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STUDENTS' PERCEPTIONS OF USING MOBILE TECHNOLOGY IN
HIGHER EDUCATION

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ABSTRACT

This study explored the perceptions of university students in the educational use of mobile technology. International degree and exchange students from the University of Lapland, Finland, were the main focus. Research questions were: 1. What is the rate of educational use of mobile technology by higher education students? 2. What is the rate of mobile technology use in promoting university students' learning? and 3. What is the amount of hindrance in the educational use of mobile technology by university students? The study described the Teaching and Meaningful Learning (TML) and the Enhanced Teaching and Meaningful e-Learning (ETMeL) models based on Ausubel's Theory of Cognitive Learning which explains the importance of meaningful learning process as being dependent on the abilities of learners to relate new concepts and propositions to what they already know. The models and the theory were used to investigate the research questions. In the study, I attempt to do an analysis of a survey done with the international degree and exchange students on the use of mobile technology (i.e., smartphone, laptop and tablet computers). This is to find out how the models have provided awareness into how mobile technology can be utilized in a pedagogically meaningful way in teaching, studying, and learning processes and to reflect on how some of these popular practices could be supported to enhance learning among the student community. Based on 120 survey responses, numeric data was used to gather all the relevant variables where the results of the study were analyzed qualitatively and quantitatively. In the final results, it was observed that the use of mobile technology for learning purposes has been widely adopted by students. Ownership and access to mobile computing devices was high among the respondents and through various synchronous and asynchronous online platforms, learning among students has been promoted. The study therefore concludes that the use of mobile technology has improved pedagogical possibilities among higher education students.

Keywords: Higher education, meaningful learning, perceptions, mobile learning, mobile technology

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DEDICATION

I dedicate this thesis to my lovely and beloved wife, Josephine Ansu Boakye (née, Josephine Okyere) and my most cherished kids, Kwasi, Heidi, and Manny. It is their unconditional love and well intent that spur me on to set higher goals. Thank you for always supporting me.

Rovaniemi, Autumn 2016

Felix Ansu Boakye

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1 INTRODUCTION

1.1 Mobile Learning in Higher Education

The global world today, has been bridged through the use and application of new technological tools. Mobile technology, such as smartphone, laptop, and tablet computers are increasingly being considered as mediating tools in teaching learning processes especially at the higher education level.

At the higher education level where the patronization of mobile technology in the teaching and learning process is ubiquitous, most students and academics seem to embrace it as a routine in the advancement of making information known, including other various purposes. Nowadays, a lot of iPhones, iPads, and other identical smart devices are equipped with many functionalities and special features that can be used for delivering learning content. As it is asserted, “Most devices are now capable of processing information in the same way as desktop computers” (Khaddage & Latteman, 2013, p. 119). It comes as no surprise therefore to be fully aware that technology experts and major stakeholders have shown considerable interests in the application of mobile technology, not only for the teaching and learning process, but also in several other workplaces. Significant projects in all these areas have revealed how mobile technology is capable of transforming and empowering individuals, promoting change, and fostering the development of 21st century skills (Oblinger & Oblinger, 2005). Taking education into account, lots of research have shown how mobile technology can offer new opportunities that can transform teaching and learning processes from being highly teacher-dominated, to student/learner-centred. Many experts are also of the view that this transformation will result in increased learning gains for students, thereby creating and allowing opportunities for learners to develop their creativity, problem-solving skills, and other higher-order thinking skills (Bullen & Morgan, 2009).

In the light of higher education, majority of university students nowadays belong to the Generation Y (also called millennial generation). This is a generation of people typically perceived as steadily more familiar with digital and electronic technology. For this reason, mobile technology is now an integral ritual in their lives. Certainly, we are living in an age of “personal and technical mobility” where mobile devices, together with mobile phones, MP3 players, and Personal Digital Assistants (PDAs), “are carried everywhere” (Sharples, Arnedillo-Sanchez, Milrad, & Vavoula, 2009, p. 234).

Thus, people have the opportunity to construct their world of learning. For example, as a way of designing learning differently, people could be linked through real and virtual worlds. Also, learning communities could be created between and amongst “people on the move”, “providing expertise on demand”, and generally “supporting a lifetime of learning” (Sharples et al., 2009, p. 234).

Adkins (2008) adds that the tipping point for the m-learning industry has probably been reached. Presently, m-learning is by and large used in museums, workplaces, and classrooms for learners inside or outside the formal education systems, such as dropouts and the unemployed, enabling a wide spectrum of educational possibilities (Attewel, 2005). This wide spectrum of educational possibilities has been reiterated by the contention that “Mobile learning offers new ways to extend education outside the classroom, into the conversations and interactions of everyday life” (Sharples et al., 2009, p. 237).

M-learning or mobile learning can be defined as “the acquisition of any knowledge and skills through the use of mobile technology, anywhere, and anytime” (Hashemi, Azizinezhad, Najafi, & Nesari, 2011, p. 1). Consequently, this recent phenomenon that is rapidly spreading in many regions of the world is ushering humankind into a new era of training and education. Indeed, many researchers and other scholars believe that the benefits that m-learning offers are credibly immeasurable. For instance, for most companies, mobile learning helps to reduce the traditional training infrastructure, facilitates the learning process of employees, and improves their productivity and effectiveness whilst on the move (Grohmann, Hofer, & Martin, 2005; Donnelly, 2009). Similarly, on campus, mobile learning provides a useful mechanism to enrich students’ learning experience (Naismith, Peter, Giasemi, & Sharples, 2004). With respect to education, Sharma and Kitchens (2004) are of the view that collaboration and informal interaction between peer students are facilitated by m-learning. Further to that, Sharma and Kitchens (2004) argue that the advent and subsequent development of mobile learning indicate a profound evolution from distance learning (d-learning) to electronic learning (e-learning), and then on to m-learning.

According to Lavin, Moreno, and Fernandez (2008), mobile learning is enabled by integrating various hardware and software technologies into multimedia applications, facilitating the communication of educational content in a number of different formats for university students. In addition, Gikas and Grant (2013), cite a survey conducted by the Educause Center for Applied Research (ECAR) (2012), which suggests that students are driving the adoption of mobile computing

devices, such as cellphones, smartphones, and tablet computers, in higher education, and 67% of surveyed students believe mobile devices are meaningful to their academic success and use their devices for academic activities. It can be said then that these mobile communication devices offer university students the opportunity to carry their university in their own hands (Taleb & Sohrabi, 2012).

A vivid clarification of what mobile computing devices constitute, have Valk, Rashid, and Elder (2010) opine that mobile computing devices have included technologies that are transportable, such as cellphones, and smartphones, and this may include tablet computers, and netbooks. On the other hand, it is stressed by Keegan (2005), that mobile learning should focus on the actual mobility of the device. That is, mobile learning should be “restricted to learning on devices which a lady can carry in her handbag or a gentleman can carry in his pocket” (Keegan, 2005, p. 33).

Fundamentally, the use of mobile technology in higher education learning should offer the opportunity of students being able to access information and knowledge at any spot and at any point of time from the devices that they (the students) are accustomed to “carrying everywhere with them”, which they also “regard as friendly and personal” (Traxler, 2007, p. 129).

It must also be emphasized that despite the new opportunities that mobile technology presents in empowering individuals, transforming the teaching and learning processes, as well as fostering the development of skills in the new millennium, there is no gainsaying the fact that mobile learning is fraught with some major challenges. For instance, it is worthy of note that since students have different interfaces, and perhaps, different technologies, not all higher institutions may be ready to formally accept and integrate mobile apps for teaching and learning.

Another considerable element of the challenges is that, even higher education institutions that are bent on adopting new technologies may be seriously constrained by not having enough of the necessary human resources as well as the financial capital to achieve their ideas. In addition, it has been observed that some new technologies are located within structures that simply were not designed to provide the ideal technology required, hence the wrongful adoption has failed to achieve projected benefits and cost savings because of shortcomings in the safe and effective use of these systems. Generally, frequent technological challenges can also inhibit the positive potential that mobile ICTs offer (Cutshall, Changchit, & Elwood, 2006).

Moreover, since we live in a world in which information is available everywhere, it is significant that the credibility of the information and its source are authentic since Johnson, Adams, and Cummins (2012) note that the university is seen to be “the golden standard for educational credentialing” (p. 5). In spite of this fact, certification programmes from other sources seem to be eroding the value of this purpose. For instance, poor system design and improper use of the programmes and other operating information used by a particular device can cause errors that can jeopardize the integrity of the information in the system (Johnson, et al., 2012).

One other challenge is the rapid development of digital technologies, especially, the mobile devices. Mobile phones that are being used currently, almost now and then, have their updated versions being manufactured, thus rendering the ones being used as aged. Certainly, this trend may make designing content specifically for some type of mobile tools seem expensive and too time-consuming when compared to the time that the content is functional on the devices. Also, some compelling issues in relation to social codes of acceptable use of mobile technologies have been raised. For instance, Whittlestone, Bullock, Pirkelbauer, and May (2008) reveal that some veterinary students felt it was not suitable to use their handheld devices during surgery and in the presence of clients and were afraid that observers or onlookers could perceive that the students were using their devices for some inappropriate purposes such as playing games or texting.

Furthermore, there has been the consideration of one vital element that seems to inhibit mobile learning. This has to do with the diverse issues of how handy and easy to manipulate these mobile devices are. According to Wang, Wu, and Wang (2009), mobile learning is fraught with several challenges such as connectivity, limited processing power and reduced input capabilities. The authors pointed out that “these (technological) challenges mean that adapting existing e-learning services to m-learning is not an easy work” (Wang et al., 2009, p. 93). In similar vein, Attewel (2005), attests to these challenges when he drums the point that impediments of using mobile phone in the university are: “small size, limited screen resolution and complicated input mechanism of mobile phone” (Taleb & Sohrabi, 2012, p. 1107).

Drawing from a review in the United Kingdom about present-day usability studies and two projects on m-learning, Kukulska-Hulme (2007) adds that usability issues are often reported since m-learning activity continues to take place on devices which are not designed for educational use. In my opinion, I think stakeholders of technology ought to take a critical look into the easy handling and use of

mobile devices and apps. By improving on them, I believe students would be more than willing to use m-learning. In support of this opinion, researchers are exploring new tools and methods for the collection and analysis of data, research methodologies and approaches suitable for interpreting such data, and issues in designing mobile learning research (Vavoula, Kukulska-Hulme, & Pachler, 2007).

1.2 Mobility

Aside from the aforementioned points of view enumerated, Sharples, et al. (2009) consider what actually constitutes ‘mobile’ in mobile learning. To these authors, 5 aspects of what mobility means have been identified — namely, *mobility in physical space*, *mobility of technology*, *mobility in conceptual space*, *mobility in social space*, and *learning dispersed over time* (Sharples, et al., 2009).

First of all, one realizes that people on the move that endeavour to learn with the use of mobile technology devices, need not be actually present in the formalized learning situation within the institutional settings. One distinctive feature of mobile learning is that it enables learners to enter an information network at the right moment when necessary, with the use of a portable learning device and a wireless network (Seppälä & Alamäki, 2003). As a result, the supposedly physical places where these learners find themselves may become part of the learning process which has been enabled by the portability of the technology. It also happens to be by way of the mobile device which they possess. The distance between the actual classroom setting and people on the move has therefore created a ‘space’ or a ‘gap’ which they can take advantage of, to “reflect on what life has taught them” (Sharples, et al., 2009, p. 235).

The authors’ point on this aspect of *mobility in physical space* is again supported by the statement that “Mobile learning offers new ways to extend education outside the classroom” (Sharples, et al., 2009, p. 237). Furthermore, an axiom by Shepherd (2001), ‘M-learning is not just electronic, it’s mobile’ (Seppälä & Alamäki, 2003, p. 330), gives more support to the fact that another distinctive feature of mobile learning is the opportunity for students to break away from the usual instructional activities that take place in the classroom. By detaching themselves from the norm, students can move to another location while communicating via information networks. Indeed, this is an indication that mobile learning may be considered as an extreme form of flexible learning. The notion is that this has become feasible because the mobile environment integrates studies that go on on campus, at

home or outside university facilities into one shared, flexible learning environment (Seppälä & Alämäki, 2003).

According to Quinn (2000), ‘Mobile learning is learning through mobile computational devices’. With the second constituent, *mobility of technology*, the opinion is that educators find it challenging to implement technology in ways that enhance student learning in m-learning environments (Sølyberg & Rismark, 2009). However, it must be acknowledged that several teachers and researchers have experimented with mobile technology in teaching and learning. Besides the fact that they may want to develop the production of digital learning materials, it also happens that the purpose behind the investigations may be to develop models of how to teach, study and learn in mobile learning environments. It can barely be gainsaid that mobile wireless phones, such as Smartphones, which consist of a combination of a mobile phone and computers, are considered the most popular mobile wireless technology that are used mainly as personal communication tool (Kim, Mims, & Holmes, 2006). A gripping statistical information on Finland revealed that with a population of 5 million inhabitants, over 70% own mobile phones, and approximately 98% of university students have a mobile phone which then can be assumed that they are “highly experienced users of mobile technology” (Seppälä & Alämäki, 2003, p. 331).

Apart from that, text messaging, also called SMS, may be one of the most common wireless applications that are used with mobile wireless phones to support teaching and learning since it can be sent from a mobile phone to a computer, or from similar mobile devices that have the SMS application. As described by Yengin, Karahoca, Karahoca, and Uzunboylu (2011), SMS is “a two-way technology that allows communication in two ways between teacher to student, students to students and teacher to teacher” (p. 1440). In another dimension, considering text messaging as an idea of mobility of technology, it is highlighted that with SMS, “professors and students can send and receive text messages to and from most modern mobile wireless phones” (Kim, et al., 2006, p. 85). Again, Seppälä and Alämäki (2003), cite a pilot study in teacher education (Uniwap II) where teachers and students could discuss teaching issues through mobile devices and also use SMS-messages and digital pictures as a part of the supervising process. It is therefore interesting to realize that with the increasing trend of higher education adopting and exploiting mobile wireless technology, these devices have indeed become prevalent.

More often than not, the mobility of digital technologies creates fascinating opportunities for new forms of learning. For this reason, these digital technologies change the nature of the physical relations between teachers, students, and the objects of learning. In discussing the aspect, *mobility in conceptual space*, this has different learning topics and themes competing for an individual's shift of focus. In this situation, numerous episodes about learning are brought to the attention of the individual, so the focus moves from one conceptual topic to another. It must also be added that this shift of focus occurs as a result of the individual being driven by "personal interest, curiosity or commitment" (Sharples, et al., 2009, p. 235). Aside from that, potential learning occurs irrespective of location. It has severally been observed that learning occurs wherever a learner is, thereby not being restricted to the classroom setting per se.

Taking into account *mobility in social space*, the idea of 'mobility' needs to be re-examined. By inference, it is one that signifies an individual's body movement in a landmarked space and between locations. According to Green (2002), shifting popular cultural notions of geographical spaces (which includes the spaces "in between" while moving) are undoubtedly evident in the case of mobile telecommunications. For instance, a group of students organizing themselves to attend an ice hockey game via mobile phone while in the lecture hall, emphasizes the fact that mobile devices can be used as tools to engage simultaneously in work and leisure relationships despite distance or location. It has also been affirmed that mobile technologies are sold on the basis that they provide "anytime, anywhere" connection, whether that connection is by means of voice or (increasingly) data connectivity (Green & Harvey, 1999).

From the point of view of mobility as other forms of educational activity, some aspects of informal and formal learning are significantly seen as mobile. For example, students within a college can move from lecture halls to lecture halls and even shift from topic to topic which highlights that the various learning experiences of people create an accumulation of a learning experience, and this learning experience involves connections and reinforcement (Dierking, Falk, Rennie, Anderson, & Ellenbogen, 2003). In the discussion of learning being dispersed over time, also indicates a better understanding of not only how knowledge and skills can be transferred across contexts such as home and school, but also how learning can be managed across life transitions, as well as how new technologies can be designed to support "a society in which people on the move increasingly try to cram learning into the interstices of daily life" (Sharples, Taylor, & Vavuola, 2005, p. 2).

By reason of *mobility* being one of the distinct aspects of mobile learning, and also appreciating the learning that takes place outside lecture halls as people initiate and organize their activities to facilitate educational undertaking and outcomes, it is crucial to avail with the possible sets of circumstances before us, to design new technology that supports learning during “the growing amounts of time that people spend travelling” (Sharples, Taylor, & Vavuola, 2005, p. 3).

1.3 The Aims and Outline of the Research

In this thesis, I aimed to investigate present-day students’ perceptions of using mobile technology in higher education learning. The motivation for this study was drawn from the aspect of international degree and exchange students’ experiences of mobile technology use in a certain university in Finland. As a foreign student myself, and by way of some relative experience with ICTs in learning, it had become apparent to me that some higher institutions were more noted for their excellence in the use of mobile technology than others. Therefore, as non-national students coming from various universities, it would not only be useful and informative, but also interesting to fathom students’ perceptions of the use of mobile technology in their studies. The quest for this investigation is also supported by the comments of Cheon, Lee, Crooks, and Song (2012), who indicated that:

“The availability of mobile devices does not guarantee their use in education so, the need to first assess students’ readiness for mobile learning is significant” (p. 1054).

In this study, I applied the pedagogical model for Teaching and Meaningful Learning (TML) (Hakkarainen, 2009) with the model of Enhanced Teaching and Meaningful e-Learning (ETMeL) (Ruokamo, Hakkarainen, & Eriksson, 2012). These models are based on the theory of cognitive learning (Ausubel, 1963 / 1968; Ausubel, Novak, & Haneasian, 1978) and the ideas of meaningful learning (Jonassen, 1995). In Ausubel et al.’s (1978) cognitive learning theory, the authors demonstrate the significance of meaningful learning process as being dependent on the abilities of learners to relate new concepts and propositions to what they already know. In the same way, a meaningful learning process should depend on how important it is for university students to relate their knowledge of the use of ICTs, with new mobile apps in their studies. The models also have features of expected learning outcomes with some pedagogical approaches like case-based teaching which focuses on teachers’ problem solving,

decision making, reflective practices, and their own personalized theory about teaching and learning (Butler, Lee, & Tippins, 2006).

Furthermore, with the advancements in mobile technology which are rapidly expanding the scope of learning in areas outside of formal education, accompanied by the expansion of flexible and instant access to rich digital resources, mobile learning can significantly offer an additional role within formal education. This additional role may involve some form of reduction in students' expenses. For example, since not all the students in the higher education level may be living on the university campus, the cost of saving some money on transportation, probably due to staying farther away from the university may be worthwhile. This may also be due to the fact that lessons that needed to be taught in the university classroom or lecture hall, could now be done with the mobile devices that the students own by means of mobile technology. In such instances it can be assumed that students have been offered new learning opportunities that have been provided by the mobile technology. A research conducted by Cheon, et al. (2012), investigating mobile learning readiness in higher education indicated that "empowering students with confidence in using m-learning would lead to a greater likelihood of m-learning adoption" (p. 1061). Hence, the more some courses are offered online, the more students become confident with the use of mobile technology in the teaching-studying-learning processes.

The thesis involved some descriptive studies where the researcher interacted with some of the participants. A paper-based survey was also conducted to collect the necessary information from the respondents, being international degree and exchange students from the said university. By design, I have structured my thesis into five chapters which are followed by a list of activities in supplement of the research work. Following the introduction, the thesis continues with a discussion on m-learning. After this, a description of the TML and ETMeL models from the theoretical approach of cognitive learning and the ideas of meaningful learning is provided. The thesis then presents the research questions and reports on the data collection and analysis procedures. The results are discussed with relationship to contemporary considerations on mobile learning. Finally, general conclusions are drawn with a summary of the whole study.

1.4 Research Questions and Purpose

The main focus of this research is to explore present-day students' perceptions of using mobile technology in higher education learning.

In the study, I identified three mobile computing devices as the significant pedagogical tools used by the university students in the teaching-studying-learning processes. To be specific, the digital devices are: laptop, smartphone and tablet computers. The study answers the following research questions:

1. What is the rate of educational use of mobile technology by higher education students?
2. What is the rate of mobile technology use in promoting university students' learning? and
3. What is the amount of hindrance in the educational use of mobile technology by university students?

Nowadays, technology is advancing at a pace that can fairly be described as breakneck when viewed across the length and breadth of the world. New electronic media and digital devices, coupled with their multipurpose applications add new meaning to mobile learning. Many governments have also invested so much in promoting and facilitating the use of information and learning technologies to support and enhance teaching and learning. This is to give learners of all ages e-learning of the highest calibre to support their lives, extend their choices, enrich their competences and strengthen their autonomy at home, work and in the community (Attewel & Savil-Smith, 2004). E-Learning is the use of telecommunication technology to deliver information for education and training (Sun, Tsai, Finger, Chen, & Yeh, 2008). In these contemporary era, e-Learning mainly takes the form of online courses (Downes, 2005). For these reasons, m-learning is part of e-Learning (Georgiev & Smrikarov, 2004). As Garrison (2011) posits, "E-learning cannot be ignored by those who are seriously committed to enhancing teaching and learning" (p. 4).

In addition to technology changing the way teachers and their students learn, there also happens to be a considerable change in the way they communicate. It is important therefore to understand how learners use technology for communication and information, and perhaps, the motivation behind, so that their wired world can be tapped into to help them become better and more independent learners (Daniel, 1996). The belief is also that successful e-learning depends on the self-motivation to learn. As Bates (1997) claims, there are four reasons for using technology in higher education. The reasons are the following:

a) to improve the quality of learning, b) to improve access to education and training, c) to reduce the cost of education, and d) to improve the cost-effectiveness of education. According to Attewel and Savil-Smith (2004), “Advances in technologies inevitably bring with them additional opportunities to facilitate and enrich the experiences of individual learners” (p. 8).

