

PEDAGOGICAL APPLICATIONS OF SMARTPHONE INTEGRATION IN TEACHING - LECTURERS', STUDENTS' & PUPILS' PERSPECTIVES

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ABSTRACT

As the disparity between educational standards and reality outside educational institutions is increasing, alternative learning infrastructure such as mobile technologies are becoming more common, and are challenging long held, traditional modes of teaching. Educators' attitudes toward wireless devices are mixed. Wireless devices are perceived by some teachers as a distraction to the educational process while others report the benefits of wireless devices to the learning process. Incorporating mobile technology in teaching can provide a chance for educators to lead innovative pedagogy.

This study was based on an experiment with middle school students, college students and college instructors. The aim of this study was to examine the extent to which the use of smartphones for teaching affects students' motivation. Moreover, it explored students' and instructors' attitudes toward the implementation of smartphones in education: the types of usage they implement and suggest and whether they think that smartphones should be implemented in academia as well as in schools at all.

The study was conducted by a qualitative and quantitative analysis. Relevant information was collected based on the questionnaires, correspondence as well as personal journals and interviews.

There was a difference in the difficulties various groups face. While the middle school students almost did not experience technical problems, the college students and their instructors needed much more technical assistance during the activities. Middle school 7th grade school students were highly motivated, demonstrated a high level of self-efficacy, found the activities interesting, learned new things and felt that they benefited from the collaborative work. Students expressed willingness to conduct such activities in the future; they said they would recommend such activities to their friends and would be excited to develop an activity of their own.

College students were skeptical regarding the implementation of smartphones in education. Although they could think of various applications of location-based lesson plans, there was no significant difference between the pre-test and the post-test regarding the extent to which they intend to incorporate smartphones in their teaching at school. There was also no significant difference in the extent to which they thought that school teachers should implement smartphones in their lessons and in the extent to which college lecturers should implement smartphones in their lessons.

College instructors were surprised to get acquainted with the "wonders" of technology. They considered the AR as "Hallucinatory" and could appraise the potential of the tool, but felt the need for more training prior to the implementation. They were practical and used the workshop in order to plan projects in the various disciplines that would benefit from the advantages mobile technologies offer.

College students and instructors mentioned the concern that not every student owns a smartphone, and were concerned that students will access improper content on school time.

There is a gap between school students, college students and college instructors in the ease and the extent they use mobile applications. In the transition period it would be useful to act side by side so that teachers can use innovative technologies for the benefit of their students' experience of best practices.

KEYWORDS

Mobile learning, 21st century skills, innovative learning, smartphone uses in education, motivation for learning

1. INTRODUCTION

The disparity between educational standards and reality outside educational institutions is increasing. Alternative learning infrastructures such as mobile technologies are becoming more common, and are challenging traditional modes of teaching. Benefits of mobile learning are 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. In particular, they offer knowledge-based learning tools allowing learning outside the classroom (Squire & Klopfer, 2007). Furthermore, they enable learners to engage in activities ranging from real-time or lapsed communication and collaboration with colleagues on location-based tasks.

Educators' attitudes toward wireless devices are mixed. There are teachers who report that using them increases the interest and involvement of students, as well as addresses different learning and teaching styles (Lamscheck-Nielsen & Jakobsen, 2009). Wireless devices are perceived by some teachers as a threat to their authority and a distraction to the educational process. To change the perception of mobile devices as a threat, the authors propose to examine the contribution of such technology to teaching and learning. Harnessing the availability of mobile devices and mobile Internet technology for teaching and learning can empower learning anywhere and at any time as well as allow better access to knowledge. This in turn makes learning relevant and adjusted to the information-savvy society in which we live.

Teaching in the 21st century, an era in which the ICT revolution is in full swing, requires teacher and student preparation to educational settings by using relevant, meaningful and challenging teaching methods, and by leading innovative pedagogy. In a reality whereby students own multimedia and personal communication devices, and are constantly acquiring new skills of information sharing and communication (Sharples et al. 2007), traditional classroom models where exams are held, content and dialogue is dictated by the curriculum and managed by the teacher do not fit in easily. These two worlds come into conflict when children bring mobile devices. Rather than focusing on the threat of mobile technologies to formal teaching, technological changes can be regarded as a positive challenge to schools, and a means of bringing teaching into the mobile technology age. Proper harnessing of the technological means available may facilitate flexible learning, that is, learning without the boundaries of time and place, characteristics that are increasingly in demand in the 21st century.

