic Hoya (2011). However, it should be noted that the disability community, like all communities, is not monolithic and some individuals may prefer person-first language for equally valid reasons. One should always ask, rather than assume preference.

and D/deaf[2] people also influenced, tested, and popularized texting. Touchscreens, made popular by the iPhone, were developed from technology designed by Wayne Westerman, who had severe carpal tunnel syndrome; he invented touch keyboards to help people with mobility impairments ("Text messaging revolution," 2001).

One thing all these inventions have in common? They are used and enjoyed by the whole world, not just disabled people. As deaf designer Elise Roy says in her 2015 TEDTalk, "When we design for disability, everyone benefits." (Roy, 2016).

Technology and Accessibility at Hiram College

Hiram College is a private liberal arts institution of higher education located in rural northeast Ohio. Hiram offers 29 majors and 36 minors for full-time traditional undergraduate students, and a smaller selection of tracks for non-traditional, part-time students enrolled in an Adult Undergraduate program. With just over one thousand traditional students, Hiram's small size, coupled with its historical dedication to experiential learning and unique curriculum design (Miller & Varonis, 2017) have established it as a place open to innovation. One recent example of this is Hiram's "Tech and Trek" initiative, which was introduced in 2017. The "Tech" component involves supplying all students, faculty and staff with an iPad Pro, keyboard, and Apple Pencil. With 98% of Hiram's students receiving financial aid, the iPad initiative helps to equalize access to technology, ensuring that everyone is working with the same device and software (Varonis & Varonis, 2018). The "Trek" aspect includes gifting all incoming students with a pair of hiking boots, encouraging outdoor exploration and breaks from technology. A central goal of the Tech and Trek program is to cultivate mindful use of technology, and encourage creative and critical thinking both within and outside the classroom (Varonis & Varonis, 2018).

Although not explicitly stated as an original goal of the 1:1 iPad initiative, the access to Apple technology has also had positive outcomes in terms of accessibility. Most Apple devices, including iPads, have a number of built in features designed to accommodate users with disabilities. The voice over technology can read screen content out loud to users,

[2] When the word Deaf is written with an uppercase 'D,' it refers to people who have a strong connection to the Deaf community and Deaf culture. On the other hand, the lowercase 'd' is used when a deaf person does not identify strongly with Deaf culture, which may be the case for a variety of reasons. Typically, both letters are used by writing "D/deaf" to represent all members of the community.

which helps those with visual impairments, students who may struggle with reading due to learning disabilities, non-disabled students who are audio-learners, rather than visual-learners, and second language learners. Predictive text features can ease the stress of writing for students with learning disorders like dyslexia. Magnifiers, customizable text-size, color control, and adjustable command controls can aid those with physical and motor impairments, visual impairments, and more. Users with Bluetooth hearing aids can even connect to the iPad to have audio content directly routed to their hearing devices. Additionally, there are a number of downloadable apps designed to make learning easier for students with diverse needs. For two examples, the Otter.ai app can create live transcripts (though the iPad must be in close proximity to the speaker, and only one person may speak at a time), and the app Calm Harm helps people with anxiety and depression manage overwhelming feelings in real time.

However, it is important to note that, on its own, access to technology is not an automatic solution for students with disabilities. In fact, if not used optimally, technology can create as many new barriers as issues it helps solve (Varonis, 2019). The ability to task students with learning through podcasts, videos, or other non-traditional sources can enhance the classroom experience, but it can also be problematic if universal design for learning is not a forethought. Does the podcast have a transcript? Are the videos captioned? Does understanding the content of a video rely on one's ability to see it? It is crucial that educators consider these factors when designing courses that are "born accessible" and not merely accessible through accommodations.

Disabled College Students and the Need for Increased Accessibility

Based on 2010 global population estimates, 15% of the world's population lives with a disability (World Health Organization, 2011). In the United States, 19–20% of college students reported having a disability in 2015–2016 (U.S. Department of Education, 2019). Yet, even though disabled people make up a significant portion of the population, at-large and within educational institutions, in many places accessibility and accommodations are lacking. A 2017 survey conducted by Rankin and Associates Consulting, which was included in a research brief by the National Center for College Students with Disabilities (NCCSD), reported that only 67.4% of disabled college students said they felt comfortable in their classes, compared to 71.6% of non-disabled college students (Harbour & Greenberg, 2017). Furthermore, only 75% of disabled college students reported feeling comfortable on campus, compared to 85% of non-dis-

abled college students (Harbour & Greenberg, 2017). Evidence also suggests that the graduation rate of disabled students is lower than that of their non-disabled peers (Mamiseishvili & Koch, 2011). In a 2019 survey conducted by the NCCSD, college students with disabilities from a range of universities in the United States reported the following issues as common barriers to success: difficulty navigating disability support services; inadequate accommodations in the classroom and instructor push-back; physical inaccessibility; negative interactions with peers; stigma of disability; and burden on disabled students to provide accommodations (Scott, 2019).