Moreover, two significant developments in technology have made a huge impact on learning. The first is the exponential expansion of the internet as a source of information and a means of communication (Parker & Plank, 2000). For instance, information obtained from the internet is “abundant, easily available, and often comprehensive” (Flanagin & Metzger, 2000, p. 517). Thus, there is a growing recognition of how the internet is stimulating connections and even forging new links at all levels of organization (Haythornthwaite, 2005). Touching on the second crucial development is the increasingly affordable use of technology, especially the decreasing cost of both using data and the mobile devices that consume the data. These critical developments in the area of education mean that technology will be an integral part of the teaching and learning process (Berge & Collins, 1995). What’s more, since the use of technology for communication is authentic, both teachers and students are obligated to continually upgrade themselves to keep up the pace with the development of technology in order to embrace it as our ally (Mellow, 2005).

Considering e-learning widely regarded as mainstream and a service offered by most colleges and universities, many intellectuals have argued that there is basis for belief that wireless portable technology, for example, tablets and smartphones, will have a significant role to play in the way students learn (Patten, Sanchez & Tangney, 2006). Again, learning with media has customarily been deliberated as a cognitive activity (Mayer, 2002). However, there is also an emerging admission that learners come to the learning platform with pre-existing intuitions (Clark, 2001; Reiser & Dempsey, 2007). Thus, to a large extent, it is being appreciated that in addition to cognitive knowledge (such as facts and concepts) and skills (like procedures and strategies), learners’ beliefs and feelings about the instructional medium should be considered by instructional designers (Sung & Mayer, 2012).

Finally, since it is instructional methods that produce learning (Clark, 2001), it will be ill-suited to view mobile devices simply as delivery systems in which information is transferred from teacher to learner (Mayer, 2002, 2003). Rather, the instructional value of educational technology hinges on how it is used to provide assistance to learners to engage in cognitive processing during learning and meaningful learning outcomes (e.g., as described by Hakkarainen, et al., 2007). For this purpose, my interest in this

study lies within how university students think of mobile computing devices as pedagogical tools (i.e., devices that one can use to learn or teach) since such opinions could influence how they engage in mobile learning.

2 THEORETICAL UNDERPINNINGS OF MOBILE LEARNING

Contemporary trends in communication and wireless technologies have resulted in the proliferation of mobile devices. For instance, cell phones and Personal Digital Assistants (PDAs). In addition, scientific investigations have equally offered significant insights into mobile learning despite the issue being a relatively new phenomenon with its theoretical premise yet to become extensive. Further, instructional designers have been given the needed support to consider the role that mobile devices, as instructional materials, play in how learners (students) go about the process of learning. This encouragement has been necessitated by the rationale of thought that students' attempt to learn, may be associated with their skills and experiences of becoming proficient with the use of various forms of mobile technology.

In this study, I will briefly present the theoretical approach and the models used in mobile learning at the higher education level. My main subject of discussion brings to focus, Ausubel's Theory of Cognitive Learning which is used as the theoretical framework which offers a lens for investigating how information is absorbed, processed, and retained during learning in the university setting. Emphasis will be placed on how students integrate new knowledge with what they have already learned or what they already know. Thus, the Theory of Cognitive Learning by Ausubel (1968); Ausubel, Novak, and Hanesian (1978) is aimed at analysing how students perceive or become conscious of the use of laptop, smartphone and tablet computers in teaching-studying-learning processes. The Teaching and Meaningful Learning (TML) and the Enhanced Teaching and Meaningful e-Learning (ETMeL) models expatiate on students' learning processes and their learning outcomes with pedagogical possibilities afforded by the three mobile computing devices. Invariably, the models discuss the rate of educational use of mobile technology by university students, how students' use of mobile computing devices has promoted their learning, as well as the amount of hindrance that is associated with the use of mobile technology in higher education learning.

Last but not least, it is the hope that learners may bring their intuitive beliefs and experiences about mobile technology in relation to new concepts to attain the desired objectives of meaningful learning, for it is quite reinvigorating to learn that in recent times, a number of studies have been endeavoured by researchers (e.g., Karppinen, 2005; Rendas et al., 2006; Rick & Weber, 2010) to apply information technologies to support the achievement of meaningful learning through mobile learning (Huang, Chiu, Liu, & Chen, 2011).

2.1 Theory of Cognitive Learning

One of the most prominent results of recent research in cognitive psychology is taking cognizance of the claim that ‘old’ knowledge plays a fundamental role in the acquisition of ‘new’ knowledge (Pieters, Breueur, & Simons, 2012). The theory of cognitive learning (Ausubel, 1963, 1968; Ausubel, Novak, & Hanesian, 1978) is analysed from the aspect of educational psychology where the centre of interest is on how students learn. The theory is based on the ideas that learners learn through meaningful learning, and not through rote memorization. In the theory, Ausubel contends that meaningful learning is accomplished by prior knowledge. That is, any new learning must, in some fashion, connect with what learners already know (Shulman, 1999). Students’ prior knowledge provides proof of both the alternative and technological conceptions that learners possess. Because of this, students’ learning is basically affected by their existing knowledge prior to instruction (Hewson & Hewson, 1983).

In Ausubel et al.’s (1978) cognitive learning theory, they demonstrate the importance of meaningful learning process as being dependent on the abilities of learners to relate new concepts to what they (the learners) are familiar with or are already used to. The theory also states that the most important factor influencing learning is the quantity, clarity and organization of the learner’s present knowledge. This present knowledge consists of facts, concepts, theories, and propositions that the learner has the right or opportunity to use or benefit from. As a matter of fact, present knowledge comprises the learner’s cognitive structure (Ausubel, 1968). Further supported, the quantity and quality of the knowledge structures that learners build, will determine their ability to transfer this knowledge for use in new contexts (Alexapolou & Driver, 1996; Basconas & Novak, 1985). Consequently, the theory explains that the construction of new meanings requires that learners attempt to achieve the integration of new knowledge with existing relevant concepts and propositions in their cognitive structure. These propositions are seen as essential elements in representing meanings. In addition, being the basic mental process that learners use to make sense of information, the cognitive structure is greatly determined by how much effort is made to seek this integration (Novak, 2002).

In the context of higher education learning, familiarity with some technological devices in pedagogy and student learning allows students to apply their computer and technological skills in not only problem-solving cases but also in the teaching-studying-learning processes (Cradler, McNabb, Freeman, &

Burchett, 2002). Again, since students are used to exploiting the technological resources in and around the university, they are capable of being motivated and having the confidence in the utilization of these technology (e.g., computers) to enhance and support new instructions such that their experiences of using technological devices to improve their learning at the higher education level can be ascertained. Also, the integration of new knowledge with students' current knowledge of mobile devices, can help them to explore more, especially when new learning opportunities are provided them (Cole, 2009).

Besides, meaningful learning gives prominence to the acquisition of new information by learners and their connections to previous experiences and knowledge in the formation of personal and unique understandings (Rendas, Fonseca, & Pinto, 2006; Viola, Giretti, & Leo, 2007). It is the belief of the researcher that every university student concerned in this research owns at least one of the mobile technology mentioned in the study. That being so, having the particular device or devices in their possession anytime, anywhere, spot on, creates a familiar bond in such a way that incorporating new knowledge in connection with their course work ensures the achievement of a meaningful learning process. As suggested, when learning materials are well organised with new ideas and concepts that are potentially meaningful to the learner, anchoring new concepts into the learner's already existing cognitive structure will make the new concept recallable. In other words, the theory explains that before new materials can be presented effectively, the student's cognitive structure (i.e., the area that is prepared to accept new or altered ideas) should be strengthened, and when this is carried out, acquisition and retention of new information is facilitated (Ausubel, 1968). On this account, the expectation of students' knowledge of laptop, smartphone and tablet computers for learning new things and solving studying-related problems can make learners recollect the experiences they used with the devices to understand the new concept taught them.

As a re-echo, the goal of formal education should be meaningful learning (Jonassen & Strobel, 2006). In suggestion of the theme of his theory, Ausbel (1968) wrote a famous quotation in the preface of his work, 'Educational Psychology: A Cognitive View':

“If I had to reduce all of educational psychology to just one principle, I would say this: The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly” (Dochy, 1994, p. 339).

The aforestated involves a tripartite assumption:

- that prior knowledge is an important variable in educational psychology;
- that the degree (content and degree of organization) of prior knowledge of a student must be explicit or measurable for the achievement of optimal learning; and
- a learning situation is optimal to the degree to which it accords with the level of prior knowledge (Lodewijks, 1983; Pieters, et al., 2012).

These suppositions point to the idea that students with prior experience of mobile technology in a particular learning situation will be able to perceive their situation in relation to their prior experiences, thereby adopting a certain approach to learning. For instance, in participating in synchronous discussions via applications based on written communication like Facebook and Skype chats, students may become conscious of the advantages these synchronous discussions may have in the promotion of their learning. On the other hand, students may also recognize that working asynchronously with their colleagues on a common written document such as wikis and Google Docs may have promoted their learning. Therefore, all aspects of this situation will be part of the learner's awareness at all times (Prosser & Trigwell, 1999).

Not all, as a fundamental principle for instructors, teachers must take seriously what their students have already learned. As a caution, to take learning seriously, teachers need to take learners seriously (Shulman, 1999).

In addition, any pedagogically significant use of technology should enable learners to engage in meaningful learning (Jonassen, 1995). In this instance, since university students own mobile devices mentioned in this study, it can be said that they are familiar with the mobile devices and are therefore able to manipulate them to their benefits; hence their ability to operate these devices indicates their prior knowledge of mobile technology in higher education learning. The caution though is that access alone does not guarantee that a particular programme will be successful (Shapely, Sheehan, Mahoney, & Caranikas-Walker, 2010). Besides, the availability of mobile devices does not guarantee their use in education. Based on these reasons, we must first analyze students' readiness for mobile learning (Corbeil & Valdes-Corbeil, 2007; Keller, 2011). This, the theory explains, is where teachers need to remember that inputs to learning are crucial. Instructors therefore should ensure that learning materials are well-

organized and new concepts must be potentially meaningful to learners such that the new concept can be recallable (Ausubel, 1968).

As previously indicated, the construction of new meanings requires that learners seek to integrate new knowledge with existing relevant concepts and propositions in their cognitive structure. Cognitive structures, according to Garner (2007), are the basic mental processes people use to make sense of information. While concepts are defined as perceived regularities in events or objects, a combination of these concepts form statements, otherwise known as propositions. Thus, knowledge stored in our brains comprises networks of concepts and propositions (Novak, 2002). In addition, effective teaching reinforces positive transfer by actively identifying the relevant knowledge and strengths that students bring to a learning situation where they build on them (Bransford, Brown, & Cocking, 1999). It is therefore gratifying to stress that the university where the research was carried out has a strong commitment to Information Communications Technology (ICT); as a result, students have some knowledge about the use of ICTs. This explains that supported by effective teaching, students will be capable of integrating whatever new things they learn with mobile technology, in combination with their relevant knowledge of the technology. The positive transfer gained, can be discussed by way of students' perceptions of using mobile technology in higher education learning. Furthermore, collaborating with the mobile devices as technological aids, enhances the creative and problem-solving possibilities of students. That is, students' current knowledge of mobile technology in union with being constantly connected with their fellow students through mobile devices may well promote their learning.

In buttressing the significance of the theory of cognitive learning, and therefore meaningful learning with its major influence on the world, there is no gainsaying the fact that invariably, major changes in various establishments are being compelled by world economic changes, thereby placing a premium on the capacity and worth of knowledge and new knowledge production. These changes require changes in school and university education that focus on the nature and power of meaningful learning (Novak, 2002). For the reasons adduced, the theory of cognitive learning makes it possible for teachers to provide new learning opportunities to students as well as students being able to identify some factors that might affect the successful use of mobile technology in higher education learning.

2.2 The TML Model

As a general approach that can be used to shape curricula, design instructional materials, and guide instructors' work which does not only take place in the lecture rooms but equally in other settings, the TML model is a pedagogical model that exploits the use of mobile technologies in the teaching-studying-learning processes. The model is concerned with students' learning processes together with their expected outcomes. This study therefore incorporates the TML model since the significant use of mobile technology is perceived as useful for learning, facilitates both teaching and meaningful learning, as well as enhances the acquisition of domain-specific knowledge and methodological skills (Hakkarainen & Vapalahti, 2011).

The TML model is presented below in Figure 1.

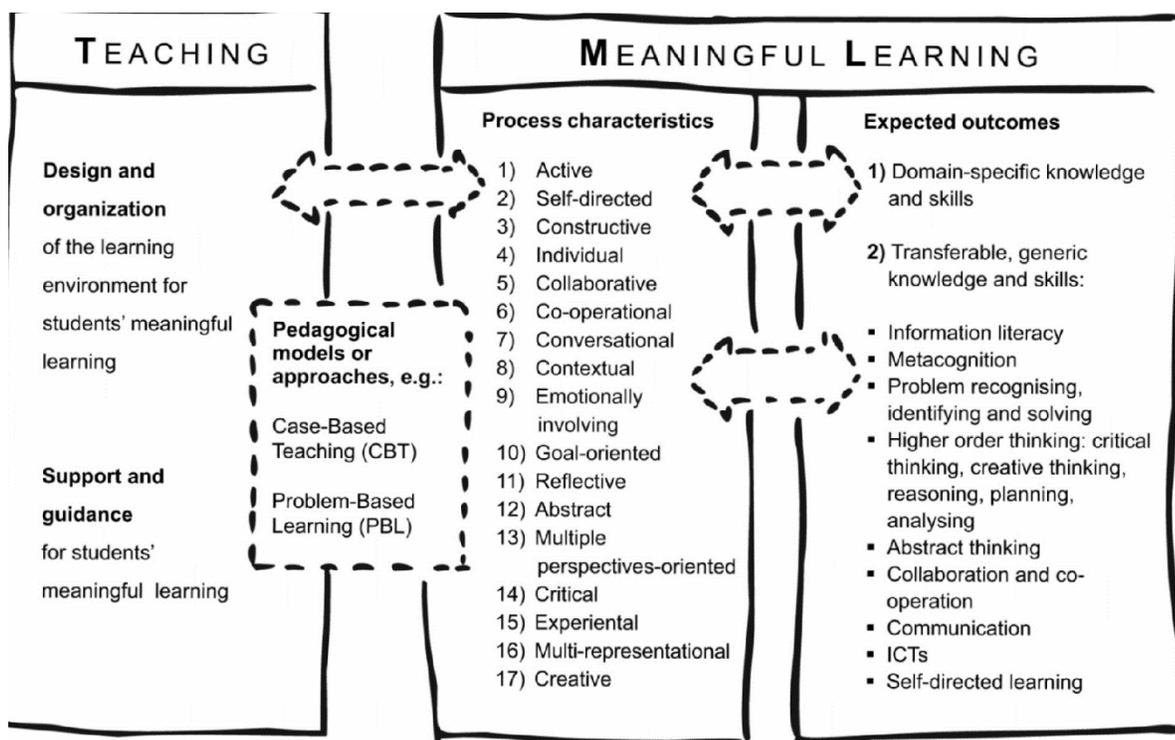


FIGURE 1. TML model (Hakkarainen, 2009).

Hakkarainen, et al.'s (2007) pedagogical model for teaching and meaningful learning is based on the theory of cognitive learning by Ausubel (1963, 1968); Ausubel, et al. (1978) and the ideas of meaningful learning by Jonassen (1995). As maintained by the model, meaningful learning refers both to the student's learning process and to the expected learning outcomes. These learning outcomes make reference to the ways of understanding the things students learn (Prosser & Trigwell, 1999). In the model, meaningful learning is described through 17 process characteristics and expected outcomes including students' domain-specific knowledge and skills together with transferable, generic knowledge and skills (Tynjälä, 2001). Thus, 'transferable', in this study, indicates students' ability to extend what they have learned from one context to the other. In the TML model, there is a dashed two-way arrow indicating the cooperation of relationships between the components of the model. The model also has some pedagogical approaches like case-based teaching which focuses on teachers' problem solving, decision making, reflective practices and their own personalized theory about teaching and learning (Butler, Lee & Tippins, 2006).

Meaningful learning gives prominence to the acquisition of new information by learners and their connections to previous experiences and knowledge in the formation of personal and unique understandings (Rendas, Fonseca, & Pinto, 2006; Viola, Giretti, & Leo, 2007). As expressed clearly, any pedagogically significant use of technology should enable learners to engage in meaningful learning (Jonassen, 1995). Therefore, students' familiarity with mobile technology (i.e., laptop, smartphone and tablet computers) should ascertain the basis for learners becoming involved in meaningful learning at the higher education level.

Furthermore, meaningful learning occurs when learners are naturally active and involved in the mental social process (Jonassen, Howland, Moore, & Marra, 2004). Through formal and informal communities of practice, learners are able to develop their skills and knowledge which they share with members with whom they learn and practise those skills with. In this study, students are provided the opportunity to share with the researcher their experiences of using mobile technology for learning in various learning situations. The development of ideas, skills and knowledge could be transferred and transmitted through reading and discussing other members' online documents aside from being constantly connected with their peers through mobile technology.

Principally, in applying the TML model, all the 17 characteristics of meaningful learning processes need not be present at any point in time although they can be "intertwined, interdependent, interactive, partly

overlapping, and synergetic” (Ruokamo, et al., 2012, p. 377; Jonassen, 2000). This statement is proven in this study by the participation of students in both synchronous and asynchronous online discussions including the production of pictorial and audio-visual content with learners’ fellow mates.

Moreover, the scheme of meaningful learning in the TML model does not only provide a broad theoretical foundation for informed design of educational technologies, but also emphasizes the meaning of students’ emotional participation in learning (Ruokamo, et al., 2012). As pointed out by Soini (1999) emotional involvement is one essential element of good learning situations for students as it becomes prominent from “feelings of personal, emotional-connectedness to some subject” (p. 84). In the study, the demonstration of emotional involvement is significantly noticed with students’ acknowledgement of mobile technology contributing positively to their satisfaction with studying as well as helping them to achieve their personal learning goals. Indeed, emotions influence “students’ cognitive processes”, and also their “psychological and physical health” (Novak, 2002, p. 92). Likewise, it is known that emotion is vital in our education since it drives attention and then possibly leads to learning itself and memory (Ruokamo, et al., 2012).

Presumably, students experience rich dimensions of diversity of emotions in learning and achievement owing to many factors notably, educational and professional pursuits, social relations, and the allocation of many kinds of resources which are largely dependent on individual achievement (Pekrun, Goetz, Titz, & Perry, 2002). This implies that learning and achievement are of great significance and that is why they are the vital sources of human emotions nowadays. In addition, these sources have been brought about by social emotions, self-referencing, and task-related disciplines (Scherer, Wallbott, & Summerfield, 1986). However, if the TML model’s process of characteristics of meaningful learning is able to help teachers with a better discernment of our emotional system and regulate it in the teaching and learning process, it will be a major step in the improvement of incorporating emotion comfortably into the curriculum and the classroom. As advanced, the emotions that students experience in academic settings play a central role in their motivation to learn, self-regulate, and achieve academically. (Pekrun, et al., 2002; Pekrun, 2009). In the study, students attested that mobile devices have been useful to them when critically evaluating and analysing information related to their field of study. What’s more, Ausubel et al. (1978) assert that the cooperative and emotionally-involving aspects of meaningful learning are capable of being analyzed. In view of this, it can be arguably stated that the TML model is a contemporary version of the Ausubel et al. (1978) point of view since it provides underlying support for analysing how

students perceive the use of mobile technology in higher education learning. Other process characteristics of the model also explain how students' experiences of using mobile technology have improved their learning together with how new learning opportunities are made available to them, including some of the factors affecting the successful use of mobile technology at the higher education level.

2.3 The 17 Characteristics of Meaningful Learning

As Figure 1 indicates, a general review of the 17 characteristics of meaningful learning given by Hakkarainen, Saarelainen, and Ruokamo (2009) are the following:

1. **Active** – It is said that “Human learning is a naturally active, mental and social process” (Jonassen & Strobel, 2006). The belief is that whatever learners involve themselves in may have some physical evidence of ways that they (the learners) particularly act in response to others and sometimes to certain situations. A detailed investigation and analysis of these activities that learners become involved in may help ascertain what they know. In other circumstances where physical evidence of conduct may be concealed from sight, the status quo should be studied with “invasive procedures such as think- alouds or teachbacks” (Jonassen & Strobel, 2006, p. 2). Thus by implication, being active suggests that learners are characterised by constant change, and the assumption of dynamic roles in their learning activities may be common.

According to Prince (2004), active learning is fundamentally any instructional method that engages students in the learning process. In actual fact, this type of learning “requires students to do meaningful learning activities and think about what they are doing” since the core elements of active learning are student activity and involvement in the learning process (p. 23). Additionally, learners are occupied with activities that promote good thinking abilities since students are not only encouraged to ask questions and acquire information, but also made to critically evaluate information as well as express new ideas and models of thinking (Ruokamo, Tella, Vahtivuori, Tuovinen, & Tissari, 2002). In the study, students have evaluated their own learning through learning journals, diaries and portfolios with the use of mobile technology. It is also stressed that in this contemporary era, simply knowing how to use tools and knowledge in a single field is not sufficient to remain competitive as an individual therefore, people must also learn to apply tools and knowledge in new fields and in different situations (Grabinger & Dunlap,

1995). In the study, students were involved in receiving instant feedback and advice from their instructors as well as their colleagues with the enablement of mobile technology.