2. THEORETICAL BACKGROUND

2.1 21st Century Skills in the School Context

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 was not born into the digital-informational revolution, and so must undergo training themselves to prepare for digital proficiency. This generation of technology users has been called "Generation X", or "digital immigrants", and it is they who will educate Generation Y – the generation born into the information age (Prensky, 2009) and the ones who will educate and teach the "Z Generation". The education system must therefore modify its teaching methods for the oncoming wave of digitally-proficient students, their skills, experiences and needs.

Teaching in the present era calls for reference to technological transformations as well as attention to definition of school, teachers, learners and curriculum. 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 director, guide and supporter of the learning process. They believe that this is the only way for developing learners' leadership skills, teamwork and necessary and relevant skills which will assist them to cope with challenging daily issues. According to Daggett, this will help students develop leadership skills, teamwork and other competences necessary and relevant to challenging issues in everyday life and the needs of the future workforce. Additional skills required are creativity and ingenuity, communication and collaboration, critical thinking and problem solving (Salpeter, 2003). Training programs that take into consideration technological changes must be committed to address the reform needed in teaching methods and take advantage of the potential of mobile technologies for an innovative pedagogy in education.

2.2 From Traditional to Innovative 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 in a unique way various content areas 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). Salomon (2009) claims that the assumption that the very introduction of computers or any other peripheral equipment will change school and its teaching method was proven wrong. It is easy to acquire equipment but difficult to lead a cultural-systemic change. According to Salomon, the introduction of technology was not accompanied by a meaningful pedagogical change in the school culture, definition of teachers' role and work methods. Indeed, 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 (Conole & Culver, 2010). Conole & Culver 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 IT activities are currently integrated in teaching. Puentedura (2006) suggests a SAMR framework for characterizing the level of technology-integrated teaching. This model consists of four levels: (1) Substitution – at this level technology is used for replacing older tools; (2) Augmentation – this level is close to the first level of use with additional functions; (3) Modification – at this level technology is used more effectively. Parts of the task are re-designed, thus modifying the learning method; (4) Redefinition – this level 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 smartphones in teaching raises concerns regarding the exploitation of technology capabilities and effective ways of integrating education technology. Carrington's wheel of pedagogy (Carrington, 2012) maps the various applications according to the levels of thinking they encourage. The wheel of pedagogy can aid teachers in the process of development, characterization and outlining available applications in order to promote higher-order thinking skills and to effectively leverage technology for learning.

2.3 Mobile Technologies, Teaching and Motivation for Learning

Smart mobile devices allow the collecting, organizing, storing and presenting of information. They are equipped with advanced multimedia players, provide access to recently updated information, store contacts and allow for real time communication using a wide range of Internet environments. They also provide the possibility to synchronize information regularly and access it anywhere, any time.

Many cellular tools and applications that are being developed; are not intended specifically for educational purposes, but can nevertheless be used in the process of teaching and learning. One example of this is the QR Code generator. Another example is augmented reality digital information, known as "AR". Through AR, learners are able to gain immediate access to a wide range of location-based information, compiled and provided by a variety of sources. Students can be engaged and motivated to explore class materials from different angles (Kerawalla, Luckin, Selijefot, & Woolard, 2006) and gain real-world first-hand experience in subjects that were not feasible otherwise (Shelton & Hedley, 2002). These technologies bridge the gap between physical content, since they allow access to digital content based on printed materials (Johnson & Adams 2011). These features of mobile technology require attention from educators in order to harness these resources to teaching and to formulate and adopt an updated pedagogy.

When considering the use of mobile technologies in education, one promising aspect is student motivation. Learning by means of these technologies is often perceived by students as informal, enjoyable and motivational, even if the use does not involve interactive games. Fundamentally informal learning emphasizes learners' goals and interests rather than learning goals, and therefore has the effect of

strengthening learners' internal motivation (Sharples, 2007). Students engaging in mobile learning report that this gives them a sense of heightened control, ownership, fun, allows enhanced communication and enables learning in context (Jones et al., 2007; Sharples, 2007).

Mobile technologies offer many options that can be useful in teaching. Laurillard (2007) suggests creating learning activities that take advantage of the uniqueness of the technology. These technologies offer discovery and study of physical environments, maintaining synchronous and a-synchronous dialogue with colleagues. Mobile technologies also offer many options of information capture, access and manipulation. Enhanced feedback is also possible, as mobile platform allows for the tracking of processes.

