PATTERNS OF MOBILE TECHNOLOGY USE IN TEACHING: A PILOT STUDY

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ABSTRACT

The use of mobile learning spaces is an opportunity to break the boundaries of the classroom and to prepare student-teachers towards teaching classes tailored to the future teaching market, while providing the tools and inspiration to lead change in schools. The purpose of this precursor study is to examine the subject of implementing mobile technology and usage patterns in the mobile technology space among the students and lecturers in a teacher training college. Another objective is to set the potential of mobile technology for teaching on the challenges which this combination conveys. Accordingly, patterns of teaching and learning were examined in the mobile learning space, as well as the role of pedagogical support and guidance in relation to the methods used and the attitudes of the lecturers and students toward teaching and learning in the mobile learning space.

The paradigm of the present study is the mixed research model combining quantitative and qualitative research. The study included the faculty members teaching in the course of the year and the students studying in this learning space. The research tools included a questionnaire administered to teachers and students at the end of the two semesters, discussions with five of the lecturers and with the support staff as well as meetings with the leading faculty in the college. Simultaneously, three lessons in the mobile learning space were videotaped and then analyzed.

The findings show that most of the lecturers do not use hybrid computers in the learning space for various reasons: some need technological and / or pedagogical support, some believe that it is not relevant to their teaching; also the number of student users is low. As a result of this study, the findings obtained can highlight models for implementing mobile technologies in teacher education institutions and contribute to decision making in the acquisition and design of the technological learning space in the teacher education college.

KEYWORDS

Mobile technologies, hybrid computers, learning space, tablets

1. INTRODUCTION

As a result of the accelerated technological development that transpires all around us in the digital age, we are required to adapt to frequent changes in our environment. The majority of teaching staff in teacher education programs were not born into the digital-informational revolution, and so must undergo training themselves to prepare for digital proficiency.

For the increased incorporation of technologies, Daggett (2005) argues that a shift in focus is necessary, from teacher-centered instruction to student-centered learning in which teachers take a secondary position as directors, guides and supporters of the learning process. According to Daggett, this will help students develop leadership skills, teamwork and other competences necessary and relevant to challenging issues related to everyday life and to the needs of the future workforce. The education system must therefore modify its teaching methods for the oncoming wave of digitally-proficient students, their skills, experiences and needs.

The benefits of mobile learning to the training of pre-service teachers can be numerous and are expressed in different facets of education, including cooperative learning, contextual, constructivist and authentic learning. Mobile-based learning facilitates location-based learning, among other flexible, unconventional teaching strategies.

Teaching in the 21st century requires teacher and student preparation for educational settings by using relevant, meaningful and challenging teaching methods, and by leading innovative pedagogy. This requires to empower educators to realize the potential of anytime, anyplace mobile learning through disruptive schooling transformation (Dede, 2011). The use of mobile learning spaces is an opportunity to break the boundaries of

the classroom and to prepare student-teachers towards teaching spaces tailored to the future teaching market, while providing the tools and inspiration to lead change in schools.