2. **Self-directed** – In this approach, the learner is motivated to exercise personal responsibility and much independence with the decision of choosing what to learn and how to learn it (Garrison, 1997). According to Knowles (1975), self-directed learning is a “basic human competence – the ability to learn on one’s own” (p. 17). Besides, it is a learning process that is extensive and occurs as part of day to day life of an adult. Aside from this learning process being methodically planned, it does not rely on a class room nor needs an instructor (Tough, 1967, 1971). Indeed, this research had respondents discussing the various degrees or levels at which mobile technology are used for study purposes outside lecture hours.

Self-directed has also been described as self-learning in which learners have the fundamental control to plan, identify, perform, and evaluate their own learning experiences (Brockett & Hiemstra, 1991). In the study, students’ knowledge of mobile device applications has helped them to manage their time while studying.

3. **Constructive** – From the constructivist’s point of view on learning, the assumption is that “knowledge is individually constructed and socially co-constructed by learners based on their interactions in the world” (Jonassen, 1999, p. 1). Constructive learning therefore means learners gain new ideas into their relevant previous knowledge in a process of meaningful making but not of knowledge reception (Jonassen, 1995, 2002). For learners to meaningfully construct and reconstruct meanings, there must be the prerequisite of actively seeking to “integrate new knowledge with knowledge already in their cognitive structure” (Novak, 2002, p. 548). Thus, constructive is a meaningful learning process in which learners actively build a mental model of the system they are to learn (Mayer & Wittrock, 1996). This research has students discussing how significant mobile technology have improved their learning with the construction of mind maps, modelling, and other new ideas on an abstract or a theoretical level of learning.

In a similar circumstance, we can say constructive is discovery learning since the student discovers knowledge by way of constructing his or her own rules that conform with meaningful learning outcomes. An example of a manipulation that can encourage and evoke a constructive activity is direct prompting (Chi, 2009). In the study, students’ experiences of using mobile technology to pick up pictures, videos and notes, as incidental ideas typically related to their studies, were considered.

for their own learning, thereby becoming analytical (Totten, Sills, Digby, & Russ, 1991). Indeed, working jointly as a team makes it possible for students to have the chance to be involved in discussions. In the study, students have been participating in discussions via video conferencing or video calls as well as working face-to-face with their fellow mates on a common written document which have collaboratively promoted their learning.

Last but not least, technological advances nowadays have greatly influenced work ethics hence, the increased emphasis on teamwork within the work institutions. Since university students are preparing to enter the job markets, they need to be able to think creatively, become problem solvers, as well as good decision makers. These could be achieved through teamwork. In fact, one of the primary goals of technology education is to develop and enhance critical-thinking skills by engaging in collaborative learning (Gokhale, 1995).

6. Co-operative – It is said that “Extraordinary achievement comes from a cooperative group, not from the individualistic or competitive efforts of an isolated individual” (Johnson & Johnson, 1999, p. 67). With a cooperative learning group, students team up with the fulfilment of shared goals. Beyond just discussing tasks with one another, members in the team ensure the provision of assistance to each and every member making certain that the said task is well comprehended as well.

Secondly, since in the lecture room it takes a cooperative effort, students give support to one another and get actively involved in all the learning activities. Making sure that each member is contributing and learning, individual performance is monitored along the line. In this situation, the result, according to Johnson and Johnson (1999), is that “the group is more than a sum of its parts, and all students perform higher academically than they would if they worked alone” (p. 68).

Further to that, cooperative learning is seen to be a student-centred, instructor-facilitated didactic strategy where small groups of students take charge of their own learning as well as all group members. With the aim of acquiring and practising the elements of a subject matter to complete a task or achieve goals, students interact with one another (Li & Lam, 2013). Also adding is the assertion that one critical element of cooperative learning is group team work and team goals (Slavin, 1996). This study involved the promotion of learning with the consideration of students’ co-operation in the production of audio-visual content with mobile technology.

7. Conversational – Conversational learning is a dialogue. That is, it is a process of internal and social negotiation (Jonassen, 1995, 2002). For learning to be effective, there must be the action of constructing an understanding that relates new experiences to existing knowledge. Most significant to this action is conversation with teachers, with other learners including ourselves, as well as with the world in its entirety. As learners conduct experiments and explorations and interpret the results, they become empowered when they are in charge of the process thus, “actively pursuing knowledge rather than passively” (Sharples, 2002, p. 506). In conversational learning, it is important that individuals and groups formulate plans such as: reflecting on what is known, what needs to be performed, what needs to be ascertained; how capable the various plans can work successfully, as well as their potential viability, before solving any situated problems (Jonassen, et al., 1995).

Furthermore, rather than looking at conversation from the point of view of exchanging of messages through a still and transparent medium, the concept of conversation has been reanalyzed as consisting of programme sharing and linguistic interaction within a widespread medium. So from a communication perspective, the mediums are active computing systems within which people and intelligent systems converse (Pask, 1975). Central to these learning conversations is the need to express one’s feelings or thoughts, in words or actions for better understanding. By virtue of having the competence of participating in a productive conversation, all parties need access to a common external representation of the content that allows them to identify and debate topics (Sharples, 2002). We must therefore not lose sight of the fact that conversation is an essential part of the meaning-making process since knowledge, for most scholars, is language mediated (Jonassen, et al., 1995). In the study, students discussed scheduling meetings with either their fellow students or with their instructors as well as how mobile devices have enabled them to receive instant feedback from them.

8. Contextual – This refers to a system of instruction which is based on the philosophy that students learn when meanings are discerned in an educational material and in works assigned them by their teachers when they can link new information with previous knowledge together with their own experience (Johnson, 2002). It is also argued that contextual learning refers to “learning tasks that are situated in meaningful, real world tasks or problem-based learning environment” (Ruokamo et al., 2012, p. 379).

Again, contextual learning is based on the premise that meaning emerges from the relationship between context and content (Garrison, 1992). By context, it includes features of the actual world setting in which

the task to learn may naturally be fulfilled (Brown, Collins, & Duguid, 1989). Thus, context assigns meaning to content. In this situation, the more students are able to link their lessons to this context, the more meaning they will gain from them. The idea ultimately is that once students are able to discover meaning in knowledge and skills, it then leads to their mastery of them (Johnson, 2002).

Another school of thought postulate that the social and cultural background of the learner (the context) and the learning situation is explicative in the sense that learners may respond differently to an experience contingent on their identities as learners, and how they interpret a particular activity or event. In certain scenarios for instance, learners may feel extremely capable and be ready to share their experiences as part of the learning programme, while in other situations they may feel apprehensive or perhaps even averse to the idea (Caffarella & Barnett, 1994).

Contextual learning works for a number of reasons too. For instance, it engages students in important activities that help them link their academic works to their context in real life situations. When these linkages are made, students then see reason in why various exercises are assigned them by their teachers. Aside from contextual learning corresponding to the way the world works, it also meets the expectations of the brain's need to link new information with previous knowledge to shape its concrete form in response to the environment (Johnson, 2002). In the study, students explained how mobile technology has been beneficial to their learning by enabling learners to get up-to-the-minute news and information about study-related courses as well as working life conditions or situations.

9. Emotionally involving – There are students who perform best in a lecture room setting where the atmosphere carries a high emotional charge. For example, some classrooms may be identified with the provision of an emotionally colourful learning atmosphere. In fact, this evocative learning setting may even include the teacher's own apparent enjoyment and participation in what is being taught. On the other hand, another emotionally involving classroom may have the teacher and students conduct active discussions or debates where dissents may be common and probably strong positions opinionated. Considering both classroom settings, the emotional tones could be observed. A comparison of the two emotionally involving settings may show the former focusing on the topic being dealt with while with the latter, the focus may be on sides taken (Fisher & Fisher, 1979).

It is also reported that according to university students' perceptions, emotional involvement is a highly important feature of a good learning environment. The relationship between the students and their academic environment has an impact on their motivation to learn (Ruokamo et al., 2012).

10. **Goal-oriented** – As learning is generally considered a goal-oriented activity, more often than not teachers are assigned to involve their students in a search for meaning and how significant learning materials are. This search for meaning must be a “pleasurable experience” (Cheung, 2001, p. 57). In addition, the learning materials should be something that students cannot only relate to, but also must be within their level of interest (Furlong & Maynard, 1995).

In a goal-oriented learning environment, learning is achieved by means of discovery and exploration (Riber, 1992). During this activity, students work diligently with the intention of achieving and increasing each individual's knowledge (Hakkarainen, Lipponen, Järvelä, & Niemivirta, 1999). Further to that, members participate in a particular task with specific body of resources, goals, and orientations. They then participate and orient to the situation where certain bits of information and knowledge become significant and are therefore initiated by the group members. In a situation where goals are already established, they are reinforced. Also based on the consistence with the goals, decisions are made either being in the know or not. Again, with respect to how members make decisions also considers what directions to pursue and what resources to use (Schoenfeld, 2010). The study thus discussed the usefulness of mobile technology to students when picking up incidental ideas related to their goals of study.

11. **Reflective** – By sound judgement in practical terms, reflection lies somewhere around the notion of learning. We reflect on something in order to consider it in every respect (Moon, 2001). One major prerequisite for making meaning of new information and advancement from surface approach learning to deep approach learning is reflection. Xie (2008) defines reflection as “a cycle of inquiry for the purpose of making meaning or finding solutions for a troubling situation or question” (p. 18). Reflection therefore places an emphasis on learning by way of interrogating and exploring to lead to a development of discernment (Smyth, 1992).

Research has detected that most university students are involved in partial reflective thinking since their reflections, under normal circumstances, cease at the lower level (King & Kitchener, 1994). In view of this, various plans of actions have been intended for encouraging and promoting the reflective thinking

skills of students; e.g. journal writing and peer feedback (Xie, 2008). Also, being an essential component of learning, reflection has been argued to be the means of integrating learning into the patterns of thought and relating it to previous knowledge. Reflection on the learning process allows the learner to make a general review and acquire further understandings of oneself or the knowledge (Moon, 1999).

In support of the aforementioned, weblogs have been cited as one significant method for underpinning reflection. This can be attributed to the fact that bloggers can easily have access to divergent opinions online. For instance, comments on classmate' blogs can activate diverse perspectives and guidance such that a thorough view of the content could be benefitted by students (Xie & Sharma, 2008). This study equally considered students' comments on someone else's articles, journals, blogs, and other online documents as having promoted their learning.

12. Abstract – By abstract, it refers to an individual's ability to make a generalization based on previous knowledge. Basically, when something is simplified by discarding irrelevant information, it can be said a learner is abstracting or generalizing.

Also, the ability to generalize from sparse data is crucial in learning, in the sense that human cognition depends on a special talent for bringing out generalized knowledge from a few specific instances (Tenenbaum, Griffiths, & Kemp, 2006). In another context, it is postulated that abstract is the construction of new ideas at an abstract level. Further supported is the assertion that from practical experience, the development of theoretical ideas becomes deeper (Ruokamo et al., 2002). In the study, students have discussed how mobile devices have been useful to them when constructing new ideas on an abstract and theoretical level.

13. Multiple perspectives –oriented – These sets of viewpoints, from instructors' position, are crucial to learners since they “allow teachers to create a bridge to powerful critical literacy learning in their classrooms” (Clarke & Whitney, 2009, p. 530). Alternatively, Mausfeld (2010) calls these learning perspectives ‘multiperspectivity’.

Learning occurs in many different facets, for example, in the lecture room, students have conversations with their fellow mates, and even after. It is therefore important that multiperspectivity is considered since it enables learners to think flexibly which in other words, leads to creativity and variation. When students are able to explore content from multiperspectivity, they will become confident with complex situations that have many correct answers (Feldman, 2002). Aside from the familiarity of

multiperspectivity helping learners to appreciate others' viewpoints, it also provides powerful tools for understanding how students learn through participation in the classroom (Borko, 2004).

14. **Critical** – Critical thinking in general refers to the ability to think clearly and rationally. It includes the ability to engage in reflective and independent thinking, so learners can understand the logical connections between ideas and identify, establish, and evaluate arguments. In addition, critical thinking focuses on messages that are conveyed through speech or writing. These same messages could be delivered by means of performance or through media (Ruokamo, et al., 2012).

According to Gokhale (1995), critical-thinking items comprise concepts that must be analyzed, synthesized, and evaluated. In fact, the relationship between critical thinking and learning on the whole seems to enjoy an indisputable coexistence in contemporary educational literature, much of which postulate that if students are to learn to think, they should be given the support and confidence to ask critical questions (Norris & Ennis, 1989). Thus, teachers are encouraged to resort to classroom strategies that churn out more active learners rather than passive ones on the basis of 'the global economy', which without any shred of doubt, needs "active, creative, and critical workers who are 'life-long' and 'life-wide' learners" (Mason, 2008, p. 10).

As expected, many faculties ensure that critical thinking becomes an integral part of learning (Kurfiss, 1988). In this study, students had their thoughts on how mobile technology have provided them opportunities to use their creativity in their studies.

15. **Experiential** – Learning per se, requires abilities that are basically diametrical, and that learners must repeatedly choose which set of learning abilities they will use in a particular learning situation. Some scholars are of the opinion that the acquisition of experience suggests learners find new information through encountering the tangible, relying on their senses, and immersing themselves in concrete reality (Kolb, Boyatzis, & Mainemelis, 2001). On the other hand, other academicians consider experience to be learners' ability to become aware of new information by way of confronting something visible that by association, represents something else that is invisible. For that reason, instead of using sensation as a guide, they would like to indulge in systematic planning. In sum, in transforming experience some learners tend to critically observe other learners' experiences and reflect on their outcomes while some too, may decide to become involved in the learning process quickly (Kolb, et al., 2001).

Similarly, experiential characteristics mean that as a starting point in the learning process, students can employ their own experiences and gradually are able to utilize their own practical experiences throughout the course. Whatever the students learn based on their direct experiences is experiential (Ruokamo, et al., 2012). Besides, it needs to be emphasized that using experiential learning is one method for responding to the needs and strengths of adult students (Caffarella & Barnette, 1994).

Further to the above, there have been recommendations that experiential learning can be incorporated into post-secondary education in several major ways. For example, in students' practical training as part of an overall programme, or part of a course design as a separate learning experience (Caffarella & Barnette, 1994). In the study, students have expressed sharing their off-campus learning experiences in workplaces and "in the field" with either their fellow students or their instructors.

16. **Multi-representational** – For learning to be effective, there is the need to integrate multi-representational techniques. Computer-based learning environments for example, widely use multiple representations to convey and visualize complex materials. Therefore, in taking full advantage of dynamic multi-representational materials, learners are required to actively organize and consolidate associated elements from different and ephemeral information sources (Yeh, Chen, Hung, & Hwang, 2010). Corroborated further is the contention that when faced with fresh and complex ideas, it would be best to have multiple external representations since they are capable of enabling an individual to have different opinions of ideas (Schwonke, Berthold, & Renkl, 2009).

As expected, cogent arguments have been made concerning the presentation of information in both visual (pictures or animations) and verbal (text or narration) forms. The presentation in these forms, it is believed, considerably improves recall and problem-solving transfer by aiding learners encode the information in both visual and verbal forms which then, are integrated in long-term memory (Mayer, 2003).

More significantly, instructional software can equally provide students with tools to make connections across multiple representations (Kozma, 2003). In the study, students recalled listening to podcasts, lectures, and other study-related audio materials via mobile technology.

17. **Creative** – To be creative means solving a problem in a new way. Considering the circumstances and goals of the current age, it is no longer sufficient to simply transmit information that students memorize and store for future use. Education therefore must be focused on "helping students learn how

to learn, so they can manage the demands of changing information, technologies, jobs, and social conditions” (Barron & Darling-Hammond, 2008, p. 3). Indeed, for students to be creative, they have to be able to apply different areas of knowledge to new problems and challenges.

Several studies have also demonstrated that students learn more deeply and perform better on complex tasks if they have the opportunity to be involved in more “authentic” learning—projects and activities that require them to apply subject knowledge to solve practical problems (Barron & Darling-Hammond, 2010).

In the same vein, a number of research have proven a positive impact on learning when students participate in lessons that require them to construct and organize knowledge, consider options, undertake detailed research, inquiry; writing and analysis, as well as to communicate effectively to audiences (Newmann, 1996). To develop these higher-order skills, students need to take part in complex, meaningful projects that require sustained engagement, collaboration, research, management of resources, and the development of an ambitious performance (Barron & Darling-Hammond, 2008). This study equally indicated how mobile technology have provided opportunities for students to use their creativity in their studies.

2.4 The ETMeL Model

As indicated in Figure 2 below, the Enhanced Teaching and Meaningful e-Learning (ETMeL) model is an upgrade of an existing pedagogical model (i.e., TML).

Enhanced Teaching and Meaningful e-Learning (ETMeL)

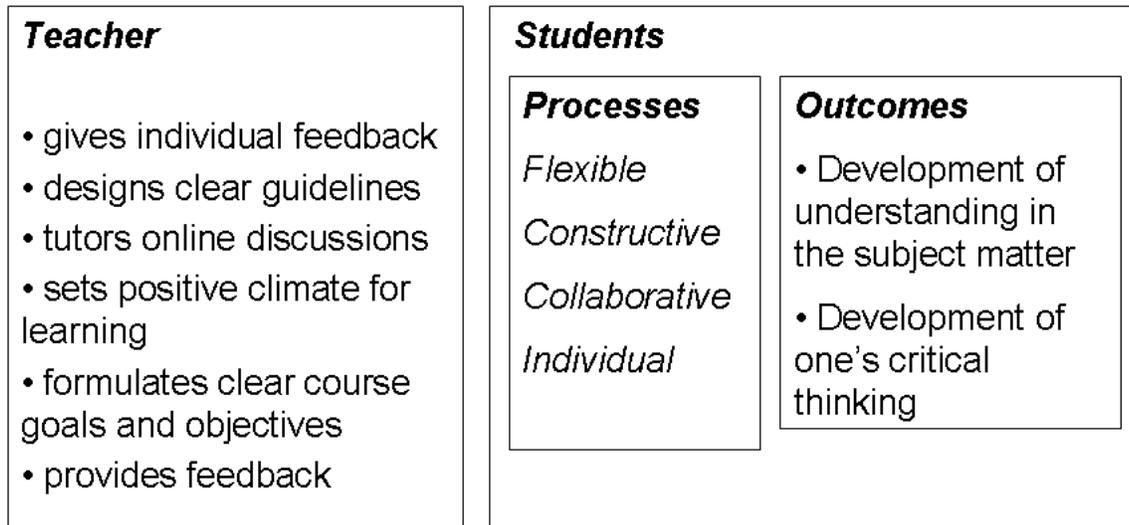


FIGURE 2: The ETMeL model (Ruokamo, Hakkarainen, & Eriksson, 2012).

The idea of reducing and simplifying the 17 process characteristics of meaningful learning in the TML model paved the way for the ETMeL model. This creation was made possible after a design-based research (DBR) had been conducted. Fundamentally, a design-based research (DBR) is about understanding how people learn, especially within the formal settings. It is also about designing ways to better ensure that learning will take place in these environments. According to Ruokamo et al. (2012), DBR targets the simultaneous improvement of both theory and local practices. In this research, the DBR in the ETMeL model is related to the theory of cognitive learning by Ausubel (1963, 1968; Ausubel, et al., 1978). Thus for all intents and purposes, the ETMeL model is a viable model.

In general, the ETMeL model makes clear how the characteristics of meaningful learning can be grouped together in the “pedagogical and learning theoretical approaches to educational use of ICTs” (Ruokamo, et al., 2012, p. 384). Not only that, it also brings to view how teaching and meaningful learning are achieved from the student perspective of the “pedagogical and learning theoretical approaches to educational use of ICTs” (p. 376). Further to that, a major plan for the preparation of the ETMeL model

considers “designing, implementing, and evaluating meaningful e-learning in higher education” (Ruokamo, et al., 2012, p. 376).

As recommended, creating an effective pedagogical model will not only increase the awareness in teachers about the various means by which technology can be used to deliver sound methods of practice and teaching, but also will provide technology skills training for students and faculty as a whole. Besides, a thorough understanding of how to use new technologies competently and efficiently in the teaching and learning process will ensure that students gain a lot from a more meaningful learning experience (Ruokamo, et al., 2012). A reminder though is that no unique way exists for the integration of technology into the teaching and learning processes.

Last but not least, to a significant extent, integration endeavours should be creatively designed for certain subject matter ideas in specific study hall or classroom contexts. Also, being aware that teaching with technology is elaborate, the recommendation is that understanding techniques to effective technology integration requires educators to develop new ways of understanding and cooperating with this complexity (Koehler & Mishra, 2009). As a matter of fact, this is one of the endeavours of the ETMeL model (see Figure 2).

To present a justification for the use of the theory and models, some past studies have been involved with them, including studies on educational digital video production (Hakkarainen, 2009), mobile learning (Franklin, 2011), pedagogical models in network-based education (Ruokamo, Tella, Vahtivuori, Tuovinen, & Tissari, 2002), and mobile technology (Turkle, 2011), to mention a few. In all these previous studies were various aspects touched on, indicating both models and the theory can be successfully applied to explain how students perceive the use of mobile technology in higher education learning. In addition, they are capable of being put to use to explain the pedagogic strategies of employing new learning opportunities with technology at the higher education level, how mobile technology can be effectively applied to improve students’ learning in universities, as well as identifying some factors that impede higher education learning with mobile technology.

To restate, this thesis is about students’ perceptions of using mobile technology in higher education learning. The study attempts to find how international degree and exchange students in a certain university in Finland consider the use of mobile technology in the teaching-studying-learning processes.