In this context, Laurillard suggests adopting a pedagogy that both promotes quality learning and is more sustainable and flexible than traditional teaching methods. It is crucial to try understanding the type of exercises required for learning complex concepts and higher-order thinking skills, and develop pedagogical applications that produce 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 are the driving forces, rather than the technology. 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. Planning and design of learning activities must be specific and goal-driven. At the same time, the planner must take into consideration the added value of mobile technologies, to allow for teaching in the best possible way using the chosen teaching tool.

2.4 Pedagogical Uses of Advanced Mobile Devices

Wireless devices serve as a “compass” for finding new information (Vandi & Djebbari, 2011) and enable access to location-based information on the basis of interest and personal need (Hicks & Sinkinson, 2011). Among the advantages of mobile learning are the ability to design cooperative, contextual, constructivist and authentic learning. This type of learning integrates mobile learning and flexible teaching strategies.

Mobile devices can be used to investigate new content by turning passive data sources that contain huge amounts of information into interactive objects (Vandi & Djebbari, 2011). This makes learning more relevant, allowing learners to access information at the right time and place. Providing the opportunity to interact with the learning materials enables a kinesthetic learning approach. Mobile resources can be an ideal way to provide immediate assistance to students through the devices they own and use themselves, to provide background on what is learned and enable individually-paced learning (Chen, Teng, Lee & Kinskuk, 2011). The aim is for students to efficiently and effectively use mobile devices to enrich the learning experience (Fasimpaur, 2011). In addition, orientation-enabled mobile devices have an advantage in reducing memory load, real-time support satisfaction and facilitate classroom management processes.

Embracing these technologies that are broadly regarded as a nuisance, if used correctly, is certainly more constructive than the attempts to fight and resist technology in the classroom.

In conclusion, mobile phones and mobile applications offer a wide range of opportunities to educators and learners as well as the community by preparing its members for the wide range of subjects and skills necessary for the 21st century. The ubiquity of mobile devices today along with the empowering potential of these devices makes mobile technologies a great candidate for integration in learning, and useful for the skills needed for employment in the future. While it is clear what educators and pedagogues think of mobile integration in the classroom, students' opinions are still underexplored. The aim of this study was to examine the extent to which the use of smartphones for teaching affects students' motivation as well as students and instructors' attitudes toward the implementation of smartphones in education: the types of usage they implement and suggest and whether they think that smartphones should be implemented in academia as well as in schools at all.

3. METHODOLOGY

3.1 Participants

This study was based on an experiment with middle school students, college students and college instructors. The student group consisted of 32 seventh grade students who used their smartphones for learning a location-based activities unit regarding Australia. In addition, another two groups of 59 eighth grade students who learned a science unit using augmented reality smartphone technology and their counterpart group which consisted of 57 eighth grade students who learned the unit in a traditional manner participated in this study. The college group comprised 42 students studying towards a Master of Education degree in teaching combined with a teaching diploma. The average age of the students was 32 years. They were from various disciplines associated with the subjects taught in Israeli high schools, such as sciences, arts, history, and literature. The group of college instructors consisted of 18 members, average age 52. The instructors were from science discipline, math, computer education and art.

3.2 The Activities Implemented

School students - The seventh grade students completed an eight-hour unit, of which the smartphone-based activity comprised a two-hour lesson during which they expanded the vocabulary and enhanced their reading comprehension. They read stories about bears, koalas and marsupials. They then used their smartphones in groups of three students, along 10-station activities, relying on the information acquired during the previous lessons and discovering new knowledge. The workgroup allowed the students without a device to participate in the activity. In addition to the seventh grade students, four eighth grade student groups (116 students) participated in the study (Tshuva-Albo & Seifert, 2013). Fifty-seven participants (two classes) formed the experiment group and 59 participants (two groups) were the control group. The eighth grade students studied a science unit on interaction, using augmented reality through their own smartphones. Using their own smartphones enabled them to bypass the fact that they had no computers available at school. The activity included watching animations, videos clips, pictures, listening to podcasts and conducting collaborative activities in Google Docs and sharing them through their smartphones.

College students - The college students participated in a mandatory course on innovative technologies in education throughout a period of one academic semester. Two students conducted their smartphone-based activity with their peers during a 90-minute period. Class was divided into 9 groups of 4-5 to complete several sub-activities. Following the activity and based on the pedagogical models they were exposed to along the course, students were required to design an activity using smartphones efficiently.