2. THEORETICAL BACKGROUND

2.1 Traditional to Innovative Pedagogy in School Context

Mobile learning can be implemented 24 hours a day, 7 days a week. It allows mobility at five levels: mobility in the physical space, technological mobility, mobility in the conceptual space, mobility in the social space and decentralized learning (Sharples et al., 2007). Naismith et al. (2004) define six theory-based categories of mobile activities, including behaviorist, constructivist, situated, collaborative, informal/lifelong, and support/coordination. According to Squire & Klopfer (2007), individuality is the most unique feature which distinguishes between mobile devices and other technologies. The learners can attain a sense of ownership of the learning process and feel that they are independent and autonomous learning agent in their learning environment (Kearney et al., 2012). The features of mobile technology require educators' attention in order to harness these resources to teaching and to formulate and adopt an updated pedagogy. The innovative pedagogy focuses on the transition from teaching to knowledge building and changes the power foci of teachers and learners, of the learning activity and of the role of technology. According to the model conceived by Shulman (1986), "teachers' knowledge" cannot be defined without the relation between the area of knowledge content and pedagogy. Teachers are expected to acquire the required unique knowledge which will allow them to teach various content areas in a unique way by means of technology. Moreover, they can choose appropriately between learning contents, technological means and pedagogical aspect (TPACK – Technological Pedagogical and Content Knowledge) so that they make an informed pedagogical use of technologies (Koehler & Mishra, 2005). Conole & Culver (2010) argue that, although new technologies evoke varied opportunities for innovative, proactive and effective learning, in practice teaching duplicates the traditional teaching and does not exploit the possibilities offered by the technology. The researchers maintain that this stems from the fact that teachers are unaware of the potential embodied in the new technologies and lack competences to design learning activities which effectively make use of the technology. Educators need to think about adapting teaching methods to the changing world, whereby ICT activities are currently integrated into teaching. Puentedura (2011) suggests the SAMR framework for characterizing the level of technology-integrated teaching. This model consists of four levels: Substitution, Augmentation, Modification and Redefinition – a level which is parallel to the high levels of thinking – synthesis and assessment – leading to teaching and learning models which are different from those not using technology. As with the integration of any technology, integrating mobile technologies in teaching raises concerns regarding the exploitation of technology capabilities and effective ways of integrating education technology.

2.2 Pedagogical Uses of Advanced Mobile Devices

Incorporating mobile technology in teaching can provide a chance for educators to bridge the gap between the school environment and the extracurricular environment. Allowing learners to use technologies in which they are versed can empower students, enrich learning, and make it more meaningful and relevant. In this context, Laurillard (2007) suggests adopting a pedagogy that both promotes quality learning and is more sustainable and flexible than traditional teaching methods. It is crucial trying to understand the type of exercises required for learning complex concepts and higher-order thinking skills, and develop pedagogical applications that yield the desired learning results. Like Laurillard, Sharples (2007) also claims that in order to develop innovative educational activities, it is necessary to integrate technology and learning in a manner whereby pedagogy and learning theories rather than the technology are the driving forces. Naismith & Corlett (2006) also provide a review of technologically-oriented pedagogies. They suggest taking advantage of the unique technology affordances that can contribute to an enhanced user experience.

The purpose of this precursor study is to examine the issue of implementing mobile technology and usage patterns in the mobile learning space (MLS) among the students and lecturers in a teacher education college. Furthermore, another objective is to set the potential of mobile technology for teaching on the challenges which this combination conveys. Accordingly, patterns of teaching and learning were examined in the MLS,

as well as the role of pedagogical support and guidance in relation to the methods used in the MLS and the attitudes of the lecturers and students to teaching and learning in an MLS.

The research questions were:

1. What practices are implemented by lecturers who teach in the mobile technologies' space, including hybrid computers (tablets and laptops)?
2. To what extent do lecturers implement in their teaching practices the use of mobility features of hybrid computers (tablets and laptops) in the MLS and beyond the MLS boundaries?
3. How do students experience learning in the mobile learning space?

3. METHODOLOGY

The research participants included the faculty members teaching in the course of the year (29 taught and 13 responded to the questionnaire), and the students studying in this learning space (21 of which responded to the questionnaire). Two related technical supporting people and a pedagogical supporting person also participated in the study.

The research tools included a questionnaire administered to instructors and students at the end of the two semesters, personal conversations with five of the lecturers and with the support staff as well as meetings with the leading faculty in the college and information minutes of meetings held throughout the year. Simultaneously, three lessons in the MLS were videotaped and then analyzed.

This study employed a mixed-method approach which combines quantitative and qualitative research methods (Johnson & Onwuegbuzie, 2004; Keeves, 1998). Data was obtained regarding the practices applied by lecturers who teach in the mobile technologies' space, teachers' level of using the mobility features of hybrid computer (HC) and the way students experience learning in the MLS. The HCs are devices that can switch between acting as a tablet and a laptop, being more powerful than standalone tablets and facilitating portability and flexible use in and beyond the MLS. The quantitative data were collected by analysis of the pre and post questionnaires. In addition to the quantitative findings, students and lecturers expressed their opinion in the open-ended questions. Additional data were collected through the conversations with the lecturers, the support staff, the video tapes of the lessons and the information minutes of meeting scheduled through the year. The design was useful as it enabled to further analyze unpredicted quantitative results and provided an expanded understanding of the results (Creswell, 2009).