In the theory of cognitive learning, the motivation is that the fact or condition of learners knowing something with familiarity gained through experience or association, is key to meaningful learning. The TML and the ETMeL models equally highlight both the students' learning processes and learning outcomes or to the expected outcomes. On account of these, the expectation is that learning with mobile technology is seen as 'existing within a context of information'. With the experience of owning a mobile device collectively and individually, learners utilize and create information thereby improving their learning. Moreover, students' interactions are mediated through technology and it is by means of such convolutions of interactions that information becomes meaningful and useful (Koole, 2009, p. 27).

Indeed, if mobile learning is learning through mobile computational devices (Quinn, 2000), and students are familiar with the use of their mobile devices (serving as their prior knowledge), then there is the opportunity to break away from teaching that takes place in the lecture rooms, and to move to another location while communicating via information networks (Seppälä & Alamäki, 2003), and which can certainly pave the way for some new possibilities of students' learning. However, risk of distraction (Crescente & Lee, 2011) and other challenges to the efficient use of mobile technology in higher education learning cannot be overlooked.

I consider the theoretical models featured in the study relevant in analyzing the objectives of this research: exploring the perceptions of students concerning the use of mobile technology in higher education learning, investigating the rate of educational use of mobile technology; how the extent by which students' familiarity with mobile devices have promoted their learning, and identifying the amount of hindrance in the educational use of mobile technology by university students. The TML model, for instance, had been applied by Hakkarainen, Sarelainen, and Ruokamo (2007) on achieving meaningful learning through digital video-supported case studies at the higher education level. The research had been necessitated by challenges faced by advanced educational institutions caused by changings in working life and new developments in the technology of digital video (DV) (Jonassen, Howland, Moore, & Marra, 2003; Kearney & Shuck, 2004, 2005). The study particularly focused on finding out the students' perspectives on whether: designing and producing digital video-supported cases and solving digital video-supported cases in an online course, supported meaningful learning as well as ascertaining the roles that digital videos played in the online students' meaningful learning process. In the end, the research indicated that designing and producing, together with solving the digital video-supported cases

promoted, especially the ‘active’ and ‘contextual’ aspects of the students’ meaningful learning as well as their positive ‘emotional involvement’ in the learning process. In actual fact, the aspects promoted by the authors’ research belong to the set of 17 process characteristics and expected outcomes through which meaningful learning is defined according to the TML model. In addition to that the focus of the study, with its accompanying research questions and the models were not only akin to this present study, but were also capable of being analyzed effectively.

Similarly, based on a DBR process for designing, implementing, and refining a problem-based learning (PBL) course on educational digital video (DV) use and production in a certain university in Finland, Hakkarainen (2009) examined students’ learning processes and outcomes from the perspective of meaningful learning. In the initial stage of the study, the purpose was to analyze, from the view point of meaningful learning, pilot students’ experiences of the DV production process and to apply the experiences in the DV course design. In the second stage of the study, the DV course was administered for the first time with the objective of investigating, from the point of view of meaningful learning, the students’ learning processes and learning outcomes, as well as utilizing the research results to improve the course. Finally, the results proved that PBL offered a good model to enhance students’ knowledge and skills in producing and using educational DV. The results also advanced that DV production was capable of being used as a method to learn about the subject matter of the DVs.

As a matter of fact, apart from the researcher’s use of the TML model, Hakkarainen’s (2009) study also included a DBR process. As pointed out earlier, DBR involves developing, testing, investigating, and refining learning environment designs and theoretical constructs such as the pedagogical models that support learning, illustrate learning, and predict how learning occurs (Barab & Squire, 2004). The study thus involved the processes of a DBR in DV use and production for instructional purposes which ultimately led to DV as a potential educational model. It is therefore the hope of the researcher of this current study that the DBR processes involved in the models propounded, will enhance, demonstrate, and even predict the use of mobile technology in the teaching-studying-learning processes at the higher education level, and the outcomes from the models thereof, provide explanatory frameworks that will specify expectations which may become the “the focus of investigation during the next cycle of inquiry” (Cobb et al., 2003, p. 10).

Last but not least, a study by Gikas and Grant (2013), paying particular attention to 3 universities across the United States, presented some findings on students' perceptions of learning with mobile technology and the roles social media played. The study was centred on examining teaching and learning when mobile computing devices like cell phones and smartphones, were administered in learning at the advanced level. Based on the models and students' prior knowledge of mobile devices, it was contended that in learning with the mobile computing devices, learners can personalize the way they react with course content since with mobile learning, content can be more text aware and also be situated in the surroundings where learning is more meaningful to the learner (Gikas & Grant, 2013; Traxler, 2010). Furthermore, from the research, students can also modify "the transfer and access of information" so that they will be able to "build on their skills and knowledge to meet their own educational goals" (Sharples, Taylor, & Vavuola, 2007, p. 223). In making comparison of this point to aspects of the TML and the ETMeL models, Gikas and Grant (2013) achieved the meaningful learning process characteristics of 'individuality or personalized' where students could have individual interactive styles and strategies towards the course content. Moreover, since learning is situated in an enabling environment of the students, there is some form of 'flexibility' in the achievement of meaningful learning (Garrison & Kanuka, 2004). In addition to that a 'goal-oriented' process feature had been achieved based on students working actively to achieve their cognitive goals or building on their skills and knowledge.

With the second aspect of the study which dealt with the roles that social media played in students' learning with mobile computing devices, it was argued that using social media tools in learning supported a greater amount of student-centred course since they empowered students to interact and collaborate with one another as well as with their teachers (Gikas & Grant, 2013; Greenhow, 2011). Indeed, 'collaboration', being one of the significant process features in the models; and social media, considered as any online technology or practice that enables us share (e.g., content, opinions, insights, experiences, media) and have a conversation about the ideas we care about, have made it possible that students can make full use of one another's skills and that they can offer social support and modelling for other students (Hakkarainen, et al., 2009). Thus respectively, 'individual', 'goal-oriented', 'collaboration', and 'flexibility' are process characteristics in the TML and ETMeL models.

To recap, the aforementioned study had explored teaching and learning with mobile computing devices using facets of the TML and ETMeL models. It had also evaluated the merits and flaws of the use of mobile computing devices for learning in higher education institutions.

In a similar way, this present study seeks to investigate students' perceptions of using mobile technology in a higher education institution by also considering the explorations of the rate of educational use of mobile technology by higher education students, how the rate of mobile technology use has impacted on students' learning, as well as the amount of hindrance in the successful use of mobile technology by higher education students. In virtue of the reviewed studies made, I consider the theory of cognitive learning and the TML and the ETMeL models proper in the circumstances of this study.

2.5 Empirical Review

In this study, I seek to investigate students' perceptions of using mobile technology in higher education learning. The study also seeks to explore the following: 1) how new learning opportunities are made available to students by means of mobile technology, 2) how the use of mobile technology has promoted students' learning at the higher education level, and 3) the hindrances that affect the successful use of mobile technology in higher education learning.

In the context of the study, mobile technology has been specified to include the use of any of the 3 mobile computing devices, namely: smartphone, tablet, and laptop computers.

2.5.1 Students' Perceptions toward Mobile Learning

Mobile learning may be defined as learning that takes place with the help of mobile devices (Attewell & Savill-Smith, 2005). According to Mahat, Ayub, and Luan (2012), mobile learning is "a new concept of learning via mobile technology" (p. 284). As Quinn (2000) states, mobile learning is learning through computational devices. One of the features of mobile learning is the flexibility for students to engage in the educational process and material, anywhere and at any time (Dew, 2010). In the universities all over the world, the popularity of accepting mobile technology in the teaching-studying-learning processes abound. In fact, it seems to have become a new phenomenon these days as students are able to even determine, when they so desire, to learn whatever they want to, or be involved in interactions with their colleagues on a common subject matter all through the application of most recent technologies. As indicated, mediated educational activities allow students to be involved in collaborative, authentic, situated learning activities (Brown & Palincsar, 1989; Brown, Collins, & Duguid, 1989). Indeed, by way of international collaboration students all over the world do engage in cooperative learning activities by sharing information through computer networks (Riel, 1993).

Furthermore, mobile technology has moved beyond being a communication technology (Goggins, 2010) due to the exponential rate and ways by which these tools are being exploited, especially in the advanced education sector. Certainly, mobile technology figures prominently in the future of higher education, particularly in its integration into teaching and learning (Rossing, et al., 2012). It had even been projected that about 80% of users accessing the internet would be using a mobile device (Wakefield & Whitten, 2006). In view of this galloping trend and in an effort to meet the educational needs of higher education population, many mobile learning strategies are being employed by educational stakeholders involved in this issue (Rossing, et al., 2012; Dahlstrom, et al., 2013).

In trying to explore the perceptions of students concerning the use of mobile technology at the higher education level, it is the author's conviction that the key phrase 'perceptions', needs some clarification to keep the study moving forward. Perception may be defined as the process by which an organism detects and interprets information from the external world by means of the sensory receptors (Wann, Rushton, & Mon-Williams, 1995). Also, it is the process by which individuals organize and interpret their sensory impressions in order to give meaning to the environment (Mitchell, 1993). By this definition, it can be said that perception is a process by which we obtain information about the world and especially, about our relationship with the world. Indeed, research on perception consistently demonstrates that several individuals may look at the same thing, yet perceive it differently. Relating these discussions to the present study, perceptions pertain to how we obtain information about mobile technology and, particularly our association with their uses. Thus the way in which mobile technology is either regarded, or understood, or interpreted by university students is significant in this study.

First and foremost, most university students consider the use of mobile technology in the teaching-studying-learning process based on the flexibility of the devices. As stated by Seppälä and Alamäki (2003), there are two clear-cut attributes of the use of mobile technology in learning: First, there exists the situation where the student can separate himself or herself from the instructional process in the lecture room and move to another location while communicating through information networks. This flexibility certainly enables students some greater freedom of learning at any place and at any time (Timmis, 2012). As a matter of fact, since the mobile computing devices are light in weight, flexibility endows the student with the convenience of carrying their mobile devices along with them whenever and wherever they want to. In placing emphasis on the issue of flexibility comes the synonymous definition of mobile technology; mobile computing devices have included technologies that are transportable, such as cellphones and smartphones, including tablet computers, laptop computers, and netbooks (Valk et al., 2010).

Another distinctive feature of mobile learning is that “it enables learners to enter an information network at the precise moment when necessary by using a portable learning device and a wireless network” (Seppälä & Alamäki, 2003, p. 330). This affords students in their learning with the capability of accessing information expeditiously (Gikas & Grant, 2013).

Moreover, it is argued that mobile technology is exponentially becoming more ubiquitous and accessible to many learners since they promote an anywhere, anytime, learning environment (Dickson & Segars, 1999). In consequence of this, it is also presumed that a technological learning environment can typically, in a comparatively small but significant way, change the way students learn and the way teachers teach (Culp, Honey, & Mandinach, 2005). Besides, students believe that owning a mobile device with more advanced technologies will lead to easy access to the internet (Cook & Smith, 2007; Taleb & Sohrabi, 2012). That apart, Al-Fahad (2009) contends that mobile technology can be used to enrich students' learning environment through the provision of quality of network or timely information. To give an instance, when in transit, students may not be able to access course information and other applications, or even complete their course work. A wireless device overrides these limitations by enabling students to disseminate information and complete other course work even when they are out of reach from their wired internet connections (Motiwalla, 2007) and this definitely, further improves the quality of the 'anyplace' potential of wired internet to the next level, namely, 'anywhere' (Peters, 2002).

Nonetheless, some students may perceive the use of mobile technology from the view point of poor network. According to Wang, Wu, and Wang (2009) one of the numerous challenges confronting m-learning includes connectivity. Indeed, since students more often than not complain of encountering technical problems when using mobile technology for learning, it seems to have dissuaded some from completely using the devices to learn. For instance, the mention of mobile technology (for educational purposes) makes some students pour out the grievance of continually losing mobile phone signal in their homes, particularly. As reiterated by Taleb and Sohrabi (2012), "university students have a good knowledge of mobile phone learning obstacles" (p. 1107). Another perception of learning with mobile technology is that it offers fresh ways to extend education "outside the classroom, into the conversations and interactions of everyday life" (Sharples, et al., 2009, p. 237).

To add, it allows students to be engaged in more extensive discussions and investigations, such that the act of learning with the mobile technology goes way beyond the walls of the lecture room (Rossing, et al., 2012). For the reason that wireless devices are highly individualized and collaborative communications tools, Motiwalla (2007) adds that mobile technology offer faculty flexible tools for complementing the existing technologies by extending the learning beyond the lecture rooms and homes from remote places where students may not have access to computers and the internet.

Again, mobile technology provides students with opportunities to deepen their learning and to create or apply knowledge (Rossing, et al., 2012). In addition, based on the features of m-learning, individualized learning and collaborative learning are achieved (Cheon, et al., 2012). Thus with mobile technology, students can either learn on their own or may decide to work in groups based on the scope of instructions. Last but not least, mobile technologies are considered significant multipurpose tools for students. For example, some students have reported that using tablet computer fosters productive collaborative learning. Besides, they improve interactions with peers and instructors (Shuler, Hutchins, & LaShell, 2010). Through a collaborative effort, students can read one another's work on a shared platform mediated by the mobile technology as well as receive feedbacks from their instructors. Also pointed out is the claim that collaborative mobile learning can create higher involvement and motivation beyond the basic traditional collaborative learning activities like, face to face in the lecture room (Ryu & Parsons, 2012). Further opined, it is believed that students are a step ahead of educators in using mobile communication to "connect, discuss, learn and identify others with the same ideas or divergent ideas" (Frank, 2011, p. 263).

Finally, there is the indication that collaborative applications of mobile technology aim to encourage knowledge sharing while making use of the learner's physical context and mobility (Patten, Sánchez, & Tangney, 2006).

2.5.2 Students' Learning Opportunities with Mobile Technology

The development of mobile wireless technologies has provoked an enormous amount of interest among researchers, educators, school administrators, and scholars, among other interest groups, due to the gradual drift from the traditional educational settings to mobile learning environments. Indeed, many institutions of higher education nowadays offer courses by taking into consideration mobile wireless technologies as alternative instructional tools. Most of these mobile wireless technologies include web-enabled wireless phones (e.g., smart phones), web-enabled wireless handheld computers (e.g., palmtop, and tablet computers), wireless laptop computers and Personal Digital Assistants (PDAs) (Kim, Mims, & Holmes, 2006).

As mentioned earlier, the ultimate learning status for students is now irrespective of the learning environment. Due to modern trends in technologies, the traditional classroom cannot be said to be the

only learning environment where students ought to gather or meet at all times for instructional activities. In view of this, mobile technology has facilitated and promoted students' learning in various ways. University teachers are now also able to stoke the embers of academic enlightenment through the provision of different learning opportunities. Young (2011) states that computer application programmes in mobile devices are worthy of being used as relevant learning aids by students, anywhere or at any place. A typical example is the application of a mobile technology enabling the learner to produce pictures, videos, or animations on a particular topic with their fellow learners. It is believed that students' capability of utilizing the apps is a means of promoting their learning one way or the other. Thus, the conclusion can also be drawn that providing students with the freedom of location and time in learning (Kim, et al., 2006), is an instructional strategy.

Again, mobile technology can be used in the collaboration of learners with similar interest who may gather either formally or informally to share ideas, solve problems, or offer suggestions concerning a specific subject matter. For instance, many are of the view that technologies like wikis, dv, podcasts, as well as tablet computers can be used to support students' engagement in learning (de Winter, Winterbottom, & Wilson, 2010; Enriquez, 2010). As a matter of fact, by the author's own experience, the students from the institution where this study is taking place have their individual students' addresses with the Outlook Web App (i.e., a browser-based email client that enables one to access his or her Microsoft Exchange – Server mailbox from almost any web browser). Using the Outlook on the web and the Optima (an online learning environment) including Google Docs, relevant information and other ideas are shared among students and their teachers. Timmis (2012), adds that university students can be involved in collaborative efforts through various communication tools and spaces including university owned spaces like virtual learning environments (VLEs), university email systems, and their own communications and social media, all being indications of “continual multitasking across formal and informal settings and boundaries” (p. 4).

As argued by Jones, Connolly, Gear, and Read (2006), mobile technology provides a discussion environment where learners can make their opinions and responses freely known by way of anonymity. The belief is that these comments from learners prevent any form of resentment and ‘counter offences’ from other members. In support of this valuable learning opportunity, it is noted that all the possibilities of using mobile interactive multimedia and communication in educational settings offer innovative ways for supporting learning, collaboration and communication (Sharples, 2006). Again, in the opinion of the

author, since there are universally available tools that enable students to learn and teachers to teach with greater efficacy and efficiency (Wurst, Smarkola, & Gaffney, 2008), there will always be new learning opportunities available for both teachers and students. Just as reiterated by Culp, Honey, and Mandinach (2005) a technological learning environment is capable of changing the way higher education students learn and the way professors teach. Besides, Mehdipour and Zerehkafi (2013) add that with the introduction of the system we use to access the internet, distant education providers and teaching institutions at all levels are on an exponential level, utilizing the Web as a medium for delivery.

Furthermore, Frank (2011) posits that ninety percent of higher education students possess a mobile phone which in new ways, connect them to other learners and information. As such, the constant access to information offers learners new ways to learn. For example, some respondents in this study confirmed that being constantly connected with their colleagues through mobile devices has promoted their learning, while others said working online in both synchronous and asynchronous forms has also promoted their learning, with others agreeing that mobile technology has been beneficial to them in the sense that the mobile devices have enabled them to receive instant feedback and advice from their lecturers. All these attestations prove that new learning opportunities are always available to be exploited by both learners and their instructors in the enhancement of the teaching-studying-learning processes.

Last but not least, it is worthy of note that it is virtually not possible and practical to conveniently provide students with every knowledge and skill they would need in life. As a result, people will need to persistently increase their knowledge and enhance their skills and professional development in order to confront immediate problems in their lifetime (Sharples, 2000). As stipulated, the new educational goal is to empower people to manage their own learning in a variety of contexts throughout the period of their lives (Bentley, 1998). Considering these contexts is the statement that “one role for computer is to be a substitute for the teacher”. Therefore, as a learning opportunity, we need to take cognizance of the reality that not only does new technology endow learners to communicate with their instructors and fellow learners but it also enables learners to interact with learning resources and stimulated environments through which information and knowledge can be acquired in solving problems as well as satisfying our curiosity (Sharples, 2000, p. 183).

2.5.3 How the Use of Mobile Technology Has Promoted Students' Learning

The use of mobile technology is now widespread among university students due to its flexibility and portability among many other uses. Students' adaptation of these technological tools has certainly deepened and encouraged a lot of research on mobile learning. It can be said then that the proliferation of mobile technology use in learning has indeed offered a plethora of opportunities to support the teaching-studying-learning processes. As attested, mobile learning opens the door for a new kind of learning known as 'here and now learning'. This type of learning takes place when learners have access to information 'anytime and anywhere to perform authentic activities in the context of their learning' (Martin & Ertzberger, 2013, p. 76). Similarly, this study will seek to explore some of the ways that mobile technology has positively impacted on higher education students' learning.

Primarily, mobile learning studies are concerned with the issue of effectiveness (Wu, Wu, Chen, Kao, Lin, & Huang, 2012). The expectancy is that through the use of mobile technology, positive learning outcomes must be met (Wu, et al., 2012). Since research has revealed that learning is increased when students are engaged in active learning, a major step in the improvement of students' learning with mobile technology is therefore through active learning. By active learning, Franklin (2011) posits that it involves students in "talking and listening, reading, writing, and reflection, all possible through the use of a mobile device" (p. 264). In the study, respondents confirmed the aspects of 'collaboration' and 'communication' efforts made while engaged in learning. For example, students believed that taking part in discussions via applications based on written communication enhanced their learning. To further buttress this point, research has again demonstrated that active and interactive ways of learning help learners acquire knowledge aside from developing students' critical thinking skills. Besides, these active and interactive ways empower learners to solve problems in a variety of situations as well as help them think independently (Motiwalla, 2007; Sharples, 2006; Patten, et al., 2006). From the study, students agreed that being constantly connected with their mates through mobile technology had an improvement on their learning.

Moreover, it is argued that through the use of mobile technology, students can help one another on projects or assignments. Just as in the study, students acknowledged participating in both synchronous and asynchronous discussions via mobile technology. Also, lecturers can provide and exchange information faster with their students as "web links can go beyond the regular curriculum of a textbook and make greater learning possible" (Wurst, et al., 2008, p. 1772). Thus, it is believed that one way of

improving students' learning is getting feedback from their teachers (Hwang & Chang, 2011). In the study, students admitted that mobile devices have enabled them to receive instant feedback and advice from their instructors.

Another significant point made on university education learning with mobile technology is the claim that mobile learning is activated by the integration of various hardware and software technologies, such that they can be turned into multimedia applications which can facilitate the communication of educational content in different forms for higher education students (Clark & Mayer, 2016; Horton, 2011; Taleb & Sohrabi, 2012). Attested to in the study, students claimed that apart from watching study-related audio-visual materials like videos, they had in actual fact, been involved in the production of audio-visual course assignments which among other forms, included videogames. To all intents and purposes, the claim is that videogames are entertaining, immersive, and they stimulate cooperation and competition (Lavín-Mera, Moreno-Ger, & Fernández-Manjón, 2008). On this account, educational videogames in mobile learning afford new possibilities for creating high quality educative experiences (Lavín-Mera, et al., 2008).