As a disabled college student herself, the second author of this paper saw many of the above barriers firsthand at Hiram College. When it comes to accommodating disabled students, Hiram's small size can be both an advantage and a disadvantage. Smaller class sizes (an average of 13 students per class) can make it easier for professors to provide accommodations and respond to requests. Yet, a smaller institution inherently means fewer resources and tighter budgets. Jay Timothy Dolmage, author of *Academic Ableism*, notes that disability services offices, which assess student needs and help provide accommodations, are underfunded and understaffed across the United States (2017). At Hiram, the "Disability Services Office" (DSO) is literally staffed by one individual, who also serves as the Director of Counseling and is the only permanent on-site mental health specialist (though the college does bring in two psychologist interns each year who also provide counseling). The DSO itself is located within the Health Services building. Many Hiram students when questioned informally indicated that they did not know where to find the DSO on campus. This is partially because at the time of this writing, there was no sign outside the building.

While the college does offer daily open tutoring sessions and educational assistance, having such a small DSO can negatively impact a disabled student's ability to receive the best possible accommodations (assistance with accessible course design is managed on an *ad hoc* basis through the Office of Learning Technologies, the department of the first author). Limited campus resources can also negatively impact a student's campus life experience. Until the spring of 2020, after the captioning project described here raised awareness for the need for better accessibility services, there was no regulation enforcing accessibility, no funding or set point person to contact for accommodations at co-curricular events (campus life events outside the classroom, such as guest lectures, theater productions, sporting events). These responsibilities now fall to the DSO, adding another task to the one-person department.

Increased awareness of disabilities and universal design training can help faculty and staff alleviate some of the previously discussed barriers. It is the belief of the authors of this paper that the use of iPad technology through the Tech and Trek program can help accomplish this both in the classroom and outside the classroom at co-curricular events. We will illustrate this by focusing on captioning, an important accommodation for d/Deaf and hard of hearing people.

One Aspect of Accessible Design: Captioning

Providing accurate captions to all students for multimedia is required by the Americans with Disabilities Act (ADA) (1990), though compliance is an ongoing challenge for most institutions. Archival material likely has no captions at all, yet copyright laws might make it impossible for captions to be added, the difficulty of doing so notwithstanding. It is more likely that recent material is captioned, but even so multiple barriers exist. For example, at one large university thousands of students were enrolled in a freshman study skills course and required to view a theatrically-released film made available for streaming; however, the version available did not include closed captions. Only after the first author investigated was the link to a second, open-captioned version shared.

A more common barrier is the quality of captions that have been automatically-generated. Many instructors create their own videos or link to those of others on video platforms such as YouTube. While automatic captioning on YouTube is improving, errors can interfere with comprehension and do not provide "equivalent information" as required by the ADA and international Web Content Accessibility Guidelines (WCAG) (World Wide Web Consortium, 2018). It is possible for a video creator to manually edit captions on YouTube, though of course it is an extra effort. It is not generally possible, however, (the non-profit Amara notwithstanding) to produce or edit captions that have been generated for videos uploaded by others. And automatic captioning can lead to some distressing or amusing results. For example, in one third party video on the history of film, "Cinerama" was automatically captioned as "ramen" in one instance and "Cinderella" in another.

Live captioning is yet another issue. According to WCAG guidelines, it is a best practice to offer captioning for live online events such as webinars or meetings. Some web-conferencing hosts make transcripts available after the event for free, or even make it possible to provide live captioning via a third party, but this comes at a cost. In the classroom, Google Slides offers fairly accurate live captioning that can be used with many but not all software applications. Another common service in the

United States is Communication Access Realtime Translation, referred to most often by its acronym CART. CART is most commonly used at larger events like conferences, but can also be integrated into smaller group settings. CART can be displayed on a large central screen or directed to individual devices. Certified human CART providers use a steno machine to record live dialogue in phonetic shorthand, which is then translated into English through fast-paced software; these trained professionals can record up to 260 words per minute at 98% accuracy (Collaborative for Communication Access via Captioning [CCAC], 2016). Due to the specialized skills needed for this service, CART can cost anywhere from $60/hour to $200/hour or more, depending on many different factors and needs relating to the situation (CCAC, 2016).