4. THE LEARNING SPACE AND THE RESEARCH PROCEDURE

During the academic year 2014 a mobile learning space comprising 26 computers was built. The planning of the space was underpinned by the thought that perhaps this space was not necessary for the purpose of teaching mobile learning applications. The lecturers and students can settle for available mobile computers and tablets which will serve for a variety of applications and activities, independently of the space and the lesson time. Following the contribution of HCs, the college has decided to make use of this space as modeling for the pre-service teachers for varied uses and for creating an innovative and diversified teaching, including teaching and learning processes beyond the class boundaries as well as examining models to be used in this kind of space. The college made arrangements for launching the space, which consisted of technical and pedagogical aspects. The first semester was mainly designed for providing a technological response. Only towards the second semester pedagogical thinking was initiated with some of the lecturers who taught in the space. Towards the planning of the space, several aspects had to be considered: the space location, space organization, staff training, managing the use of the space, technical support during the hours of using the space, pedagogical support, safety of the equipment and interactive board.

Most of the 29 lecturers who taught in the MLS (22 lecturers) taught one course, four lecturers taught two courses and three lecturers taught three courses. As for the students, as some have learned more than one course, it was difficult to estimate their numbers. At the end of the first semester, 7 lecturers responded to the questionnaire. At the end of the second semester 6 lecturers and 21 students responded to the questionnaire. In order to maintain anonymity of the participants, the students' names were replaced by numbers and the names of the lecturers were replaced by other names.

5. FINDINGS

This chapter presents the quantitative and qualitative findings with respect to lecturers and students as derived from various data. A few themes emerged throughout the analysis of the qualitative and quantitative data: 1. The extent of use and the type of use of the HCs, 2. Pedagogical and technical support, 3. Technical difficulties, 4. Organization of the learning space, 5. Attitudes towards teaching and learning in an MLS.

5.1 Pedagogical Uses of Advanced Mobile Devices

Three main patterns of use by the lecturers were identified: Use of the HC as a laptop or desktop (common use), use of the HC for running applications (reasonable use) and the use of the HC for location-based activities (limited use). Table 1 presents the three patterns of use and the students and lecturers excerpts.

Table 1. Students (N=21) and lecturers (N=13) excerpts regarding HC usage

Type of Use of HC	Excerpts
As a portable computer or a desktop computer	"Mobile technology enables individual work and work carried out in the classroom, sending email to the lecturer and there is no need to rewrite..."; "... I'm not a big believer in computers. If I integrated them it would be from fourth grade and up, and this is not the population I work with..."; "... instead of bringing one's laptop, the tablets can be used".
To run computer applications	"... You can use this class to implement the use of new software applications and for the use of cooperative learning... ".
Location based activities outside the classroom	-

Some of the lecturers who did not intend to use the computers at all, used them due to their availability in the MLS for surfing the Internet, writing and editing, as part of their planned lessons. Some of the lecturers made use of HC to work collaboratively and a few made use of social networking and of the computer cloud. Although most students indicated that they did not use the HC, some of them were aware of the applications that can be performed by using mobile technologies. Most suggestions for implementing mobile technology options came from students who studied in the technology track or with ICT lecturers. Suggestions included Internet applications, writing joint papers, and working in groups on Google Drive. Analysis of the observations of the three videotaped lessons revealed diverse use of the HCs. One lesson involved collaborating in class through the use of playlists on YouTube, as well as the students creating and communicating through their own discussion threads on Facebook. In the second lesson the HCs were used for drawing and presenting the drawings on the interactive whiteboard. In the third lesson the HCs were used for an activity based on QR Codes which students conducted beyond the class boundary. In the current year there was a limited use of HCs by lecturers and students.

Students' responses were similar to the lecturers' answers about the limited amount of their use of the hybrid computers (about 50% did not use the HC, about 35% used the HC for a lesson or two, about 10% used the HC in a large number of lessons and about 5% used the HC in all lessons). Although the use of HC was limited, some of the lecturers who had used the hybrid computers reported a variety of uses and applications. Some students wrote on Moodle blogs on their HCs and shared their writing on the whiteboard/screen. Others created collaborative Google Docs on their HCs, which their lecturer then shared on the whiteboard for all of the class to see and give feedback. Another activity involved explaining meaningful teaching and learning through text, pictures, video and sharing them via the Padlet application. Finally, one classroom utilized online document management and cloud services via their HCs. The quantitative data provided information on the extent to which the HCs were used by faculty and students, and the type of use they implemented. Table 2 presents the type of use of hybrid computers lecturers made during their lessons.