Moreover, mobile technology has wielded a lot of support in students' learning due to its portability. Because the device does not carry much weight, they can be carried and taken anywhere in different locations where learners can use them to communicate with their mates or instructors on a specific focus of attention. Actually, the mobile technology is always accessible (Cheon, et al., 2012; Mehdipour & Zerehkafi, 2013) and the accessibility is within reach (Gikas & Grant, 2013). In the study for example, students admitted using mobile technology for study purposes outdoors. Next, one learning approach which seems to be approved by mobile technology is individualized learning (Franklin, 2011; Ryu & Parsons, 2012; Virvou & Alepis, 2005). Without any undue pressure on the student, they can learn by themselves and at their own convenience and satisfaction. This type of learning has some students affirm that mobile technology has aided them to achieve their own personal goals.

Another crucial point worthy of note in students' mobile learning is the ability to use and effectively manage their time, especially while off-campus or outside the university context. Although mobile learning can take place any time anywhere, there is still the need to plan at certain times when one needs to study. For this reason, mobile technology has device applications, like calendar applications which can be used to alert them. Indeed, vibrotactile displays have been featured in mobile devices to alert users to upcoming calendars or reminders. It is believed that by providing such alerts, it would be possible to

carefully monitor incoming calls, including calendar alerts and respond to them if it is appropriate to the particular circumstances (Brown, Brewster, & Purchase, 2006). In the current study, students did admit that mobile device applications have aided them to manage their time while studying.

2.5.4 Some Factors Affecting the Use of Mobile Technology in Higher Education

Mobile information and communication technologies are reasonably being promoted in 21st century education, the ultimate aim, of which is to influence student learning processes and outcomes (Cradler, McNabb, Freeman, & Burchett, 2002). With the recognition of mobile technology, learning appears to be occupying a new space that gives individuals the capacity to make use of electronic resources and tools in adaptable ways that suit their circumstances and lifestyles (Kukulka-Hulme & Pettit, 2009). As a matter of fact, mobile technology such as smartphones, laptops and tablet computers offer a tremendous amount of access to information as well as provide new ways of learning.

Even though there have been many reports on the benefits and potential of these technologies in learning, many researchers have found reasons to exercise caution on their full advancement. As Sharples, et al. (2009, p. 238) caution, “Having to change the focus of attention from the surrounding world to a handheld device can at best be distracting and at worse dangerous (such as the hazard of walking while gazing at the screen).” Another challenge of the use of mobile technology in higher education is possible distractions while learning (Gikas & Grant, 2013). In the view of Cheon, et al. (2012), using these technologies in higher education learning hinders students’ concentration and even interrupts class progress. Moreover, these devices carry the potential to distract and create frustrations in the lecture room (Rossing, et al., 2012). In the opinion of the author, students need to be fully and authentically engaged in the lecture room. This is because using their mobile technology to communicate with their friends or other people on issues that may not be related to what is being learnt during lecture hours, will not be the ideal learning environment to do so. In actual fact, using the mobile technology that has not been instructionally permitted in the lecture room should neither be encouraged nor promoted, for we must not lose sight of the fact that technology will always continue to advance, so it is up to all and sundry to learn how to take advantage of it in this situation.

Furthermore, it is usually the case that university students equate technical challenges with the successful use of mobile technology in their learning. As expected, higher education students have a good

knowledge of mobile phone learning obstacles (Mansouri, Kaghazi, & Kharmali, 2010; Taleb & Sohrabi, 2012). According to Maniar, Bennett, Hand, and Allan (2008), the success of m-learning is also limited to the hardware and software constraints of mobile devices such as low screen resolution and small screen size, among others. Again, as Kukulska-Hulme and Pettit (2009) posit that fiddly small screen mobile technology is taxing on the eye, the argument is also made that small PDA and cellular phone screen sizes limit the abilities to display information (Georgiev, Georgieva, & Smrikarov, 2004). Equally important, research has established that two underlying reasons why screen size is a challenge to learners are human visual perception and attention. Ultimately, human visual perception limits the level of small detail learners can see which also affects their attention span (Chen, Xie, Fan, Ma, Zhang, & Zhou, 2003). In like manner, a different study carried out suggested that screen size affects the viewer's quality of experience (Knoche, McCarthy, & Sasse, 2006). For these reasons, it is believed that learners would be more willing to use m-learning, if they found that that the technology can be used easily (Liu, et al., 2010).

Aside from the aforementioned challenges, the largest impediments to learning and the strongest challenge to the convenient use of mobile technology appears to be wireless connectivity as well as the stability of applications (Rossing, et al., 2012). Also, lack of Wi-Fi in many locations coupled with battery problems (Kukulska-Hulme & Pettit, 2009; Liu, et al., 2010; Maniar, et al., 2008) does frustrate students in their learning when they earnestly need a better battery life and a more reliable network connection for their devices. Besides PDA and mobile phones having limited memory, it has also been observed that the small keyboards of PDA and cellular phones make the input of the information difficult for learners (Georgiev, et al., 2004; Gikas & Grant, 2013).

By and large, some mobile devices have been identified as creating interaction issues due to their small key boards (Chang, Chen, & Zhou, 2009; Gikas & Grant, 2013; Rossing, et al., 2012). Further, it has been indicated that incessant technological challenges are also capable of restricting or placing a limit on the productive power that laptops afford (Cutshall et al., 2006; Demb, Erickson, & Hawkins-Wilding, 2004; Vuojärvi, 2013). In addition, text-based messages of some of the mobile devices lack inflection and because of that students find it difficult to communicate via blogs and conferencing. Apart from that everything has to be short and small, thereby making meaningful interaction difficult (Kukulska-Hulme & Pettit, 2009).

3 RESEARCH DESIGN AND METHODOLOGY

3.1 Questionnaire Design and Structure

The statement has been made that “survey research rests on the age-old practice of finding things out by asking questions” (Tourangeau, Rips, & Rasinski, 2000, p. 1). It must also be borne in mind that when carrying out a survey, the questions that the interviewer asks and the answers that the respondent provides are always the essential elements (Tourangeau, et al., 2000). In this regard, the study into students’ perceptions of using mobile technology in higher education was conducted with the collaborative efforts of four researchers. The research group consisted of Heli Ruokamo, Paivi Hakkarainen, Miikka Eriksson, and Hanna Vuojarvi. The instrument for the study is a collaborative process based on the seventeen characteristics of meaningful learning and their learning outcomes. In addition is the pedagogical model of Enhanced Teaching and Meaningful e-Learning (ETMeL), being an upgrade of the pedagogical model for Teaching Meaningful Learning (TML). According to Ruokamo, et al. (2012), not only is ETMeL intended for the improvement of the designation, implementation, and evaluation of e-learning but more significantly, it will ensure that “students benefit from a more meaningful learning experience” (p. 376).

The structured questionnaire (See appendix I) for this study has 47 items. The first nine items of the questionnaire (nos.1-9) provided the demographic characteristics of the survey respondents. McCarthy, Franklin, and Burgman (1994) state that demographic uncertainty can cause greater variation in population size. Since the author is focusing on a population of international degree and exchange students, ascertaining respondents’ demographic profiles will inform me as to whether I am gathering the right information that I am attempting to find. Besides, it will enable me in determining whether I am reaching the right respondents (Dierckx, 2013). The rest of the items (nos. 10-47) were measured with a frequency scale of four possible responses (“Not at all”, “A little”, “Some”, and “A lot”) which are aimed at measuring the various learning outcomes of meaningful learning, including issues like the rate of educational use of mobile technology by respondents, how the extent of mobile technology use has promoted respondents’ learning, as well as some amount of hindrances in the educational use of mobile technology experienced by respondents.

In the questionnaire, items 10-11 measured students’ familiarity with using mobile technology. Furthermore, students’ activeness in learning was measured by items 12-13. As discussed, in active learning, students are encouraged to ask questions, critically evaluate information, as well as express new

ideas and models of thinking (Hakkarainen, et al., 2007; Ruokamo, et al., 2002). Also, students' cooperative endeavours in learning were measured by items 14-19. According to Johnson and Johnson (1999) apart from discussing tasks with one another, students team up with the fulfilment of shared goals in a cooperative learning group. Again, the process of flexibility was measured by item 20, since mobile learning is viewed as a useful element of the flexible learning model (Peters, 2007; Park, 2011). Items 21-23 measured the intertwined learning characteristics of students' activeness and reflection while item 24 measured how students' experiences of using mobile technology have improved their learning. The characteristic of goal-oriented was measured by item 25. In the characteristic of this activity, students work diligently with the intention of achieving and increasing each individual's knowledge (Hakkarainen, et al., 1999). Moreover, items 26-27 measured both reflective and conversational learning. It has been suggested that for learning to be effective, there must be the action of constructing an understanding that relates new experiences to existing knowledge. Most significant to this action is conversation with teachers, with other learners including ourselves, as well as with the world in its entirety (Jonassen, 2002). On item 28, the characteristic of creativity in students' learning was measured. As previously stated, for students to be creative, they have to be able to apply different areas of knowledge to new problems and challenges. Next, items 29-30 measured students' individual learning with mobile technology. More often than not, "it is the learner who must choose to learn meaningfully" (Hay, et al., 2008, p. 1037).

Consequently, the experiential learning methods by students were measured by items 31-33. As Kolb, et al. (2001) note, in transforming experience, some learners tend to critically observe other learners' experiences and reflect on their outcomes while some may decide to become involved in the learning process quickly. Again, item 34 measured students' conversational learning with off-campus experts. Besides, the characteristic process of self-reflective by the students was measured by item 35. According to Xie (2008), various plans of actions have been intended for encouraging and promoting the reflective thinking skills of students; e.g. journal writing and peer feedback. Having said that, experiential characteristic process of meaningful learning was measured by items 36-37. Acquiring experience means that learners find new information through encountering the tangible, relying on their senses, and immersing themselves in concrete reality (Kolb, et al., 2001). With item 38, it measured students' individual abilities to make generalization based on previous knowledge. Ruokamo, et al. (2002) explain that abstract is the construction of new ideas at an abstract level. Concerning item 39, it measured the critical thinking abilities of the students in terms of the use of mobile technology in learning. Item 40 on

the other hand, measured how students' experiences of mobile devices have improved their learning. Furthermore, multi-representational process characteristics were measured by items 41-44. To add, items 45-46 were measured by the amount of hindrances in the use of mobile technology in learning. Finally, item 47 offered respondents the opportunity for comments or feedback since "feedback must 'connect' with students" (Higgins, Hartley, & Skelton, 2002, p. 55). As stipulated also, the provision of feedback helps develop 'deep learning' (Biggs, 2011).

3.2 Study of Research Instrument

With the ultimate aim of developing and testing the adequacy of the group's research instrument, a pilot test was performed superintended over by the thesis supervisor. In the first place, I collected preliminary data by means of initial questionnaires on a mobile learning survey which were sent out through electronic mail. In addition, I accompanied these mobile learning survey questionnaires by sending invitation letters to the respondents who were international degree and exchange students from various departments and who had voluntarily offered themselves to answer the questionnaires. Significant to realize, the international degree and exchange students were chosen because they are the group of people identified to be most relevant to the study. As a matter of fact, undertaking the pilot testing of the mobile learning survey questionnaires was equally significant because "testing helps make the survey run smoothly" (Fink, 2015, p. 8). Likewise argued, pilot studies are a crucial element of a good study design (Van Teijlingen & Hundley, 2002).

Indeed, having carried out several research designs based on the theory of cognitive learning, the research group settled on planning and conducting cognitive interviews for its data and analysis methods. Basically, cognitive interviewing refers to "a set of techniques (e.g., think aloud protocols, verbal probes) that enable a researcher to deeply analyze how respondents understand survey questions they are to answer" (Ryan, Gannon-Slater, & Culbertson, 2012, p. 415). Not to mention, it is also a method that is made up of a series of memory retrieval and communication techniques designed to augment the amount of information that can be derived from an interviewee (Memon, Meissner, & Fraser, 2010). Furthermore, it has been stipulated that cognitive interviewing "requires respondents to report aloud everything they are thinking as they attempt to answer a survey question" (Ouimet, Bunnage, Carini, Kuh, & Kennedy, 2004, p. 234). The significance of these tasks is that researchers take records of all the activities that take

place during the interview and later analyse them for evidence of misconstruction and other challenges that may have occurred (Ouimet, et al., 2004; Tourangeau, et al., 2000).

In carrying out the cognitive interview, I had by an online invitation, been able to make contact with four international degree and exchange students who had accepted to participate in the cognitive exercise. In addition to a written informed consent and making the venue for the cognitive interview known to the participants, other formal standards for survey ethics were equally taken into consideration. For instance, the situation of identity protection or respecting participant confidentiality. As Warrel and Jacobsen (2014, p. 31) observe, “If anonymity is to be maintained, the researcher needs to consider how this will be accomplished”. Thus, the issue of anonymity was discussed with the respondents before the cognitive exercise began. To further buttress the point on survey ethics, suggestions from the thesis supervisor indicated that I also had to be mindful, the fact that the participants had offered themselves to be part of the survey did not mean the interviewer could lord it over them in terms of the time for the cognitive exercise. Thus, it was imperative to let the participants honour the interview at their own convenience. Moreover, I needed to inform them (the participants) concerning the duration of the interview so they could make preparations towards it.

As a matter of concern, some necessary internal preparations needed to be made before meeting the participants to conduct the cognitive interviews. In order to make quality assessment of the study with data collection and analysis needs, including gathering feedback after conducting the survey, I used the Webropol 2.0 survey software (also known as Web 2.0). The Webropol is a survey application which is processed into knowledge and understanding of information. Also, it gives users the tools to interact, edit, and contribute information (Buchanan & Hyizdat, 2009). Student participants therefore would use their own email to access and answer the cognitive questionnaire. With the Web 2.0, the application would send the online questionnaire into the participants’ email boxes and when they finish answering and subsequently submit, all answered questionnaire would be collated and stored.

As it has been discussed, cognitive interviewing is by far the most extensively accepted instrument for questionnaire development (Beatty & Willis; Dillman, 2000; Ouimet, et al., 2004). Beyond that, the cognitive interview I conducted was based on the combined approaches of think aloud procedures and probing protocols (Ryan, et al., 2012). Through think aloud procedures, the participants are asked to perform the task of answering the cognitive questionnaire as well as verbalize whatever crosses their minds in the process of answering the cognitive questionnaire (Jääskeläinen, 2010). With the second

paradigm, the participants fill in the cognitive questionnaire first and the probe questions follow immediately. The interaction is guided by the interviewer “more proactively” by usually asking additional questions “about the basis for responses” (Beatty & Willis, 2007, p. 289).

In actual fact, meeting the four student participants (on different occasions) required some preliminary proceedings; I had to go through all the preparatory steps (i.e., before, during, and after) needed for the cognitive exercise before the scheduled dates of our separate meetings. Thirty minutes to meeting each of the participants, I made sure that the webropol.fi was ready to be activated with the sending of the mobile learning questionnaire to their email addresses. For the purpose of undertaking probing procedure, I had also ensured that hardcopies of the cognitive questionnaires were ready and easily reachable to each of us (i.e., I, the interviewer and the student participant), with my Sony IC Recorder and stop watch both in place. In the process of beginning the exercise, I had to once again remind the participants about the purpose for having the cognitive interview concerning the mobile learning survey. Furthermore, I had to assure each participant that not only was the interview solely meant for its intended purpose, but also their identities would not be disclosed.

For the ensuing part, I had to make the request that as much as every participant could, they should be thinking out aloud while answering the questionnaire online. This request was particularly made based on the agreed approach by the research group on how the cognitive interview should be conducted — a combination of think-aloud procedures and probing during and after answering the questionnaire. Thus, I sent the link to the questionnaire via Webropol.fi to each participant’s email address. Suffice it to say, each participant had access to an internet-connected desktop computer right in front of me, so once they received the link to the questionnaire, I started to record all that might be heard as they gave their responses. At the same time, my stop clock had been activated to monitor how long it approximately took the participant to answer the questionnaire as well as the duration of the cognitive interviewing.

With the online questionnaire answering completed, it was now time for some probe questions to be asked, face to face. As affirmed, as far as the amount of response is concerned, face to face interview method is still the best (Niero, 2014; Szolnoki & Hoffmann, 2013). By virtue of this, I gave the participants the hardcopy of the mobile learning questionnaire that had just been answered online, while I held one. After conducting probes on some selected questions in the questionnaire, some general thoughts were shared on the mobile learning survey throughout this stage after which I kept the hard copies of the questionnaire I had given them. Much to my satisfaction, answers that were received were

indeed intellectually perceptive. As Beatty and Willis (2007) posit, using cognitive interviews helps in the determination of whether the questions are generating the information that the researcher intends. In the opinion of the author, using the mixed approach of thinking-aloud and probing procedures as alternative paradigms of the cognitive interviewing was very effective and significant. This is in view of the fact that the relevance of that choice reflected in the actual cognitive interviewing process. For example, it was observed that of the four student participants who were interviewed, two were very active with the think-aloud process during the answering of the online questionnaire. The other two participants, on the contrary, muttered some few words at that stage but contributed very actively and significantly during the probing questions to end the entire cognitive exercise.

On the whole, cognitive interviews have been used by many sectors of the world due to its prominence. Cognitive interviewing was a major leitmotif during the 2002 Conference on Questionnaire design, evaluation, and testing. The volume about the conference detailed several viewpoints on cognitive interviewing (Beatty & Willis, 2007; Presser, et al., 2004). Also, Memon, et al. (2010) examined the methodologies that cognitive psychologists applied to study “false memory”. These same processes were used to make an assessment of whether the cognitive methodologies were capable of facilitating scientific advancement. Furthermore, a book describing the cognitive interviewing techniques appropriate for questionnaire development and testing, by Willis (2004) contains a substantial level of analysis of the methodologies which are used by many cognitive research laboratories.

Undeniably, the pilot study came with a number of advantages. As observed, carrying out a pilot study might give advance warning about a particular area that could ruin the main research (Van Teijlingen & Hundley, 2002). During the testing, the student participants had been asked to point out any sections in the questionnaire that they found difficult to answer. They were also given the opportunity to comment on the response options in case they were not clear about the instructions. It was through this exercise that it was detected that certain items concerning the background information of the respondents needed to be reviewed. The selection, wording and even ordering of the items, upon careful consideration, had to be revised in view of the fact that some respondents regarded certain items either too sensitive, or too complicated to be answered.

To emphasize, Blair and Presser (1993) argue that pretesting focuses on issues of respondents’ understanding of questions and how their understanding may be different from those the researcher hopes to achieve. Moreover, the testing centres around the challenges respondents experience when performing

the tasks demanded by questions (Blair & Presser, 1993). Thus, the cognitive exercise in general revealed that not all the respondents understood the directions provided in the questionnaire so there was the need to make some more meaningful adjustments which were effectively treated.

3.3 Study Sample and Data Collection

To find things out about all the people of a particular place that interests a researcher, the usual practice is for the researcher to take a sample. In addition, since it is relatively challenging to explore a whole population study due to reasons such as undefined amount of objects, time, and cost, among others, sampling is used to replace the whole population in most studies. According to Frey, Botan, and Kreps (2000), sampling is a subgroup of a population. By another definition, sampling is the process or the method of drawing a definite number of the individuals, cases or the observations that form part of a total group for investigation (Parten, 1950). Moreover, Latham (2007) explains that the method for sampling involves taking a representative selection of the population and using the data collected as research information. Concerning research methodology, consideration can be made that sampling is a method of data collection where a group of people are identified and chosen from a larger group or population (Babbie, 1973). As a matter of fact, the distinction has also been drawn between a sample design and a sample survey. While the sample design refers to how often the researcher's survey takes place, the sample on the other hand, refers to the number and characteristics in the survey (Fink, 2015). Thus, through the exploration of the sample, the researcher may generalize the findings of their studies about the total population. As Marshall (1996, p. 522) asserts, "The aim of all quantitative sampling approaches is to draw a representative sample from the population, so that the results of studying the sample can then be generalized back to the population".

In view of the aforementioned, many scholars of research have put forth various perspectives on the appropriate sample size to be used in a quantitative study. For example, it has been proposed that the adequate or acceptable size for a particular study can be decided based on the following scales of sampling: "Sample size below 50 is very poor, sample size below 100 is poor, sample size below 200 is fair, sample size below 300 is good, sample size below 500 is very good and sample size below 1000 is excellent" (Lee & Comrey, 1992, p. 217). Consequently, Barrett and Kline (1981) proposed an absolute minimum of 50 while Aleamoni (1976) proposed an absolute minimum of 400. Besides, Guadagnoli and

Velicer (1988) proposed that the absolute minimum sample size is the most efficient method for determining the accurate sample size of a study, although the fundamental recommendation has been a minimum sample size of 100 to 200 observations (Comrey, 1978; Gorsuch, 1983; Loo, 1983).

For the purposes of reliability, accuracy and the research to be scientific in nature, the sample for this study was carried out with some international degree and exchange students from a higher education institution in Finland. As indicated by the law of Statistical Regularity, a moderately large number of the items chosen at random from the large group are almost sure on the average, to possess the features of the large group (McKeown, 1999). The study is also justified by its quantitative approach since quantitative research methods are usually used to quantify data and generalize information from the large numbers of population (Blaxter, Hughes, & Tight, 1996). It is the hope of the author therefore that by using sampling, the perceptions of mobile technology use in the teaching-studying-learning processes by the 120 international degree and exchange students selected from the university, will fairly and accurately represent the latter's views. This is in view of the fact that respondents selected for the survey belong to the same group of international degree and exchange students from the university about whom this research is concerned.