A more challenging environment is that of a live theater production. Sometimes, the services of a sign language interpreter are available at designated performances, and theater-goers must identify themselves as needing these services and sit in a designated area for the best view. Some theater-goers have noted that this can be isolating, as having designated seating may mean that a family member in need of interpreting services has to sit apart from the hearing members of their group (Page-Kirby, 2019). And while having an interpreter is useful for many, not all D/deaf and Hard of Hearing people use sign language. More recently, some theaters with a budget are offering live captioning through third party services such as GalaPro, an app that offers translations, captions, and audio descriptions for theater productions (GalaPro, 2019). The Israel-based company started in 2015 with the goal of providing live translation to audience members at Operas performed in foreign languages (McEntee, 2018).They quickly expanded their vision to include accessibility for non-English speakers, D/deaf attendees, and even blind/low vision viewers (McEntee, 2018). GalaPro states,"Our mission is to make the world of entertainment accessible and inclusive to everyone, at any venue, in any seat, anywhere in the world" (GalaPro, 2019). The app only works if the venue has specifically partnered with GalaPro. At the performance, audience members can download the app, connect to a closed WiFi circuit, and then follow along on their phone. In order to stay in sync with the live production, the app uses voice recognition technology—so if an actor skips a line, the captions will skip ahead, too (Page-Kirby, 2019). Though GalaPro and services like it are becoming more common in large theaters, especially those in New York City and on Broadway, they still haven't caught on in smaller, regional venues. Amateur productions especially, such as those hosted by colleges or primary schools, cannot afford such solutions and are therefore often inaccessible, despite the fact that accessibility is required by law.

Stepping Out: Develop Live Captions for a Small Theater

Inspired by apps like GalaPro and services like CART, but unable to afford these specific models due to limited institutional resources, the authors of this paper worked to devise an alternative solution. Our captioning design needed to meet the following criteria: it needed to be low-cost or free; discreet enough so as not to distract other viewers and the actors in a relatively small theater; and easily adjustable, as the timing of amateur productions has been known to fluctuate between performances. Due to these needs, we couldn't have one big screen to the side of the stage with captions, as some public theaters have done. We couldn't use a pre-recorded video with the dialogue because if the actors got ahead or behind on pacing, the captions would no longer be accurate, leaving viewers stranded. The obvious solution was to innovate with Hiram's Tech and Trek program, specifically the 1:1 iPad initiative.

Since the introduction of iPads into Hiram College classrooms, both professors and students have taken advantage of an app called Nearpod as a presentation tool. Nearpod is an interactive learning app that allows students to view slides and lessons on individual smart devices. The instructor controls the advancement of the slides, and can also add interactive features like polls, collaborative chats, and games. Co-founded by Guido Kovalskys, Emiliano Abramzon, and Felipe Sommer in the United States, Nearpod's name speaks to the app's goal—the need to stop technology from becoming a distraction in classrooms and instead use it as a tool for "close interactions" and learning opportunities (Rivero, 2012). Teachers can also monitor when students are logged in to the app and when they're not, ensuring effective participation. In these scenarios, smartphones and tablets in the classroom become valuable learning devices rather than taboo distractions. The same is happening in theaters, where apps like GalaPro rely on tablets and smartphones for delivery to individual users.

The app works by assigning a unique code to each presentation event. With the code, and depending upon the type of license, unlimited participants can sign in to the presentation by downloading the free Nearpod app or by navigating to the Nearpod website. The ability of one user in "teacher mode" to control the advancement of slides on the other participants' screens make Nearpod perfectly suited to be adapted as a tool for the manual facilitation of live captions. Furthermore, the app only needs WiFi to function, so users on cell phones can put their phone in airplane mode to prevent text or call disruptions during the performance.