Table 2. The type of use lecturers did with HC (N=13).

Amount of use	Number of lecturers (%)
Did not use	6 (46.2)
Running applications	3 (23.1)
Run Office and access to the Internet	2 (15.4)
Location-based activities outside the classroom	2 (15.4)
Total	13

The few lecturers who used the HC during their lessons mainly used them for running applications (23.1%), for using Office software and accessing the Internet to retrieve information (15.4%) and for location-based activities (23.1%). These findings show that most of the lecturers did not use HC in the learning space for various reasons: some need technological and / or pedagogical support, some believe that it is not relevant to their teaching; also the number of student users is low.

5.2 Pedagogical and Technical Support

The lecturers were asked to which extent they wished to receive technical and pedagogical support. Lecturers' answers are presented in Table 3.

Table 3. Lecturers' wish to receive technical and pedagogical support (N = 13).

Category (Likert 1-4)	Technical support N (%)	Pedagogical support N (%)
Not relevant	5 (38.5)	3 (23.1)
Not at all	2 (15.4)	2 (15.4)
To a small extent	-	-
Reasonably	5 (38.5)	7 (53.8)
To a great extent	1 (7.7)	1 (7.7)
Total	(100) 13	(100)13

Table 3 shows that about half of the lecturers are interested in technical support (46.2%) and over half of them (61.5%) are willing to get pedagogical support. Lecturers that did not receive pedagogical and / or technological support regarding the use of HC, did not use them during their lessons. The importance and necessity of support becomes very prominent. Some of the lecturers are interested in getting practice time in order to get familiar with the learning space, equipment and functionality.

Some of the lecturers (30%-40%) say that hybrid computer and / or laptop are not relevant to their work and therefore they have no interest in technical or pedagogical support. Sometimes they also explain the lack of relevance from their perspective. Some of the lecturers demonstrate a wish to get pedagogical support in the use of HC for the purposes of teaching. Prior to getting pedagogical support, lecturers are primarily using the HC for Internet access, using Office, drawing, introducing applications to their students with special

needs and downloading applications. Half of the lecturers who responded to the questionnaire have the intention to use mobile technology in the future, given the appropriate support. Some of the lecturers have raised the challenge of the need to rethink the lessons' properties and means of transmission. Limor offers: "... It is important to rethink characteristics of the lessons and of teaching methods".

5.3 Technical Difficulties

Although the technical support was available, lecturers reported technical difficulties which included: sensitivity of interactive whiteboard leading to unexpected situations and difficulties operating it, sound problems, the fact that the room is not always opened on time, difficulty writing on the board. 6 says: "There are problems with electricity on the desks around the classroom, it is very difficult to connect everything and the electrical wire causes a mess". 14 says: "Improving the wireless network which does not always functions well… we used it in one lesson and what we had to do was to photograph with the camera in it but the photography software did not function in most of the tablets". Dana, a lecturer in the course sums this up: "… the biggest challenge is starting the lesson on time when all the functions are working and the room is arranged according to my request… ".

In order to overcome part of the difficulties, it is very important to support lecturers and aid them gain a feeling of comfort when using technology. Lecturers prefer mentoring and do not find interest in guidelines relevant to the use of space. Lack of control and familiarity with the implementation and harnessing of mobile technology in favor of teaching brought students to such sayings: says 4, "We used only once the tablets and the smart board. It is a shame we did not make more use of the learning space.", says 6, "... Today, as every student has a laptop this MLS is redundant...", says 11, "... I would very much appreciate getting to know how to implement them in my school".

5.4 Organization of the Mobile Learning Space (MLS)

Organization of the learning space often dictates the ways of usage and is also derived from the application of teaching methods. The lecturers were asked about the degree to which the learning space meets their needs. Table 4 presents lecturers' answers.

Table 4. The degree to which the Learning Space meets the instructors' needs (N = 13).