For all intents and purposes, the author had originally planned to do an online survey of the questionnaire since favourable responses had been received during the pilot studies. Unfortunately, low responses were received. For instance, out of the one hundred and twenty respondents expected to answer the online questionnaire during the carrying out of the actual study, only forty-eight respondents had answered it. Perhaps, the online survey was ill-timed since many undergraduates were equally carrying out similar research exercises. Besides, students were getting ready for the summer vacation. However, primary data was collected from the international degree and exchange students through the administering of paper based questionnaires.

The procedures for data collection were as follows: Students were contacted at the international students' apartments after permission had been sought and granted without any hesitations since most of them were already aware of the survey. During the pilot testing of the questionnaire, email messages had been sent to their various email addresses informing them about the mobile learning survey and many had voluntarily responded to be participants. Consequently, the student participants who consented to answering the survey, the filling in of the paper questionnaires were administered with them based on mutual assent with the collection plans. Actually, ten out of the one hundred and twenty student

participants had elected themselves to gather the completed questionnaires so I had to contact them instead, for the various collections through phone.

During the data collection, the completed questionnaires were gathered by the ten representatives of the whole student participants. Some called on their own volition to give the information that the questionnaires were ready while others announced with a text message whereby, I had to go to their apartments for them on scheduled occasions. Suffice it to say, all completed questionnaires were not damaged in anyway in their envelopes.

3.4 Analysis

Having collected all the questionnaires administered out, I ensured that my data collection process was ascertained with a careful check on the validity of each respondent's questionnaire. As noted, "All survey returns should be reviewed for missing data" as "missing data results from unanswered questions or entire surveys" (Fink, 2015, p. 98).

The ensuing exercise then was about using quantitative and qualitative methods to describe and interpret respondents' answers to the survey questions. Fink (2015) observed that data management is an integral component of analysing data. That being so, I organised my data into variables through naming and coding so as to enable me analyze the theoretical concepts once the variables have been operationalized in a database. Some of the analysis methods that I employed involved descriptive statistics and reliability statistics. These analysis methods were carried out with the aid of the statistical software 'SPSS'-22.0 (Statistical Package for the Social Sciences). Using the SPSS-22.0 was to facilitate and assist me to describe, compare, and interpret higher education students' perceptions of the rate of educational use of mobile technology, the extent by which the use of mobile technology has promoted students' learning, as well as the amount of hindrance that students face when using mobile technology in the teaching-studying-learning processes. Using statistics therefore places a considerable role in quantitative work by "informing us when we use data derived from samples" as well as "when we speak about the whole in terms of the properties of part of that whole" (Byrne, 2002; p. 5). Thus, presentation of the data entry and analysis were in the form of tables and charts.

Aside from that, data from the cognitive interviews that were conducted and recorded were transcribed into printed form. It is suggested that “transcription is a powerful act of representation” (Oliver & Mason, 2005, p. 1273). Scholars from diverse disciplines have also reinforced the centrality of transcription in qualitative research (Lapadat & Linday, 1999; Poland, 2002; Tilley, 1998). From these observations, a lot has been learnt about how “transcription can powerfully affect the way participants are understood, the information they share, and the conclusions drawn” (Oliver & Mason, 2005, p. 1273). More significantly, how transcription is reported in research studies was gained in the study as data from the cognitive interviews was analyzed based on content analysis. As a matter of fact, since the content analyst views data as representing texts and other forms of expressions designed to be not only seen and read, but also interpreted and acted on for their meanings (Krippendorff, 2004), I applied a coding procedure to the qualitative study. According to Auerbach and Silverstein (2003), coding involves the process of organizing the text of the transcripts and discovering patterns within that organizational structure. By the virtue of this assertion, I made sure that I examined all my transcription data both in audio and printed forms in order to understand what they mean. In addition, the relevance of the information conveyed by the participants who were interviewed was to enable me connect some salient portions of them with my research questions. Not only that, I used the method of categorization where relevant information was put into themes, interpreted, and then discussed.

4 RESULTS OF THE STUDY

The findings from analysis of the empirical data collected for the study are presented below. The chapter presents the demographic characteristics of the respondents. The chapter also covers the findings on the research questions: 1. What is the rate of educational use of mobile technology by higher education students? 2. What is the rate of mobile technology use in promoting university students' learning? and 3. What is the amount of hindrance in the educational use of mobile technology by university students? The results are presented in tables using mainly descriptive statistics such as frequency counts and percentages as well as means and standard deviation.

4.1 Demographic Characteristics of Respondents

This section presents the results on the demographic characteristics of the respondents of the study. The demographic variables considered in the study include the gender of the respondents, age of respondents, programme (level) of study by respondents, year of study, their working status (schedules) and respondents' ownership of mobile devices. These characteristics are considered by the researcher as factors that facilitate the understanding of how students use mobile devices in the context of higher education learning environment. The study also explores the relationship between these characteristics and respondents' perceptions and use of mobile devices in promoting learning in the university.

4.1.1 Gender of Respondents

From the analysis of the data collected, it points out that both males and females participated in the study. However, the female respondents dominated in the study. From the results as presented in Table 1, it is shown that 72 of the respondents constituting 60% of the total respondents are females. Male respondents are 48, constituting 40% of the respondents. Considering the results presented, the male to female ratio stands at 2:3. The implication of this result is that fair presentations of both male and female students' responses and perceptions of the use of mobile technology in promoting learning was obtained. The results on the gender of the respondents are presented in Table 1.

TABLE 1. Gender distribution of respondents

Gender	Frequency	Percent
Female	72	60.0
Male	48	40.0
Total	120	100.0

4.1.2 Age of Respondents

The statistics on the age of the respondents are presented in Table 2. From the table, the mean age of the respondents is 31 years calculated at a standard deviation of 5.453. The ages of the respondents range from 22 years to 43 years. The minimum age of the respondents is 22 and the maximum age is 43 years. The results show that most respondents are middle-aged which may be a common characteristic of most university students. The results showing the age of the respondents is presented in Table 2 below.

TABLE 2. Age of respondents

Statistic	Value
Minimum	22
Maximum	43
Mean	31
Standard Deviation	5.453
N	120

4.1.3 Work Schedule of Respondents

The results in Table 3 show the working status and schedules of the respondents of the study. From the results, it is noted that only 17 (14.2%) of the respondents are not working currently, 31 (25.8%) work full time while 44 (36.7%) work part-time and 28 (23.3%) work occasionally. The results show that apart from the 14.2% of the respondents not working currently, the remaining 85.8% of the respondents are

engaged in some form of work arrangements alongside studying. The practice of work integrated in education as reported by Edwards (2008), is a very common phenomenon among international students. This situation could lead to a more dependency on mobile technology for both education and work schedules. Also, one quarter (25.8%) of the respondents are into full time work schedule and this could likely make dependency on mobile technology in learning much more crucial since very little time would be available for them to learn. The results on the working status and schedules of the respondents are presented in Table 3 below.

TABLE 3. Current working status of respondents

Work Status	Frequency	Percent
Full time	31	25.8
Part time	44	36.7
Occasionally	28	23.3
Not applicable	17	14.2
Total	120	100.0

4.1.4 Degree Pursuing

The various degrees that respondents are pursuing for are presented in Table 4. Clearly as the results show, the majority (64.2%) of respondents are Master’s degree students. The remaining respondents consist of 34 (28.3%) Bachelor’s degree students and 9 (7.5%) Doctoral degree students. Most master’s degree and doctoral degree programmes are research intensive programmes. The use of mobile technology devices therefore serves as viable options for flexible information seeking and learning. The results in Table 4 present the results of the various degree programmes that respondents are pursuing in the university.

TABLE 4. Distribution of respondents by degree pursuing

Degree pursuing	Frequency	Percent
Bachelor's	34	28.3
Master's	77	64.2
Doctoral	9	7.5

Total

120

100.0

4.1.5 Ownership of Mobile Devices

Ownership of mobile technology devices is the main predisposing factor for the adoption of m-learning. In the Table 5, the results of the respondents' ownership of mobile devices have been presented. From the results, it is clear that each of the respondents owns at least one of the mobile devices considered in the study (i.e., laptop, smartphone and tablet computer). Specifically, the results show that ownership of laptop and smartphone was the most common as about a quarter (26.7%) of the respondents reported ownership of the two devices combined. The least singularly owned mobile devices among the respondents were found to be laptop and tablet computers as reported by 9 (7.5%) of the respondents. This means that most students own various combinations of these mobile devices. The high level of ownership of mobile devices among the respondents is an indication of easy access to m-learning resources with the propensity to be translated into improved learning. The results in Table 5 show the mobile devices and the number of respondents that own these devices.

TABLE 5. Mobile device owned by respondents

Mobile device	Frequency	Percent
Laptop	9	7.5
Smartphone	12	10
tablet computer	9	7.5
Laptop and Smartphone	32	26.7
Laptop and Tablet computer	24	20
Smartphone and Tablet computer	14	11.7
Laptop, Smartphone and Tablet Computer	20	16.7
Total	120	100

4.1.6 Relationship between Respondents' Characteristics and Mobile Device Uses

The study also sought to find the relationship between demographic characteristics of the respondents and their use of mobile devices. A cross tabulation was therefore performed with the demographic characteristics against use of mobile devices. The results of the cross tabulation as presented in Table 6 show that there is relatively equal use of mobile devices among both females and males. The majority of both the male and female respondents use smartphones, tablet computers and laptops. The mobile devices used mostly by both male and female respondents are laptops. Among female respondents, 54(75%) use laptops whereas only 25% do not. Similarly, among the males, the highest proportion (65%) report the use of laptops whereas only 35% do not use laptops.

With regards to educational pursuit, the results on use of mobile devices vary across the different categories (Bachelor's, Master's and Doctoral degrees). For respondents pursuing Bachelor's degree, the highest proportion (91%) of them use smartphones as compared to 55% of Master's degree students and 56% of Doctoral students. With regards to the use of laptops however, the highest proportion (73%) was recorded by Master's degree students. Generally, more of the Master's degree and Doctoral degree students tend to use more of laptops than smartphones and tablet computers, unlike the Bachelor's degree students where smartphone use was highly reported.

The results on mobile device use among various working status/schedules also show very little variation. Majority of respondents who work full time, part time, occasionally and none at all, use all three mobile devices (i.e., smartphone, tablet computer and laptop). With respondents working full time, the highest proportion (71%) use laptops. Also, for respondents working part time, 77% use smartphone whereas about 88% of respondents who are not working at all, use laptops. The results indicate that there is no obvious relationship between mobile devices used by respondents with respect to their working status. It does appear however, that respondents working part time and occasionally, seem to have higher preferences for easy portable mobile devices like smartphones and tablet computers than laptops. The cross-tabulated results on mobile device use and working status of respondents are presented in Table 6.

TABLE 6. Cross tabulation of mobile device use and respondents' characteristics

		Use smartphone		Use tablet com-puter		Use laptop	
Response		No	Yes	No	Yes	No	Yes
Gender	Female	23 (32%)	49 (68%)	32 (44%)	40 (56%)	18 (25%)	54 (75%)
	Male	18 (38%)	29 (62%)	19 (40%)	28 (60%)	17 (35%)	31 (65%)
Level of study	Bachelor's	3 (9%)	31 (91%)	15 (44%)	19 (56%)	11 (32%)	23 (68%)
	Master's	34 (45%)	42 (55%)	31 (41%)	45 (59%)	21 (27%)	56 (73%)
	Doctoral	4 (44%)	5 (56%)	5 (56%)	4 (44%)	3 (33%)	6 (67%)
Work status	Full time	14 (45%)	17 (55%)	12 (39%)	19 (61%)	9 (29%)	22 (71%)
	Part time	10 (23%)	33 (77%)	20 (47%)	23 (53%)	12 (27%)	32 (63%)
	Occasionally	12 (43%)	16 (57%)	11 (39%)	17 (61%)	12 (43%)	16 (57%)
	Not working	5 (29%)	12 (71%)	8 (47%)	9 (53%)	2 (12%)	15 (88%)

(Percentages in parenthesis are based on rows)

In order to properly understand the relationship between mobile device use and respondents' demographic characteristics, a Pearson Chi-square test of independence was performed and the results are presented in Table 4.8. From the results, it clear that with $\chi^2(1) = 0.508$, $p=0.476$, $\chi^2(1) = 0.188$, $p=0.665$ and $\chi^2(1) = 1.513$, $p=0.219$, there is no statistically significant difference between gender and the use of smartphone, tablet computer and laptop respectively. This means that the use of mobile devices is independent of the gender of the respondents.

With regards to the degree the respondent is pursuing, the results show that the use of smartphone has statistically significant difference with the degree being pursued by the respondent ($\chi^2(2) = 13.846$, $p=0.001$), however, the use of tablet computers and laptop has no statistically significant difference with respect to the degree of the respondents as the test statistics were $\chi^2(2) = 0.747$, $p=0.688$, and $\chi^2(2) = 1.513$, $p=0.219$ respectively. This implies that the use of smartphone was not independent of the degree of the students. This observation is made in the results in Table 7 where the largest proportions of Bachelor's degree students use smartphones as compared to other devices.

The results in Table 7 also show that no statistically significant difference exists with working status of respondents and use of smartphone, tablet computer and laptop with respective test statistics of $\chi^2(3) = 5.028$, $p=0.170$, $\chi^2(3) = 0.721$, $p=0.868$, and $\chi^2(3) = 5.109$, $p=0.164$. This finding also shows that working status does not predispose respondents to the use of any mobile device. The chi-square of independence between demographic characteristics of respondents and use of smartphone, tablet computer and laptop are presented in Table 7 below.

TABLE 7. Chi-square test of independence between respondents' characteristics and mobile device usage

Variable	Df	Use smartphone		Use tablet computer		Use laptop	
		χ^2	<i>P-value</i>	χ^2	<i>P-value</i>	χ^2	<i>P-value</i>
Gender	1	0.508	0.476	0.188	0.665	1.513	0.219
Degree pursuing	2	13.846	0.001	0.747	0.688	0.376	0.828
Working status	3	5.028	0.170	0.721	0.868	5.109	0.164

($\alpha=0.005$)

4.2 Use of Mobile Devices in Promoting Learning

One of the key objectives of the study is to determine how often students use mobile devices in the promotion of their learning. In the first place, the author sought to determine the level of use of the available devices in academic related activities. The results as presented in Table 8, show that most respondents have used the available mobile devices to some extent in their academic work. As the result shows, 66 (55%) of the respondents who own laptops use them ‘a lot’ for academic tasks or purposes whereas 42 (35%) of those who own smartphones and 27 (22.5%) of those who also own tablet computers also indicate that they use them ‘a lot’ for academic work. In the cognitive interview, Participant 2 (second interviewee) expressed that:

“I don’t own a tablet. But because I usually have some degree of freedom with my study schedules, when I learn together with someone or with my colleagues or if we have to do a group work of some sort, I prefer to use my laptop a lot, although I have a good smartphone too.”

Also in another interview, Participant 4 confirmed,

“...yeah, we... normally have to upload ... our ... works on the internet or send... send an email, so ... I use the laptop a lot.”

The results further show that whereas only 4 (3.3%) of laptop users indicated they do not use laptop at all for academic work, 7 (5.8%) of smartphone users and as high as 36 (30%) of tablet computer users do not totally use these devices for academic work. This was partially confirmed by Participant 1:

“I have a smartphone and ...em... because I have some..., let’s say learning apps or educational games on my smartphone, I’ll like to play...”

Thus, the findings show that laptops are the primary and most used mobile device for academic purposes. Despite the observation above, the results also show clearly that at least a certain proportion of the users of each of the mobile devices used them in academic work to some extent as the result show (See table 8). As murmured by Participant 3 in agreement,

“Yes, my smartphone also, ...em... helps me to achieve my ...personal... personal learning goals.”

The general implication from the results is that mobile devices are used by respondents for academic purposes. The rate at which respondents have used the available devices in academic work are presented in Table 8 below:

TABLE 8. Rate of educational use of mobile devices by respondents

Devices	Not at all	A little	Some	A lot
Smartphone	7 (5.8%)	35 (29.2%)	36 (30%)	42 (35%)
Tablet	36 (30%)	25 (20.8%)	32(26.7%)	27 (22.5%)
Laptop	4 (3.3%)	14 (11.7%)	36 (30%)	66 (55%)

4.3 Research question 1: What is the rate of educational use of mobile technology by higher education students?

The use of mobile devices provides various platforms and opportunities that promote students’ learning. This section enumerates the learning opportunities made available to students by means of mobile technology and the extent to which respondents use the available mobile technology to participate in, as well as access the learning opportunities provided. The extent of participation was determined and measured using a 4-point scale with 1= Not at all, 2= A little, 3= Some and 4= A lot. The results in Table 10 show the mean and standard deviation of the students’ responses with respect to the rate or extent to which they have used the available mobile devices in participating in the learning platforms and taking advantage of the opportunities to promote their learning.

From the results, it is observed that respondents use all three mobile devices (i.e., laptop, smartphone and tablet computer) in participating in synchronous discussions via applications based on written communication to promote their learning. The results further show that on the average, there is some extent or rate of use of laptop and smartphone for synchronous discussions via applications based on written communication. This was with scores of Mean=3.32, SD=0.745 and Mean=2.58 SD=0.914 respectively. The results for mobile devices used for asynchronous discussions in social media sites or course management systems also show a similar pattern. Respondents’ use of laptop, smartphone and tablet computers for participation in asynchronous discussions in social media sites or course management recorded mean of 3.43 (standard deviation of 0.774), Mean=2.54 (standard deviation of 1.020), and Mean=2.55 (standard deviation of 1.180) respectively. Considering the mean scores against the scale used, it is clear that on

the average, respondents to some extent use the various mobile devices in asynchronous discussions in social media sites or course management systems.

Other learning opportunities mobile devices provide, including production of pictorial and / or audio-visual content with fellow students has for learning; laptop (Mean=3.43, SD=0.630), smartphone (Mean=2.28, SD=1.006) and tablet computers (Mean=2.33, SD=1.022), participation in discussions via video conferencing or video calls; laptop (Mean=3.21, SD=0.869), smartphone (Mean=2.32, SD=1.130), participation in discussions via calls through phone to promote learning; laptop (Mean=3.14, SD=0.833), Smartphone (Mean=2.99, SD=0.874) and tablet computer (Mean=2.37, SD=1.130) and working asynchronously online with fellow students on a common written document to promote learning; laptop (Mean=3.58, SD=0.589), smartphone (Mean=2.73, SD=0.923) and tablet computer (Mean=2.68, SD=1.108).

The results also show that respondents have participated in working synchronously online with their fellow students on a common written document; laptop (Mean=3.31, SD=0.696), smartphone (Mean=2.63, SD=1.021) and tablet computer (Mean=2.50, SD=1.045) and also participate in working face-to-face with fellow students on a common written document; laptop (Mean=3.48, SD=0.621), smartphone (Mean=3.25, SD=0.843) and tablet computer (Mean=2.57, SD=1.098). Overall, the results show clearly that mobile technology use has provided a wide range of learning opportunities for students in the university. The results also show that through the use of laptops, smartphones and tablet computers, students are able to participate in the wide range of m-learning opportunities that are available to them. Results on the learning opportunities provided by mobile technology devices and the extent to which respondents have accessed and participated in the available learning platforms using laptops, smartphones and tablet computers are presented in Table 9 below.

TABLE 9. Educational use of mobile technology by higher education students

	N	Laptop		Smartphone		Tablet computer	
		Mean	S.D	Mean	S.D	Mean	S.D
New Learning Opportunities							
Synchronous discussions via applications based on written communication	120	3.32	0.745	2.58	0.914	2.48	1.115

asynchronous discussions in social media sites or course management systems	120	3.43	0.774	2.54	1.020	2.55	1.180
Production pictorial and / or audio-visual content with fellow students has for learning.	120	3.43	0.630	2.28	1.006	2.50	1.029
Discussions via video conferencing or video calls	120	3.21	0.869	2.32	1.130	2.33	1.022
Discussions via calls through phone to promote learning	120	3.14	0.833	2.99	0.874	2.37	1.130
Working asynchronously online with fellow students on a common written document	120	3.58	0.589	2.73	0.923	2.68	1.108
Working synchronously online with fellow students on a common written document	120	3.31	0.696	2.63	1.021	2.50	1.045
Working face-to-face with fellow students on a common written document	120	3.48	0.621	3.25	0.843	2.57	1.098

4.4 Research question 2: What is the rate of mobile technology use in promoting university students' learning?

One of the objectives of the study is to examine how often mobile technology is used in promoting students' learning in the university. In this section, respondents responded to statements on how mobile technology (i.e., laptop, smartphone and tablet computers) are used in promoting their learning. The responses on the extent of use of mobile devices in promoting learning ranges from 'not at all', 'a little', 'some' and 'a lot'. The responses were quantified using the scale of 1= Not at all, 2= A little, 3= Some and 4= A lot. The results in Table 10 present the mean and standard deviation of the responses on how mobile devices are used in promoting students' learning.

From the results, it is noted that mobile devices have been used by students in many ways that have promoted their learning. The mean score for students' responses on use of mobile devices to get constantly connected with their mates to promote learning was 2.50 at standard deviation of 0.996 for laptop

users, 3.29 at standard deviation of 0.715 for smartphone users and 2.95 at standard deviation of 0.924 for smartphone users. This in the scale of 1= Not at all, 2= A little, 3= Some and 4= A lot, means that on the average, respondents’ learning is promoted by getting constantly connected with their mates through the use of mobile technology to some extent.

Further analysis of the results shows there are other means by which mobile devices are used to promote learning among respondents. They include: enabling students to receive instant feedback and / or advice from instructors, enabling students perform and submit assignments on time, enabling students receive useful comments on their learning from persons outside university context, enabling students to be able to search for course-related information to improve their learning as well as enabling students to be able to listen to study-related audio materials that promote learning. The results in Table 10 show that mean scores of the responses on each of these statements range from 2.50 to 3.59 for laptop users, 2.39 to 3.71 for smartphone users and 2.57 to 3.27 for tablet computer users.