We innovated to expand the use of Nearpod to live captioning in order to provide an accessible experience for the Hiram College Theatre production of the musical *Stepping Out*. The second author had attended previous productions at the theater, but "missed" much of the content each time. Therefore, she envisioned leveraging technology resources already available to provide Hiram College's first live-captioned theatre performance and reached out for some help with execution. First, a copy of the script had to be obtained from the theatre department. This was a challenge, and the second author had to dance around the staff's two major concerns: 1) that sharing a script did not violate copyright (as the ADA allows such sharing when the intent is to create an accessible digital format); and 2) that providing captions would not prove to be a distraction to other theater goers, as projecting captions on the wall of a small theater might be.

Since the script existed only as a hard copy, which the second author was not permitted to remove from the building, it had to be copied on the very basic theatre department copier. Then, with the assistance of the first author, it was digitized on a more robust copier and scanner, which allowed saving the digital format to a flash drive. The scan by default resulted in an inaccessible PDF format, composed of images of pages rather than readable pages. To render these images as "text" for further manipulation, the file was imported into a computer that had Adobe Acrobat Pro, which could apply Optical Character Recognition (OCR) to convert the PDF to an accessible format. Then, the text in the pdf was copied and pasted into a Microsoft Word document for easier editing. Next, the script had to be edited into a "subtitle" format. This meant removing stage directions, though sound descriptions remained (i.e., "*car horn honking*"). Several sections of text were not picked up by the OCR due to ink smudges on the page, and thus were not translated into text, presenting another challenge. The play's director was consulted to help edit the garbled sections.

The next step was to transfer the script dialogue from a document form into a slide format that could integrate with Nearpod. We experimented with the Apple presentation software, Keynote, since all Hiram students have an iPad with Keynote installed. However, Keynote does not integrate with Nearpod, so we utilized Microsoft PowerPoint (PPT) instead.
When designing slides, we needed to consider two aspects of the slide text: *font size* and *contrast*. With respect to *font size*, there are two competing needs: 1) a font size easily viewed on a mobile device, including smart phones; and 2) limiting the frequency with which slides need to be advanced, since there is a lag between when the Teacher advances a

slide and when the Students view it. A 36pt font with about nine lines of dialogue per screen was a good compromise. Native PPT bullets were used to signal each actor's lines in turn. *Contrast* between font color and background was another consideration, as it affects both readability of the screen and possible distraction to other theater goers. We decided upon white text on a black screen, which is high contrast and therefore easier for users to read, while the dark background minimizes a digital glow, and therefore distraction, in the dimmed theater.
When the presentation was complete, we imported it into the Nearpod Teacher app for use in a real time session; although only one performance was scheduled to be captioned, the presentation could have been reused as many times as desired. The performance dress rehearsal provided a "proof of concept" even before the slides were completed. The first author advanced slides in Teacher mode while another accessibility advocate and colleague viewed the slides in Student mode and provided feedback. Attending the dress rehearsal allowed us to identify and address the lag issue and also to identify where the performance deviated slightly from the script, which resulted in adjustments based upon a comparison with the director's annotated script.

The captioning of the actual performance proceeded smoothly, with the first author advancing slides on her iPad while theatre goers viewed the production and simultaneously, on their personal iPad or Smartphone, the Nearpod presentation. As the second author commented after the experience, "While the actors tap-danced, argued, cried, and gossiped on stage, the captions brought the full experience to hard-of-hearing audience members…I felt elated that my months-long dream had become a reality." (Kemerling, 2019; view an image here as well). Administrators at the college were very enthusiastic about the powerful and efficient accessibility solution. Happily, the theatre department was so impressed with the smooth and discrete solution that they asked that the next production be captioned in a similar way, thus truly demonstrating that their initial view of captioning as a "distraction" had moved to one of "traction" moving forward.

Next Steps

The process of implementing live captioning on a small college campus using a free, innovative technique revealed that creating accessible environments doesn't need to be expensive. It does, however, require a little extra time, creativity and thoughtfulness. The process revealed that while financial and human resources do pose a barrier to creating equal access, perhaps an equally significant barrier is the lack of disabled voices in decision making processes and the lack of awareness surrounding

the need for accommodations. While Hiram College's theater department was hesitant at first to deviate from the norms of theater culture and allow digital devices to be used for captioning, they came around to the idea once they saw it in action and saw its positive impact on hard-of-hearing audience members. This proves that education on and experience with accessibility can have a positive impact on perceptions. The critique that disability experiences are often a second thought, if a thought at all, in the planning of events, courses, etc., is not a critique that falls just on institutions of higher education. This problem is rooted in the culture and history of the United States. It's the reason why 30 years after the passage of the Americans with Disabilities Act, disabled Americans are still fighting for their rights. For example, in 2015 the National Association of the Deaf filed a federal class-action lawsuit against Harvard and the Massachusetts Institute of Technology (MIT) for failure to provide captioning for online courses, despite the fact that this is required by law (Leuc, 2020).