Category (Likert 1-4)	Number of lecturers	Percentage (%)
Not relevant	3	23.1
Not at all	3	23.1
To a small extent	1	7.7
Reasonably	6	46.2
To a great extent		
Total	13	100

As shown in Table 4, some of the lecturers were not satisfied with the space design. Some of the lecturers were disturbed by the fact that the space design prevented the sense of the group while working in groups. Suggestions regarding the organization of the learning space were made by the lecturers.

Says Neta "... As for the chairs, on the one hand, I would recommend bringing flexible chairs that come along with a small table. On the other hand, high mobility can cause distraction to students with learning disabilities...". 11 says: "... The MLS is very easy to use with laptops. There are many electrical outlets and the special interactive board is very convenient and practical for lecturers who use it properly...". It was

proposed to have a larger MLS with more flexible arrangement, so that the space is suitable for working in groups as well as in a circle of chairs or in a u-shaped format. The lecturers mentioned the challenges that such MLS poses to lecturers – the lecturers mentioned a few issues: a. Need to rethink the characteristics of their lessons and the teaching methods B. The need to know how to apply the different functions and gain pedagogical and technical support,. C. The possibility to conduct advanced lectures while typing on the tablet and presenting in the interactive whiteboard while moving around the space.

5.5 Attitudes of Teaching and Learning in an MLS

The main objective in teacher education is to prepare the pre-service teachers to implement at school what they have learnt. Only students in their technology courses were inspired to implement similar processes in the school. Despite the fact that findings indicate that there was a low rate of teaching with HCs, the answers to the open-ended questions and the conversations held demonstrate a desire to study and learn the use of HCs and the operation of the MLS. Still, the level of implementation mostly remained using the HC as a laptop. Instructors were able to run applications with technical support, but for conducting collaborative and location-based activities exploiting the mobility of the technology outside the learning space, lecturers needed pedagogical training and assistance.

Lecturers were mostly positive in implementing mobile learning after receiving technical and pedagogical support. As for the students, it is important to expose them to a variety and innovative teaching models as well as help them develop attitudes and deal with mobile technology implementation in their classrooms. Some students expressed their views about the use of HC and about computers in general. A number of students thought that integrating technology into teaching is unnecessary. 8 assumes that teachers are good enough and does not consider technology as part of an educational social reality. "... We teachers are good enough. ". Some students think that suitable conditions for innovative technology implementation do not exist yet in school. 2 says: "... The condition for this application is not yet here... There are very few localities in the periphery without computers and the Internet at home... ". 19 comments: "... Class tablets showed us a new and varied teaching, and I enjoyed the class." As appears from the following students: 14 says: "... You can try new ideas, teaching with tablets and after the attempt to implement it in the classroom... ".

6. CONCLUSIONS

The study emphasizes the fact that students and instructors should be made aware of the potential encompassed in the new technologies and get help in developing competencies necessary for shaping learning activities which effectively use the technology. When they gained pedagogical and technological support, lecturers tended to incorporate more constructivist and collaborative activities, as described also by Naismith et al. (2004). Out of the five levels of mobility described by Sharples et al. (2007), this study found two major patterns of HC implementation. The first is technological mobility in the social space, as demonstrated by the facilitation of collaboration. The second pattern of mobility involves the physical space, which prior to HC implementation had been restricted to the classroom. It is suggested to explore all five levels of Sharples et al.'s of mobility as part of the teacher training in the LMS.

Following this study, it is important to provide resources to lecturers who promote innovative teaching models and help them become acquainted with the properties and benefits of this technology. They should also be aware of the difficulties that are part of the process of implementing a new technology. The more educators are aware of the potential of the usage of mobile technologies, the more they can rethink their current pedagogy and implement the technology efficiently. The model of Peuntedura (2006), with its several levels of ICT integration, provides a useful tool to map this transformation of technology-based learning. Technology-based learning activities should not be aimed merely at replacing older tools, but should aspire to re-define the learning process and learning method and hence increase the level of interest and engagement of both pupils, students and lecturers.