The implication of the mean scores based on the scale used is that respondents believe the use of laptops has somehow promoted their learning, while using the smartphone a lot, has had a positive effect on students’ learning. The use of the tablet on the other hand, has somewhat promoted students’ learning.

Overall, the results show that respondents have used mobile devices in each of the stated ways above to promote their learning. The results on the rate at which mobile devices are used to promote learning are presented in Table 10 below.

TABLE 10. Rate of use of mobile device in promoting learning in higher education

Statements	Laptop		Smartphone		Tablet computer		
	N	Mean	S.D	Mean	S.D	Mean	S.D
Mobile device promotes learning by; enabling students get constantly connected with their mates in ways that promote learning	120	2.50	0.996	3.29	0.715	2.95	0.924
enabling students receive instant feedback and / or advice from my instructors	120	2.56	1.083	3.50	0.621	2.79	0.916

enabling students receive instant feedback and / or advice from fellow students	120	2.84	1.029	3.62	0.582	3.27	0.786
positively contributing to students' satisfaction in studying	120	2.90	1.012	3.67	0.613	3.26	0.728
enabling students perform and submit assignments on time	120	2.76	1.130	3.71	0.614	2.66	1.065
Enabling students receive useful comments on their learning from persons outside university context	120	2.69	1.114	3.52	0.648	2.93	0.857
evaluated my own learning (e.g., via learning journals) through a mobile device	120	2.58	1.026	3.33	0.678	2.60	1.064
Enabling students able to searched for course-related information to improve their learning	120	3.59	0.655	2.96	0.991	2.82	1.069
enabling students being able to listened to study-related audio materials that promote learning	120	3.19	0.901	2.39	1.048	2.57	1.002
enabling students watched study-related audio-visual materials to promote their learning	120	3.48	0.860	2.48	1.037	2.78	1.096

4.5 Research question 3: What is the amount of hindrance in the educational use of mobile technology by university students?

Despite the preponderance of opportunities that mobile technology presents for the improvement of students' learning, some factors militate against its successful use. From the results of the study, it is noted that respondents encounter technical challenges while using mobile devices for learning. The amount of technical challenges (i.e., hindrance) respondents encountered was either a lot of the time, some of the time, a little or no challenges at all were encountered. The results are presented in Table 11. From the

results, it is shown that the majority (52.5%) of the respondents indicated they have had technical challenges sometimes with using laptop for learning. With the use of smartphone for learning, the highest proportion (45%) of the respondents encounter a little hindrance, whereas with the tablet computers, the highest proportion (42.5%) of respondents encounter no hindrance at all in using it for learning. The finding above suggests that using laptop for learning gives respondents much more technical challenges than other mobile devices. In the cognitive interview, the responses were as follows:

Participant 2: “... about technical problems? A lot of bad things to say, ... only that I’m not sure if the problem is from my laptop because our internet system is not that bad.”

Participant 4: “... that’s a nice question, having detected technical problems, em... sometimes, there are some problems and em ..., yeah, that’s it.”

Participant 1: “Maybe some of the devices give a lot of problems. But ... with my smartphone, I hardly experience technical problems ... unless maybe my battery is running low.”

Participant 3: “I don’t experience many problems when I use my smartphone for studies but I can say whenever I use a tablet, I don’t have any technical problems at all, but the tablet is not mine and I can say, I don’t use it that much to learn something.”

TABLE 11. Technical challenges with respondents’ use of mobile devices for learning

Mobile devices	Encounter technical challenges while learning			
	<i>Not at all</i>	<i>A little</i>	<i>sometime</i>	<i>A lot</i>
Laptop	8 (6.7%)	34 (28.3%)	63 (52.5%)	15 (12.5%)
Smartphone	18 (15%)	55 (45.8%)	26 (21.7%)	21 (17.5%)
Tablet computer	51 (42.5%)	34 (28.3%)	24 (20%)	11 (9.2%)

5 RELIABILITY AND VALIDITY OF THE STUDY

It has been suggested that when quantitative researchers discuss the theme of reliability and validity, they mean a research that is credible (Golafshami, 2003). As can be seen in quantitative research, it enables the researcher to get acquainted with the concepts that are involved in the case being explored as well as the generation of hypotheses to be tested (Golafshami, 2003). This section presents the reliability test results of the study. In all, three sum variables were analyzed as use of tablet, use of smartphone and use of laptop. The Cronbach's alpha test was performed as a proxy measure of the reliability of the instrument used. The results in Table 12 present the Cronbach's alpha value for each variable together with some basic statistics.

From the results as presented in Table 12, it is quite clear that overall respondents indicated that they use laptops, smartphones and tablet computers in their learning as the mean values of 3.55 (standard deviation of 0.47), 2.7 (standard deviation of 0.67) and 2.7 (standard deviation of 0.84) correspond with the options of use to 'some' extent and use 'a lot' in the questionnaire. The Cronbach's alpha values also show that there is high level of internal consistency among the sum items for each variable. Though there are generally no rigid rules on which value of Cronbach's alpha value is acceptable, George and Mallery (2003) have proposed that a Cronbach's alpha values > 0.9 is Excellent, > 0.8 is Good, > 0.7 is Acceptable, > 0.6 is Questionable, > 0.5 is Poor, and < 0.5 is Unacceptable. Therefore, with the Cronbach's alpha values for use of laptop, use of smartphone and use of tablet computer being 0.838, 0.917 and, 0.955 respectively, it can be inferred that there is high level of internal consistency and hence high reliability of the study.

TABLE 12. Reliability and descriptive statistics of variables

Variables	No. of items	No. of Respondents	of Cronbach alpha	Mean	Std. Dev.
Use of Laptop	7	120	0.838	3.55	0.47
Use of phone	12	120	0.917	2.70	0.67
Use of tablet	13	120	0.955	2.70	0.84

5.1 Use of Mobile Devices in Promoting Learning

Mobile device ownership and use by students in recent times is high and diverse. Dahlstrom, Walker, and Dziuban (2013), reported a high number of the level of ownership of mobile technology devices among undergraduates with nearly half of them owning a tablet and laptop ownership as high as 90%. In this study, ownership of mobile technology device was also high with every student possessing at least one of the three devices (i.e., laptop, smartphone and tablet computers). Ownership of laptop and smartphone was the most common as about a quarter (26.7%) of respondents reported ownership of the two devices combined. The least singularly owned mobile devices among the respondents were found to be laptop and tablet computers only as reported by 9 (7.5%) of the respondents. This means that most students own various combinations of these mobile devices and therefore are able to participate in mobile aided learning opportunities.

With specific regards to learning opportunities provided by mobile technology devices, the results of the study have shown that a wide range of such opportunities for new learning exist among the respondents. These opportunities include online and offline synchronous and asynchronous discussions platform that used application based on written communication that students' access with mobile technology devices. This platform provides a new opportunity for enhanced learning through what Mahat, Ayub, and Luan (2012) refer to as mobile learning. One significant feature that makes these opportunities much more desirable for students, probably is the flexibility they offer for engagement in education process and learning materials in terms of time and location.

The results also show other learning opportunities provided by mobile devices including production of pictorial and / or audio-visual content with fellow students to aid learning, participation in discussions via video conferencing or video calls, participation in discussions via calls through phone, among others. These platforms, as respondents noted, provide mediated educational platforms that provide opportunity for collaborative learning and sharing of authentic academic content. These platforms, as hinted, enhance international collaboration between students all over the world in cooperative learning using computer networks (Riel, 1993).

The findings generally support the argument of Jones, Connolly, Gear, and Read (2006) that mobile technology provides a discussion environment where learners can make their opinions and responses to clarify their understanding of concepts and promote learning.

5.2 Use of Mobile Technology in Promoting Students' Learning at the Higher Education Level

Despite the enormous opportunities that mobile technology provides for learning, the target objective can be achieved without conscious participation and use by learners. From the findings of this study, students' use of mobile technology devices in education is high. The use of these mobile devices has been made easier and productive with the opportunities they provide beyond the lecture room walls as confirmed in the proposition of Rossing, et al., (2012). For this same reason, Motiwalla (2007) notes that mobile technologies are used among students because they offer faculty, flexible tools for complementing the existing technologies by extending the learning beyond the lecture rooms and homes from remote places where students may not have access to computers and the internet.

From the results of the study, it is also noted that mobile devices have been used by students to get constantly connected with their mates in a way that promotes their learning. On the average, the results show respondents are able to promote their learning by getting constantly connected with their mates using mobile technology to some extent. The respondents also noted that through the multiplicity of platforms that they used mobile devices on, they are able read one another's work on a shared platform mediated by the mobile technology as well as receive feedbacks from their instructors and other professionals outside the university setting. Through such platforms as noted, students obtain some level of involvement and motivation beyond the basic traditional collaborative learning activities like, face to face in the lecture room (Ryu & Parsons, 2012).

The findings of the study again support the assertion of Frank (2011) that through mobile technology, students are often a step ahead of educators as they are able to "connect, discuss, learn and identify others with the same ideas or divergent ideas" (p. 263). Some of the key ways in which respondents indicated students are able to promote their learning with mobile technology devices include the opportunity for students to receive useful comments on their learning from persons outside university context and the ability to search for course-related information to improve their learning independently.

5.3 Hindrances to Successful Use of Mobile Technology in Higher Education Learning

The use of mobile technology for learning has challenges. Some technical challenges sometimes hinder the ability to use these mobile devices profitably. The findings of the study reveal that by using laptops, smartphones or tablet computers for learning, students encounter a number of technical challenges. The severity of such challenges varies from person to person and from device to device as situations like

either ‘a lot’, ‘sometimes’, ‘a little bit challenging’ or ‘not experiencing any challenges at all’ are experienced by students. With specific reference to the findings of this study, the results show that the majority of the respondents indicated that they have technical challenges sometimes with using laptop for learning. With the use of smartphone for learning, the highest proportion of the respondents encounter a little hindrance whereas with the tablet computers, the highest proportion of the respondents encounter no hindrances at all in using them for learning.

Technical challenges from using mobile device for learning are numerous, but according to Wang, Wu, and Wang (2009) connectivity remains one of the most common challenges. The greatest advantage of using mobile devices is the opportunity to be able to use them anywhere and anytime. Poor connectivity therefore could be critical technical challenges for the use of mobile technology for learning. Other challenging but non-technical hindrances to the success of mobile technology use may include theft or damage to device and cost of the available device.

6 DISCUSSION AND CONCLUSIONS

Some thoughts about the study are shared in this section. The discussion focused on the theoretical framework and the conceptual models (i.e., TML and ETMeL models) on which the study was conducted. Moreover, it was juxtaposed with the empirical findings of the study based on the research questions that were formulated. The discussions provide answers to the research questions and conclusion drawn accordingly.

6.1 Discussion

The study was conducted as an application of the models, Teaching and Meaningful Learning (TML) proposed by Hakkarainen, (2009) and the Enhanced Teaching and Meaningful e-Learning (ETMeL) by Ruokamo, Hakkarainen, & Eriksson, (2012) using pedagogical possibilities afforded by the three mobile computing devices (i.e., laptop, smartphone and tablet computers). The underlying principle of the study is to examine how learners may bring their intuitive beliefs and experiences of using mobile technology devices and platforms in relation to new concepts to attain the desired objectives of meaningful learning. This concept is supported widely in recent literature including Karppinen, (2005); Rendas et al., (2006) and Rick and Weber, (2010).

Recently, many scholars of educational technology (e.g., Alexander, 2001; Oblinger & Oblinger, 2005; Ruokamo & Eriksson, 2012) have observed that the use of mobile technology is to provide opportunities for new learning experiences while enhancing the acquisition of domain-specific knowledge and methodological skills (Hakkarainen & Vapalahti, 2011). Considering the two conceptual models used in this study, the use of mobile technology in higher education learning is seen in two lights, that is, the provision of opportunities for new learning methods as well as how students have used the available learning opportunities and to what extent learning has been improved with such methods.

6.2 Conclusions

This study was conducted with an aim to exploring present-day students' perceptions of using mobile technology in higher education learning. The motivation for this study was drawn from the aspect of international degree and exchange students' experiences of mobile technology use in a certain university in Finland. The rationale of the study is to provide useful and informative empirical results on students'

perceptions of mobile technology use and the rate of educational use of mobile technology, taking into consideration some learning opportunities offered through mobile technology and how students utilize these opportunities to promote their learning.

From the empirical findings of the study, it is established that the use of mobile technology for learning purposes is common among the students surveyed. Ownership of mobile devices, specifically, laptops, smartphones and tablet computers is high among the respondents. Also, as the findings revealed, through various online and offline synchronous and asynchronous platforms, students are able to promote and enhance their learning using mobile technology.

Some of the platforms mentioned, provide opportunities for sharing of audio and visual academic contents in ways that greatly enhanced interaction between the faculties and students which have promoted their learning. With a high level of ownership of mobile devices among the respondents' learning, using these platforms can be much better. Respondents however reported some technical hindrances with the devices towards the effective and efficient exploitation of these platforms. Therefore, to ensure that mobile technology devices offer another paradigm in promoting students' learning, concerted efforts should be made to ensure the integration of students, faculty, and technical service providers in a coordinated system of the university settings.

6.3 Suggestions for Future Research

The present study addressed the issue of how mobile technology (i.e., smartphone, tablet, and laptop) could be used as prospective tools for promoting education. This was with special contemplation on two upper level concepts (i.e., TML and ETMeL models), achievable through various pedagogical approaches. The focus of the study was strictly limited to higher education students. Nevertheless, the perspectives of other stakeholders of education including instructors, faculty members, and learners are equally important in playing major roles in the teaching-studying-learning processes where the active role of the student is emphasized. Furthermore, fruitful interactions are suggested as the central plan in these processes. The author suggests that future research should also include the views of instructors, since their readiness, knowledge and competence in delivering mobile technology mediated learning environments are exhaustive.

REFERENCES

- Adkins, S. S., & Insight, C. A. (2008). *The US Market for Mobile Learning Products and Services: 2008-2013 Forecast*. CRO Ambient Insight.
- Ainsworth, S. (2006). DeFT: A conceptual framework for considering learning with multiple representations. *Learning and instruction, 16*(3), 183-198.
- Aleamoni, L. M. (1976). The relation of sample size to the number of variables in using factor analysis techniques. *Educational and Psychological Measurement, 36*(4), 879-883.
- Alexander, B. (2004). Going nomadic: Mobile learning in higher education. *Educause Review* (9-10), 29-35.
- Alexander, P. A., & Jetton, T. L. (2000). Learning from text: A multidimensional and developmental perspective. *Handbook of reading research, 3*, 285-310.
- Alexander, P. A., Murphy, P. K., Woods, B. S., Duhon, K. E., & Parker, D. (1997). College instruction and concomitant changes in students' knowledge, interest, and strategy use: A study of domain learning. *Contemporary Educational Psychology, 22*(2), 125-146.
- Alexander, S. (2001). E-learning developments and experiences. *Education+ Training, 43*(4-5), 240-248.
- Alexopoulou, E., & Driver, R. (1996). Small group discussion in physics: Peer interaction modes in pairs and fours. *Journal of Research in Science Teaching, 33*(10), 1099-1114.
- Al-Fahad, F. N. (2009). Students' attitudes and perceptions towards the effectiveness of mobile learning in King Saud University, Saudi Arabia. *TOJET: The Turkish Online Journal of Educational Technology, 8*(2).
- Allan, B., & Lewis, D. (2006). The impact of membership of a virtual learning community on individual learning careers and professional identity. *British Journal of Educational Technology, 37*(6), 841-852.
- Amiel, T., & Reeves, T. C. (2008). Design-Based Research and Educational Technology: Rethinking Technology and the Research Agenda. *Educational Technology & Society, 11*(4), 29-40.
- Anderson, T., & Shattuck, J. (2012). Design-based research a decade of progress in education research? *Educational researcher, 41*(1), 16-25.
- Attewel, J. (2005). *Mobile technologies and learning: A technology update and m-learning project Summary*. London: Learning and Skills Development Agency.
- Attewell, J., & Savill-Smith, C. (2004). *Learning with mobile devices. Learning and Skills*. London: Learning and Skills Development Agency.

- Attewell, J., & Savill-Smith, C. (2005). Mobile learning: reaching hard-to-reach learners and bridging the digital divide. *Methods and technologies for learning*, 361-365.
- Ausubel, D. (1963). *The psychology of meaningful verbal learning*. New York: Grune and Stratton.
- Ausubel, D., P. (1968). *Educational psychology. A cognitive view*. New York: Holt, Rinehart, & Winston.
- Ausubel, D., Novak, J. D., & Hanesian, H. (1978). *Educational Psychology: A Cognitive View (2nd edition)*. New York: Holt, Reinhart and Winston.
- Ausubel, D. P., & Robinson, F. G. (1969). *School learning: An introduction to educational psychology*. Holt, Rinehart and Winston.
- Babbie, E. R. (1973). *Survey research methods*. Wadsworth.
- Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *Journal of the Learning Sciences*, 13(1), 1-14.
- Barrett, P. T., & Kline, P. (1981). The observation to variable ratio in factor analysis. *Personality study and group behavior*, 1(1), 23-33.
- Barron, B., & Darling-Hammond, L. (2008). *Teaching for Meaningful Learning: A Review of Research on Inquiry-Based and Cooperative Learning*. Book Excerpt. George Lucas Educational Foundation.
- Barron, B., & Darling-Hammond, L. (2010). Prospects and challenges for inquiry-based approaches to learning. *The nature of learning: Using research to inspire practice*, 199-225.
- Bascones, J., Venezuela, & Novak, J. D. (1985). Alternative instructional systems and the development of problem ~~The Virginia Journal of Science~~
Education, 7(3), 253-261.
- Bates, T. (1997). *Restructuring the university for technological change*. Perth: Murdoch University.
- Beatty, P. C., & Willis, G. B. (2007). Research synthesis: The practice of cognitive interviewing. *Public Opinion Quarterly*, 71(2), 287-311.
- Bennett, N., Dunne, E., & Carré, C. (1999). Patterns of core and generic skill provision in higher education. *Higher education*, 37(1), 71-93.
- Bentley, T. (1998). *Learning Beyond the Classroom*. London: Demos.
- Berge, Z. L., & Collins, M. P. (Eds.). (1995). *Computer mediated communication and the online classroom: distance learning*. Cresskill: Hampton press.
- Bergmann, R., Richter, M. M., Schmitt, S., Stahl, A., & Vollrath, I. (2001). Utility-oriented matching: A new research direction for case-based reasoning. In *Professionelles*

Wissensmanagement: Erfahrungen und Visionen. Proceedings of the 1st Conference on Professional Knowledge Management. Shaker.

- Bielaczyc, K., & Collins, A. (1999). Learning communities in classrooms: A reconceptualization of educational practice. *Instructional-design theories and models: A new paradigm of instructional theory*, 2, 269-292.
- Biggs, J. B. (2011). *Teaching for quality learning at university: What the student does*. UK: McGraw-Hill Education.
- Black, T. R. (1999). *Doing quantitative research in the social sciences: An integrated approach to research design, measurement and statistics*. London: Sage.
- Blair, J., & Presser, S. (1993). Survey procedures for conducting cognitive interviews to pretest questionnaires: A review of theory and practice. In *Proceedings of the Section on Survey Research Methods, Annual Meetings of the American Statistical Association* (Vol. 370, p. 75).
- Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. *Bmj*, 314(7080), 572.
- Blaxter, L., Hughes, C., & Tight, M. (1996). Thinking about methods. *How to Research*, 53-91.
- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational researcher*, 33(8), 3-15.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. National Academy Press.
- Brown, A. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences*, 2(2), 141-178.
- Brown, A. L. (1978). *Knowing when, where, and how to remember: A problem of metacognition*. Technical Report No. 47. Retrieved March 23rd, 2016 from <http://files.eric.ed.gov/fulltext/ED146562.pdf>.
- Brown, A. L. (1985). *The importance of diagnosis in cognitive skill instruction. Thinking and learning skills: Current research and open questions*, 2.
- Brown, A. L., & Palincsar, A. S. (1989). Guided, cooperative learning and individual knowledge acquisition. *Knowing, learning, and instruction: Essays in honor of Robert Glaser*, 393-451.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational researcher*, 18(1), 32-42.
- Brown, L. M., Brewster, S. A., & Purchase, H. C. (2006, September). Multidimensional tactons for non-visual information presentation in mobile devices. In *Proceedings of the 8th conference on Human-computer interaction with mobile devices and services* (pp. 231-238). ACM.
- Bruning, R., Schraw, G., Norby, M., & Ronning, R. (2004). *Cognitive psychology and instruction*. Columbus.