Judy Heumann, a recognized disability rights activist, and John Wodhatch, a disability rights lawyer, captured the problem perfectly in an article for *The New York Times* titled "We're 20 Percent of America, and We're Still Invisible" (2020). Heumann and Wodatch wrote, "…laws can only do so much. To be fully realized, the people themselves must do more than follow them by the letter. They must embrace their spirit." (2020). In other words, laws and funding, while important, are not nearly enough if thinking about and planning for disability is not an integrated part of society.

At Hiram College, the success of using Nearpod to provide captions, and the realization that there was no set process for requesting accommodations at co-curricular events, led to the creation of an "Event Accessibility Checklist" that walks event planners through accommodation considerations, from captioning to dietary-friendly food options to quiet spaces for attendees who may find social situations overwhelming. The Hiram College Student Senate now requires completion of the checklist before funding or approval to host student events on campus. We hope that "stepping out" to integrate disability considerations into the culture will continue to gain traction, so that rather than "dance around" barriers, community members will not encounter barriers at all.

References

Adams, K., & Hollenhorst, M. (2018, November 22). 3 innovations that started out as inclusive design solutions. *Marketplace*. Retrieved from https://www.marketplace.org/2018/11/22/3-innovations-start-

ed-out-inclusive-design-solutions/
Americans With Disabilities Act (ADA) of 1990. (1990). Public Law 101–336. 108th Congress, 2nd session (July 26, 1990). Retrieved from https://www.ada.gov/
Brown, Lydia X.Z. (2011, November). The Significance of Semantics: Person-First Language: Why It Matters. *Autistic Hoya*, Retrieved from https://www.autistichoya.com/2011/08/significance-of-semantics-person-first.html
Collaborative for Communication Access via Captioning (CART). (2016). What is CART and FAQs – Find a CART captioning provider. *Captioning activism and community*. Retrieved from http://ccacaptioning.org/faqs-cart/
Dolmage, J. T. (2017). *Academic Ableism.* Ann Arbor, MI: University of Michigan Press.
Finkelstein, V. (1980). *Attitudes and Disabled People: Issues for Discussion.* New York: World Rehabilitation Fund.
GalaPro. (2019). *What we do*. Retrieved from https://www.galapro.com/
Goering, S. (2015). Rethinking disability: The social model of disability and chronic disease. *Current Reviews in Musculoskeletal Medicine 8*(2): 134–138. DOI: 10.1007/s12178-015-9273-z
Goldberg, L. & Rothberg, M. (2013, January 28). Born digital – And accessible [Webinar]. *Educause ELI webinars*. Retrieved from http://www.educause.edu/library/resources/born-digital-and-accessibl
Harbour, W.S., & Greenberg, D. (2017). NCCSD Research Brief: Campus Climate and Students with Disabilities. *National Center for College Students with Disabilities (NCCSD) Research Brief, 1*(2), 2–27.
Heumann, J., Wodatch, J. (2020, July 6). We're 20 Percent of America, and We're Still Invisible. *The New York Times.* Retrieved from https://www.nytimes.com/2020/07/26/opinion/Americans-with-disabilities-act.html
Holmes, K. (2018). *Mismatch: How inclusion shapes design.* Cambridge, MA: The MIT Press.
Jacob, S. (2015, June 2). History of Technology Advances Inspired by Disability. *Infinitec.* Retrieved from http://www.infinitec.org/history-of-tech-advances
Kemerling, A. (2019, December 5). The story behind Hiram's first captioned theater production. *Hiram News*. Retrieved from https://www.hiram.edu/hiram-news/the-story-behind-hirams-first-captioned-theater-production/
Leduc, J. (2020, March 5). Overview of NAD v. Harvard and NAD v. MIT Lawsuits. *3Play Media*. Retrieved from https://www.3playmedia.com/blog/harvard-mit-sued-captioning-violation-ada-rehabilita-

tion-act/#:~:text=In%20the%20NAD%20v.,quality%20of%20the%20captions%20provided.