Laurillard and Sharples argue that pedagogy and learning theories should drive the use of technology; this study too emphasizes the importance of providing close, personal, constant assistance to lecturers. In this study, technological and pedagogical support was offered to all teachers. Only some lecturers responded to

this offer, and it was these lecturers who reported a high level of comfort and competence with the technologies, and went on to implement them successfully in the classroom. Lecturers who did not take advantage of the support services offered, were not as comfortable with the technologies and the learning space they created was that of a traditional classroom. There is a need for further experimentation with the motivation of lecturers who are less technologically-inclined, so that the potential of a broader learning space is made clearer to them.

We are now in the second year of teaching in the MLS. At this early stage, we have focused on observing and defining learning needs, and providing support for the lecturers in implementing these relatively new practices. Some technological challenges have been resolved. For instance, since the devices belong to the institution and not to the students, lecturers and students are offered the option of using the college cloud computing, so that they can access the learning space from their own devices as well. There is still much to be examined, however. A similar study should be performed with a larger population of lecturers, and in-depth interviews performed to determine the technological and pedagogical needs of different disciplines.

The findings obtained can highlight the best suitable models for implementing mobile technologies in teacher education institutions and contribute to decision making in the acquisition and design of the technological learning space in the teacher education college. Another benefit derived from this experience is thinking about the design of technological spaces in the institution while relating to the different teaching preferences as well as to the learners' differentiation. Through slow, gradual introduction of the technology into the classroom, lecturers can gain pedagogical experience without being overwhelmed.

REFERENCES

[1] Daggett, W. R., (2005). Preparing Students for Their Future President, International Center for Leadership in Education. Presented at June 2005 Model Schools Conference.

[2] Dede, C., & Bjerede, M. (2011). Mobile learning for the 21st century: Insights from the 2010 Wireless EdTech Conference. *San Diego, CA: Qualcomm.*

[3] Sharples, M., Taylor, J., & Vavoula, G. (2007). A Theory of Learning for the Mobile Age. In R. Andrews and C. Haythornthwaite (Eds.) *The Sage Handbook of Elearning Research* (pp. 221-47). London: Sage.

[4] Naismith, L., Lonsdale, P., Vavoula, G., & Sharples, M. (2004). Literature review in mobile technologies and Learning, NESTA Futurelab Series.

[5] Squire, K., & Klopfer, E. (2007). Augmented Reality Simulations on Handheld Computers. *The Journal of the Learning Sciences*, 16(3), 317-413.

[6] Kearney, M., Schuck, S., Burden, K., & Aubusson, p.(2012). *Viewing mobile learning from a pedagogical perspective 2012*. A Centre for Research in Learning and Change, University of Technology, Sydney (UTS).

[7] Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.

[8] Koehler, M. J., & Mishra, P. (2005). (Lee Shulman - 1987) What happens when teachers design educational technology? The development of Technological Pedagogical Content Knowledge. *Journal of Educational Computing Research*, 32(2), 131-152.

[9] Conole, G., & Culver, J. (2010). The design of Cloudworks: Applying social networking practice to foster the exchange of learning and teaching ideas and designs. *Computers and Education*, 54(3) ,679–692.

[10] Puentedura, R. (2011). *Thinking About Change in Learning and Technology*. Presentation given September 25, 2012 at the 1st Global Mobile Learning Conference, Al Ain, UAE. Retrieved from: http://www.hippasus.com/rrpweblog/archives/2012/04/10/iPad_Intro.pdf.

[11] Laurillard, D. (2007). Pedagogical forms for mobile learning: Framing research questions. In N. Pachler (Ed.), *Mobile learning: Towards a research agenda*, 1, 153-175. London: WLE Centre for Excellence, Institute of Education.

[12] Sharples, M. (Ed.) (2007). *Big issues in mobile learning*. LSRI, University of Nottingham.

[13] Naismith, L., & Corlett, D. (2006). *Reflections on Success: A Retrospective of the mLearn Conference Series 2002-2005*. In Proceedings of the 5th World Conference on Mobile Learning, Banff, Alberta, Canada, 2006.

[14] Johnson, B. R., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher, 33*(7), 14-26.

[15] Keeves, J.P. (1988), Educational inspect methodology, as good as measurement: *An International Handbook*. Oxford: Pergamon Press.

[16] Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches. SAGE Publications, Incorporated.