College instructors - The college instructors participated in a 4-hour workshop in which they were instructed on mobile technology affordances. During the workshop, the lecturers came up with ways to implement various applications of mobile technologies in their teaching.

3.3 Instruments

Data presented in this study regarding the middle school and college students was collected before the activity through a pre- and a post-questionnaire. The eighth grade groups were compared based on an existing questionnaire (Midgley et al., 2000) on motivational components: level of interest and the perception of self-efficacy.

In addition, during the lesson immediately following the activity, a forum was assembled in which college students reflected on application of smartphone in their various disciplines, wrote their suggested lesson plans for their students and any comment they had. The questions focused on students' attitude toward implementation of smartphones in education and its contribution to learning.

College students were also asked whether they would implement it in their classrooms and whether they think that their instructors should implement smartphones in teaching. In addition, throughout their course, college students reflected on their work in a personal blog, where they described the process of lesson planning, and shared their work and thoughts with their peers and teachers. The instructors filled in a short questionnaire prior to the workshop and at the end of it.

The study was conducted by a qualitative and quantitative analysis. Relevant information was collected based on the questionnaires, correspondence, course forum and personal journals and interviews.

3.4 Findings

Among the 32 middle school students, 78% owned a smartphone and 22% did not. Among the college students who filled in the questionnaire (37), 74% owned a smartphone and 26% did not. Among the 18 instructors, 78% owned a smartphone and 22% did not. There was a difference in the difficulties various groups face. While the middle school students almost did not experience technical problems, the college students and their instructors needed much more technical assistance during the activities.

Middle school 7th grade school students found the activity interesting ($M=4.0$) on a range of 1-5. They learned new things ($M=3.5$) and they felt that they benefited from the collaborative work ($M=3.8$). Students expressed willingness to conduct such activities in the future ($M=3.5$); they said they would recommend such activities to their friends ($M=3.5$) and would be excited to develop an activity of their own ($M=3.8$).

Eighth grade students who experienced AR technology were found to be highly motivated compared to the control group: an average level of interest of ($M = 4.4$) compared to the control group ($M = 3.7$) and was found significant ($P < 0.05$, $t(114) = 4.9$). As for the perception of self-efficacy, the average rate of the experiment group who experienced AR was higher ($M = 4.39$) than the average of the control group ($M = 3.78$) and was found significant ($P < 0.05$, $t(114) = 4.6$).

School students think that smartphones could assist them in their learning. one student stated that when using his smartphone it helps him to concentrate and enables him to learn more.

College students were skeptical regarding the implementation of smartphones in Education. There was no significant difference between the pre-test and the post-test regarding the extent to which college students intend to incorporate smartphones in their teaching at school. There was also no significant difference in the extent to which they thought that school teachers should implement smartphones in their lessons and in the extent to which college lecturers should implement smartphones in their lessons.

In general, the mere exposure to the smartphones and the personal experience brought the students to consolidate their attitudes toward the subject and to think about appropriate ways to integrate smartphones in teaching. In addition to the quantitative findings, students expressed their opinions in the open-ended questions and in the forum and blog. Students' responses included a number of aspects: strong opposition for classroom use and adherence to traditional teaching methods, ambivalence while raising objections and suggestions for implementing controlled use of smartphones as part of planned process. Some students favored the usage as raising motivation and as part of the ideology of no prohibition of the usage of smartphones in class. Others favored the implementation only after setting clear instructional goals. Some students changed their opinion after they experienced location-based activity. Based on the pedagogical models they acquired during the course, some students were able to design activities that promoted higher-order thinking skills and were able to use smartphones effectively.

College instructors were surprised to get acquainted with the "wonders" of technology. They considered the AR as "Hallucinatory" and could appraise the potential of the tool, but felt the need for more training prior to the implementation.

We found a difference in the way the three generations relate to smartphones and mobile technology: Middle school students use their smartphones to download and listen to music, Facebook, download applications and contact friends and family. If mobiles were allowed in class, students stated they would use them for translation, recording, taking notes, taking pictures of the board instead of copying the material, use the internet to clarify issues and expand knowledge, calculator, text to voice software and spellchecking. In the post-test they suggested using their smartphones in order to take exams, view maps in geography, learn history facts and solve math riddles. Some students felt that using the various functions smartphones offered could save a lot of time in the classroom. College students, on the other hand, use smartphones for surfing the Internet, as a GPS, learning management, Facebook, recording lessons, chat, watch alarm and taking notes. Most instructors use smartphones for making calls, time management, mind maps, keeping a calendar, and very few other applications, which they discover gradually.