Mace, R. (1985). Universal design : Barrier free environments for everyone. As cited by The Center for Universal Design, College of Design, NC State University. Retrieved from http://www.ncsu.edu/ncsu/design/cud/about_ud/about_ud.htm

Mamiseishvili, K., & Koch, L. C. (2011). First-to-second-year persistence of students with disabilities in postsecondary institutions in the United States. *Rehabilitation Counseling Bulletin, 54*(2), 93–105.

McEntee, B. (2018, April 16). GalaPro app provides all-access experience for theatregoers. *American Theatre*. Retrieved from https://www.americantheatre.org/2018/04/16/galapro-app-provides-all-access-experience-for-theatregoers/

Meyer, A., Rose, D. H., & Gordon, D. T. (2014). *Universal Design for Learning: Theory and practice.* Wakefield, MA: CAST Professional Publishing. Retrieved from http://udltheorypractice.cast.org

Miller, J. L., & Varonis, E. M. (2017) Transitioning to blended eight-week delivery: A case study in adult education. In L. Morris & C. Tsolakidis, C. (Eds.), *The Proceedings of the International Conference on Information Communication Technologies in Education 2017*, 271–284. United Kingdom: Southampton Solent University. Retrieved from http://www.icicte.org/ICICTE_2017_Proceedings/8.1_Miller_Varonis_2017.pdf

Nario-Redmond, M. (2020). *Ableism: The Causes and Consequences of Disability Prejudice*. Hoboken NJ: Wiley Blackwell.

National Center for Education Statistics. (2019). *Fast facts: Students with disabilities.* Retrieved from https://nces.ed.gov/fastfacts/display.asp?id=60.

Oliver, M. (1996). *Understanding Disability: From Theory to Practice*. St. Martin's Press.

Page-Kirby, K. (2019, March 7). Arena Stage, Signature Theatre debut accessible captioning technology. *The Washington Post.* Retrieved from https://www.washingtonpost.com/express/2019/03/08/arena-stage-signature-theatre-debut-accessible-captioning-technology/?noredirect=on

Rivero, V. (2012, May 10). Interview: Getting cozy with Nearpod. *EdTech Digest*. https://edtechdigest.com/2012/05/10/interview-getting-cozy-with-nearpod/

Roy, E. (2016, July). *When we design for disability, we all benefit.* [Video]. TED Conferences. Retrieved from https://www.ted.com/talks/elise_roy_when_we_design_for_disability_we_all_benefit/up-next

Scott, S. (2019). Access and Participation in Higher Education: Perspectives of College Students with Disabilities. *National Center for College*

Students with Disabilities (NCCSD) Research Brief, 2(2), 2–21.
Solsman, J.E. (2017, April 10). Internet inventor: Make tech accessibility better already. *Cnet*. Retrieved from https://www.cnet.com/news/internet-inventor-vint-cerf-accessibility-disability-deaf-hearing/
Text messaging revolution for the hard of hearing. (2001, July 9). *The Irish Times*. Retrieved from https://www.irishtimes.com/news/text-messaging-revolution-for-the-hard-of-hearing-1.316903
U.S. Department of Education, National Center for Education Statistics. (2019). *Digest of Education Statistics, 2018* (2020-009, Chapter 3). Retrieved from https://nces.ed.gov/programs/digest/d18/ch_3.asp.
Varonis, E. M. (2019). Preface to the proceedings. In E. M. Varonis (Ed.), The Proceedings of the International Conference on Information Communication Technologies in Education 2019, vii–viii. Chania, Greece: ICIDTE. Retrieved from http://www.icicte.org/assets/0.1-preface.pdf
Varonis, E. M. & Varonis, M. E. (2018). Mentor in the Middle: Reimagining the Roles of Teacher and Learner through Mindful Technology. In L. Morris & C. Tsolakidis, C. (Eds.), *The Proceedings of the International Conference on Information Communication Technologies in Education 2018,* 139–151. United Kingdom: Southampton Solent University. Retrieved from http://www.icicte.org/assets/4.2_varonis_varonis.pdf
World Wide Web Consortium (W3C). 2018. Web Content Accessibility Guidelines. *Web Accessibility Initiative*. Retrieved from https://www.w3.org/WAI/standards-guidelines/wcag/
World Health Organization. (2011). World Report on Disability. *World Health Organization*. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/70670/WHO_NMH_VIP_11.01_eng.pdf

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