Middle school students found the activity interesting ($M=4.0$), learned new things ($M=3.4$) and benefitted from the collaborative work. Participating students enjoyed the activity ($M=3.0$, $SD=1.1$). For most of the students, this activity was different from the usual types of lessons they have experienced. They learned an innovative topic and had to participate in an activity designed by two of their peers. The students who designed the activity received guidance during a 6-week preparation phase. Following the activity, students presented their ideas regarding smartphone incorporation in class in their various disciplines giving ideas in fields such as: History, Literature, Biology, Physics, and Communications to name but a few. There was no significant difference between the pre-test and the post-test regarding the extent to which students intend to

incorporate smartphones in their teaching at school. Students mentioned the concern that not every student owns a smartphone, and were concerned that students will access improper content on school time.

College instructors were practical and used the workshop in order to plan projects that would benefit from the advantages mobile technologies offer. For both teachers and students, participation in smartphone-based activities was eye-opening: it was more of an experiential teaching experience than any lecture could be. After the activity, students were less skeptical about the potential of smartphones in education.

Further examples of activities of location-based learning implemented by the students and instructors and further findings will be presented in the lecture.

4. CONCLUSION

Despite the benefits of having students bring their own devices, it is necessary to deal with the variability and the wide variety of types of devices which students possess and find means to deal with technical difficulties.

Middle school students were very excited about the prospect of incorporating cell phones and AR into their learning. Incorporating smartphones and AR can increase the elements of interest rate and provide students with a learning space in which they can act and research different topics, having the teacher spark their imagination and guide them along the process. Designing the learning environment in a way that harnesses the potential of available technologies and engages the learners can promote a number of factors such as the level of motivation: pleasure, curiosity, access to information, interactivity, diversity and address learning differences. From the teachers' perspective, preparing the units was an innovative and intriguing experience which propelled them on a professional level as professional teachers in the 21st century.

College students, on the other hands, were very reluctant to implement smartphones in their classrooms. One reason that college students' attitudes did not markedly change after the activity could be that students who participated in this study are still in training. When they begin teaching in schools, they will first need to make sure they can establish themselves respectably in their new setting. Only then will they be ready to lead new changes. Once teachers experience the implementation of an activity with mobiles and overcome technology difficulties, they start considering interdisciplinary activities such as an activity combining English and history, exposing students to art, music, architecture and, thus, gaining reading comprehension, grammar and vocabulary. Another reason for the students' lack of perspective shift may be that the activity in which they participated wasn't directly related to their area of expertise and they did not experience the integration of the activity they designed in a school setting. Because of this its impact on them was not as effective as it could have been. The process was also short, so the opportunity for a profound reversal of student opinions was limited. Yet another reason is cultural: the Israel Ministry of Education does not regard implementation of the technology positively. Most current educators are also not very receptive to the changes that come with new technologies.

College instructors were ambivalent about integration of mobile technologies in their teaching. They were not aware of the potential the technologies offer, but needed more exposure to the value of technology and time to become adept at using mobile technologies before being ready to incorporate them into their teaching. Massive personal training in using applications that are related to their expertise and giving them extra value to their teaching can encourage them.

Qualitative findings reinforce the importance of integrating mobile technologies in teaching and learning, as part of the pre-service training programs. Practice in these areas enables students to acquire skills and experience, develop attitudes towards the usage of mobile technology, and make decisions regarding best ways to exploit technology for pedagogical needs.

There is a gap between school students, college students and college instructors and in the transition period it is beneficial to act side by side. One solution for instructors can be harnessing the technological abilities of students: teachers can ask assistance from a small group of students in using the technologies with which they are so familiar, thus empowering the students and acquiring the help they need. Teacher education programs must tackle the difficulties and the generation gap and train students and college instructors accordingly.

This study sheds some light on the questions that each new technology raises during its first implementation stages. As students stated, it is important for teachers to know the affordances and benefits of this technology, as well as to be aware of the difficulties that are part of the process of implementation of a new technology. Through slow, gradual introduction of the technology into the classroom, teachers can gain pedagogical experience without being overwhelmed.

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