- Bullen, M. (2007). Participation and critical thinking in online university distance education. *International Journal of E-Learning & Distance Education*, 13(2), 1-32.
- Bullen, M., & Morgan, T. (2009). The net generation in higher education. *International Journal of Excellence in eLearning*, 2(1), 1-13.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. National Academy Press.
- Bransford, J. D., & Schwartz, D. L. (1999). Rethinking transfer: A simple proposal with multiple implications. *Review of research in education*, 24, 61-100.
- Brockett, R. G., & Hiemstra, R. (1991). *Self-Direction in adult learning: Perspectives on Theory, Research, and Practice*. *Routledge Series on Theory and Practice of Adult Education in North America*. New York: Routledge.
- Buchanan, E. A. (2011). Internet research ethics: Past, present, and future. *The handbook of Internet studies*, 11, 83.
- Buchanan, E. A., & Hvizdak, E. E. (2009). Online survey tools: Ethical and methodological concerns of human research ethics committees. *Journal of Empirical Research on Human Research Ethics*, 4(2), 37-48.
- Butler, M. B., Lee, S., & Tippins, D. J. (2006). Case-based methodology as an instructional strategy for understanding diversity: Preservice teachers' perceptions. *Multicultural Education*, 13(3), 20-26.
- Byrne, D. (2002). *Interpreting quantitative data*. London: Sage.
- Caffarella, R. S. (2000). Goals of self-learning. Conceptions of self-directed learning: *Theoretical and conceptual considerations*, 37-48.
- Caffarella, R. S., & Barnett, B. G. (1994). Characteristics of adult learners and foundations of experiential learning. *New directions for adult and continuing education*, 1994(62), 29-42.
- Cappella, E., Reinke, W. M., & Hoagwood, K. E. (2011). Advancing intervention research in school psychology: Finding the balance between process and outcome for social and behavioral interventions. *School Psychology Review*, 40(4), 455-464.
- Carey, S., & Spelke, E. (1994). Domain-specific knowledge and conceptual change. *Mapping the mind: Domain specificity in cognition and culture*, 169-232.
- Carr, N. (2010). *The shallows: How the Internet is changing the way we think, read and remember*. London: Atlantic.
- Chan, T. W., Roschelle, J., Hsi, S., Kinshuk, Sharples, M., Brown, T., et al. (2006). One-to-one technology-enhanced learning: An opportunity for global research collaboration. *Research and Practice in Technology Enhanced Learning Journal*, 1, 3-29.
- Chang, Y. F., Chen, C. S., & Zhou, H. (2009). Smart phone for mobile commerce. *Computer Standards & Interfaces*, 31(4), 740-747.

- Chapel, E. (2008). Mobile technology. The foundation for an engaged and secure campus community. *Journal of Computing in Higher Education*, 20(2), 15-23.
- Chen, L. Q., Xie, X., Fan, X., Ma, W. Y., Zhang, H. J., & Zhou, H. Q. (2003). A visual attention model for adapting images on small displays. *Multimedia systems*, 9(4), 353-364.
- Cheon, J., Lee, S., Crooks, S. M., & Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Computers in Education*, 59(3), 1054-1064.
- Cheung, C. K. (2001). The use of popular culture as a stimulus to motivate secondary students' English learning in Hong Kong. *ELT Journal*, 55(1), 55-61.
- Chi, M. T. (2009). Active learning activities. *Topics in Cognitive Science*, 1(1), 73-105. -constructive
- Chomsky, N. (1980). Rules and representations. *Behavioral and brain sciences*, 3(01), 1-15.
- Clark, R. E. (2001). *Learning from media: Arguments, analysis, and evidence*. Greenwich, CT: IAP.
- Clark, R. C., & Mayer, R. E. (2016). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. John Wiley & Sons.
- Clarke, L. W., & Whitney, E. (2009). Walking in Their Shoes: Using Multiple Texts as a Bridge to Critical Literacy. *The Reading Teacher*, 62(6), 530-534. -Perspectives
- Cobb, P., Confrey, J., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational researcher*, 32(1), 9-13.
- Comrey, A. L. (1978). Common methodological problems in factor analytic studies. *Journal of consulting and clinical psychology*, 46(4), 648.
- Conceicao, S., Sherry, L., & Gibson, D. (2004). Using developmental research to design, develop and evaluate an urban education portal. *Journal of Interactive Learning Research*, 15(3), 271-286.
- Cook, J., Bradley, C., Lance, J., Smith, C., & Haynes, R. (2007). Generating learning contexts with mobile devices. *Mobile learning: Towards a research agenda*, 1, 25-38.
- Corbeil, J. R., & Valdes-Corbeil, M. E. (2007). Are you ready for mobile learning? *Educause Quarterly*, 30(2), 51.
- Cradler, J., McNabb, M., Freeman, M., & Burchett, R. (2002). How does technology influence student learning? *Learning and Leading with Technology*, 29(8), 46-49.
- Crescente, M. L., & Lee, D. (2011). Critical issues of m-learning: design models, adoption processes, and future trends. *Journal of the Chinese Institute of Industrial Engineers*, 28(2), 111-123.

- Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. London: Sage.
- Culp, K. M., Honey, M., & Mandinach, E. (2005). A retrospective on twenty years of education technology policy. *Journal of Educational Computing Research*, 32(3), 279-307.
- Cutshall, R., Changchit, C., & Elwood, S. (2006). Campus laptops. What logistical and technological factors are perceived critical? *Educational Technology & Society*, 9(3), 112-121.
- Daniel, J. S. (1996). *Mega-universities and knowledge media: Technology strategies for higher education*. Psychology Press.
- Demb, A., Erickson, D., & Hawkins-Wilding, S. (2004). The laptop alternative: Student reactions and strategic implications. *Computers & Education*, 43(4), 383-401.
- Dew, J. (2010). Global, mobile, virtual, and social: The college campus of tomorrow. *The Futurist*, 44(2), 46.
- de Winter, J., Winterbottom, M., & Wilson, E. (2010). Developing a user guide to integrating new technologies in science teaching and learning: teachers' and pupils' perceptions of their affordances. *Technology, Pedagogy and Education*, 19(2), 261-267.
- Dickson, G. W., & Segars, A. (1999). Redefining the high-technology classroom. *Journal of Education for Business*, 74(3), 152-156.
- Dierckx, D. (2013). The importance of socio-demographics in online surveys. Retrieved June, 1, 2016.
- Dierking, L. D., Falk, J. H., Rennie, L., Anderson, D., & Ellenbogen, K. (2003). Policy statement of the "informal science education" ad hoc committee. *Journal of Research in Science Teaching*, 40, 108-111.
- Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method*. New York: Wiley.
- Dochy, F. J. R. C. (1994). Prior knowledge and learning. In J. M. Pieters, K. Breuer, & P. R. J. Simons (Eds.), *Learning environments: Contributions from Dutch and German Research* (pp. 339-356). Berlin: Springer-Verlag.
- Donnelly, K. (2009). Learning on the move: how m-learning could transform training and development. *Development and Learning in Organizations*, 23(4), 8-11.
- Downes, S. (2005). E-learning 2.0. *Elearn magazine*, 2005(10), 1-7.
- Educause (2014). ECAR study of undergraduate students and information technology. Retrieved May 21, 2016, from <https://library.educause.edu/~-/media/files/library/2014/10/ers1406.pdf>
- Edwards, D. (2008). International engagements: The characteristics of international students' engagement with university. *AUSSE*, 27(2), 1-10.

- Ellinger, A. D. (2004). The concept of self-directed learning and its implications for human resource development. *Advances in Developing Human Resources*, 6(2), 158-177.
- Engelbrecht, E. (2003). A look at e-learning models: investigating their value for developing an e-learning strategy.
- Engeström, Y. (1987). *Learning by expanding: An activity theoretical approach to developmental research*. Helsinki, Finland: Orienta Konsultit Oy.
- Enriquez, A. G. (2010). Enhancing student performance using tablet computers. *College Teaching*, 58(3), 77-84.
- Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, 53(4), 25-39.
- Feldman, A. (2002). Multiple perspectives for the study of teaching: Knowledge, reason, understanding, and being. *Journal of Research in Science Teaching*, 39(10), 1032-1055.
- Fink, A. (1995). *How to sample in surveys. The Survey Kit (6)*. Thousand Oaks (US): Sage.
- Fink, A. (2015). *How to conduct surveys: A step-by-step guide*. Sage Publications.
- Fischer, B. B., & Fischer, L. (1979). Styles in teaching and learning. *Educational Leadership*, 36(4), 245-254.
- Flanagin, A. J., & Metzger, M. J. (2000). Perceptions of Internet information credibility. *Journalism & Mass Communication Quarterly*, 77(3), 515-540.
- Franklin, T. (2011). Mobile learning: At the tipping point. *TOJET: The Turkish Online Journal of Educational Technology*, 10(4), 261-275.
- Franklin, T. J. (2011). The Mobile School: Digital Communities Created by Mobile Learners. In *Bringing Schools into the 21st Century* (pp. 187-203). Netherlands: Springer.
- Franklin, T., & Peng, L. W. (2008). Mobile math: Math educators and students engage in mobile learning. *Journal of Computing in Higher Education*, 20(2), 69-80.
- Frey, L., Botan, C. H., & Kreps, G. (2000). *Investigating communication*. NY: Allyn & Bacon.
- Furlong, J., & Maynard, T. (1995). *Mentoring student teachers: The growth of professional knowledge*. Psychology Press.
- Garner, B. K. (2007). *Getting to "got it!": helping struggling students learn how to learn*. ASCD.
- Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult education Quarterly*, 48(1), 18-33.
- Garrison, D. R. (2011). *E-learning in the 21st century: A framework for research and practice*. Taylor & Francis.
- Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its formative potential in higher education. *The internet and higher education*, 7(2), 95-105.

- George, D., & Mallery, P. (2003). Reliability analysis. *SPSS for Windows, step by step: a simple guide and reference*, Boston: Allyn & Bacon, 222-232.
- Georgiev, T., Georgieva, E., & Smrikarov, A. (2004). M-learning-a New Stage of E-Learning. In *International Conference on Computer Systems and Technologies-CompSysTech*, 4(28), 1-4.
- Georgina, D. A., & Hosford, C. C. (2009). Higher education faculty perceptions on technology Integration and training. *Teaching and Teacher Education*, 25(5), 690-696.
- Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *Internet and Higher Education*, 19, 18-26.
- Glaser, R. (1984). Education and thinking: The role of knowledge. *American psychologist*, 39(2), 1-54.
- Goggin, G. (2010). *Global mobile media*. London: Routledge.
- Gokhale, A. A. (1995). Collaborative learning enhances critical thinking. *Journal of Technology of Education*, 7(1), 1045-1064.
- Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report*, 8(4), 597-606.
- Gorsuch, R. L. (1983). *Factor analysis* (2nd ed.). Hillsdale, NJ: LEA.
- Gravetter, F. J., & Wallnau, L. B. (2016). *Statistics for the behavioral sciences*. Cengage Learning.
- Green, N. (2002). On the move: Technology, mobility and the mediation of social time and space. *The Information Society*, 18, 281-292.
- Green, S., & Harvey, P. (1999, December). Scaling place and networks: An ethnography of ICT “innovation” in Manchester. In *Internet and Ethnography Conference, Hull*, 13-14.
- Greenhow, C. (2011). Online social networks and learning. *On the Horizon*, 19(1), 4-12.
- Greenhow, C. (2011). Youth, learning, and social media. *Journal of Educational Computing Research*, 45(2), 139-146.
- Gregersen, T., & MacIntyre, P. D. (2013). *Capitalizing on language learners' individuality: From premise to practice* (Vol. 72). Multilingual Matters.
- Guadagnoli, E., & Velicer, W. F. (1988). Relation to sample size to the stability of component patterns. *Psychological bulletin*, 103(2), 265-275.
- Gulek, J. C., & Demirtas, H. (2005). Learning with technology: The impact of laptop use on student achievement. *The journal of technology, learning and assessment*, 3(2).

- Hakkarainen, K., Lipponen, L., Järvelä, S., & Niemivirta, M. (1999). The interaction of motivational orientation and knowledge-seeking inquiry in computer-supported collaborative learning. *Journal of Educational Computing Research*, 21(3), 263-281.
- Hakkarainen, P. (2009). Designing and implementing a PBL course on educational digital video production: lessons learned from a design-based research. *Educational Technology Research and Development*, 57(2), 211-228.
- Hakkarainen, P., & Vapalahti, K. (2011). Meaningful Learning through Video-Supported Forum Theater. *International Journal of Teaching and Learning in Higher Education*, 23(3), 314-328.
- Hakkarainen, P., Saarelainen, T., & Ruokamo, H. (2007). Towards Meaningful Learning through Digital Video Supported, Case Based Teaching. *Australasian Journal of Educational Technology*, 23(1), 87-109.
- Hakkarainen, P., Saarelainen, T., & Ruokamo, H. (2009). Assessing teaching and students' meaningful learning processes in an E-learning course. *E-Learning technologies and evidence-based assessment approaches*, 20-36.
- Hashemi, M., Azizinezhad, M., Najafi, V., & Nesari, A. J. (2011). What is mobile learning? Challenges and capabilities. *Procedia-Social and Behavioral Sciences*, 30, 2477-2481.
- Hay, D. B., Kehoe, C., Miquel, M. E., Hatzipanagos, S., Kinchin, I. M., Keevil, S. F., & Lygo - Baker, S. (2008). Measuring the quality of e ~~learning~~ *British Journal of Educational Technology*, 39 1037-1056.
- Haythornthwaite, C. (2005). Social networks and Internet connectivity effects. *Information, Community & Society*, 8(2), 125-147.
- Hembrooke, H., & Gay, G. (2003). The laptop and the lecture. The effects of multitasking in learning Environments. *Journal of Computing in Higher Education*, 15(1), 46-64.
- Higgins, R., Hartley, P., & Skelton, A. (2002). The conscientious consumer: Reconsidering the role of assessment feedback in student learning. *Studies in higher education*, 27(1), 53-64.
- Hiemstra, R. (2000). Self-directed learning: The personal responsibility model. *Conceptions of self- directed learning: Theoretical and conceptional considerations*, 93-108.
- Hirschfeld, L. A., & Gelman, S. A. (1994). *Mapping the mind: Domain specificity in cognition and culture*. Cambridge, MA: MIT Press.
- Horton, W. (2011). *E-learning by design*. New York, NY: Wiley.
- Huang, Y. M., Chiu, P. S., Liu, T. C., & Chen, T. S. (2011). The design and implementation of meaningful learning-based evaluation method for ubiquitous learning. *Computers & Education*, 57(4), 2291-2302.
- Hussin, S., Manap, M. R., Amir, Z., & Krish, P. (2012). Mobile learning readiness among Malaysian students at higher learning institutes. *Asian Social Science*, 8(12), 276-283.

- Hwang, G. J., & Chang, H. F. (2011). A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students. *Computers & Education*, 56(4), 1023-1031.
- Jackson, C., Arici, A., & Barab, S. (2005). Eat your vegetables and do your homework: A design-based investigation of enjoyment and meaning in learning. *Educational technology: The magazine for managers of change in education*, (1), 15-20.
- Jacob, S. M., & Issac, B. (2008). The Mobile Devices and its Mobile Learning Usage Analysis. *International Journal of Interactive Mobile Technology*, 2(1), 10-18.
- Johnson, D. W., & Johnson, R. T. (1999). Making cooperative learning work. *Theory into Practice*, 38(2), 67-73.
- Johnson, D. W., Johnson, R. T., & Holubec, E. J. (1994). *The nuts and bolts of cooperative learning*. Interaction Book Co.
- Johnson, E. B. (2002). *Contextual teaching and learning: What it is and why it's here to stay*. Corwin Press.
- Johnson, R. T., & Johnson, D. W. (1986). Cooperative learning in the science classroom. *Science and Children*, 24, 31-32.
- Jones, A., & Issroff, K. (2005). Learning technologies. Affective and social issues in computer-supported collaborative learning. *Computers & Education*, 44(4), 395-408.
- Jonassen, D. H. (1995). Computers as cognitive tools: Learning with technology, not from technology. *Journal of Computing in Higher Education*, 6(2), 40-73.
- Jonassen, D. H. (1999). Designing constructivist learning environments. *Instructional design theories and models: A new paradigm of instructional theory*, 2, 215-239.
- Jonassen, D., Davidson, M., Collins, M., Campbell, J., & Haag, B. B. (1995). Constructivism and computer-mediated communication in distance education. *Distance Education*, 9(2), 7-26.
- Jonassen, D. H. (2000). *Computers as mind tools for schools: Engaging critical thinking*. Prentice Hall.
- Jonassen, D. H. (2002). Learning as Activity. *Educational Technology*, 42(2), 45-51.
- Jonassen, D., Howland, J., Moore, J., & Marra, R. (2003). *Learning to solve problems with technology. A constructivist perspective*. Upper Saddle River, NJ: Merrill.
- Jonassen, D. H., & Strobel, J. (2006). Modeling for meaningful learning. In *Engaged learning with emerging technologies* (pp. 1-27). Netherlands: Springer.
- Jones, C., Connolly, M., Gear, A., & Read, M. (2006). Collaborative Learning with Group Interactive Technology. A Case Study with Postgraduate Students. *Management learning*, 37(3), 377-396.

- Jones, A., & Issroff, K. (2005). Learning technologies. Affective and social issues in computer-supported collaborative learning. *Computers & Education*, 44(4), 395-408.
- Jääskeläinen, R. (2010). Think-aloud protocol. *Handbook of translation studies*, 1, 371-374.
- Kafai, Y. B. (2005). The classroom as “living laboratory”: Design-based research for understanding, comparing, and evaluating learning science through design. *Educational technology: The Magazine for Managers of Change in Education*, (1), 28-33.
- Karppinen, P. (2005). Meaningful learning with digital and online videos: Theoretical perspectives. *AACE JOURNAL*, 13(3), 233-250.
- Kearney, M., & Schuck, S. (2004). Authentic learning through the use of digital video. In *Proceedings of the Australian Computers in Education Conference*.
- Kearney, M., & Schuck, S. (2005). Students in the director’s seat: Teaching and learning with student-generated video. In *World Conference on Educational Multimedia, Hypermedia and Telecommunications* (pp. 2864-2871).
- Kearney, M., Schuck, S., Burden, K., & Aubusson, P. (2012). Viewing mobile learning from a pedagogical perspective. *Research in learning technology*, 20.
- Keller, J. (2011). The Slow-Motion Mobile Campus–The Digital Campus–The Chronicle of Higher Education. Retrieved September 14, 2015.
- Kelly, A. (2004). Design research in education: Yes, but is it methodological? *The Journal of the Learning Sciences*, 13(1), 115-128.
- Khaddage, F., & Lattemann, C. (2013). The future of mobile apps for teaching and learning. In Z. L. Berge, & L. Y. Muilenburg (Eds.), *Handbook of mobile learning* (pp. 119-128). New York: Routledge.
- Khaddage, F., Lattemann, C. & Bray, E. (2011). Mobile apps integration for teaching and learning. (Are teachers ready to re-blend?). In M. Koehler., & P. Mishra (Eds.), *Proceedings Society for Information Technology & Teacher Education International Conference* (pp. 2545-2552).
- Kim, S.H., Mims, C., & Holmes, K.P. (2006). An introduction to current trends and benefits of mobile wireless technology use in higher education. *AACE Journal*, 14(1), 77-100.
- King, P. M., & Kitchener, K. S. (1994). *Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults*. San Francisco: Jossey-Bass.
- Kline, P. (2014). *An easy guide to factor analysis*. London: Routledge.
- Knoche, H., McCarthy, J., & Sasse, M. A. (2006). A close-up on Mobile TV: The effect of low resolutions on shot types. In *Proceedings of EuroITV* (pp. 359-367). Athens, Greece: Athens University of Economics and Business.
- Knowles, M. S. (1975). *Self-directed learning*. New York: Associated Press.

- Koehler, M. J., & Mishra, P. (2008). Introducing tpck. *Handbook of technological pedagogical content knowledge (TPCK) for educators*, 3-29.
- Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70.
- Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning & Education*, 4(2), 193-212.
- Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (2001). Experiential learning theory: Previous research and new directions. *Perspectives on thinking, learning, and cognitive styles*, 1, 227-247.
- Koole, M. L. (2009). A model for framing mobile learning. *Mobile learning: Transforming the delivery of education and training*, 1(2), 25-47.
- Kozma, R. (2003). The material features of multiple representations and their cognitive and social affordances for science understanding. *Learning and Instruction*, 13(2), 205-226.
- Krippendorff, K. (2004). *Content analysis: An introduction to its methodology*. London: Sage.
- Kukulka-Hulme, A. (2007). Mobile usability in educational contexts. What have we learnt? *The International Review of Research in Open and Distance Learning*, 8(2), 1-16.
- Kukulka-Hulme, A., & Pettit, J. (2009). Practitioners as innovators: Emergent practice in personal mobile teaching, learning, work and leisure. *Mobile learning: Transforming the delivery of education and training*, 135-155.
- Kukulka-Hulme, A., & Traxler, J. (2005). *Mobile learning: A handbook for educators and trainers*. London and New York: Routledge.
- Kurfiss, J. G. (1988). *Critical thinking: Theory, research, practice, and possibilities*. ASHE-ERIC Higher Education Report No. 2, Washington, DC.
- Lapadat, J. C., & Lindsay, A. C. (1999). Transcription in research and practice: From standardization of technique to interpretive positionings. *Qualitative inquiry*, 5(1), 64-86.
- Latham, B. (2007). Sampling: What is it? *Quantitative Research Methods*, ENGL, 5377.
- Laurillard, D. (2007). *Pedagogical forms of mobile learning: framing research questions*. London: Institute of Education.
- Lavín-Mera, P., Moreno-Ger, P., & Fernández-Manjón, B. (2008, November). Development of educational videogames in m-Learning contexts. In *Digital Games and Intelligent Toys Based Education, 2008 Second IEEE International Conference on* (pp. 44-51). IEEE.
- Lee, H. B., & Comrey, A. L. (1992). *A first course in factor analysis*. Hillsdale, N.J.
- Leinhardt, G., & Greeno, J. G. (1986). The cognitive skill of teaching. *Journal of educational psychology*, 78(2), 75-79.

- Li, M. P., & Lam, B. H. (2013). Cooperative learning. *The Active Classroom, The Hong Kong Institute of Education*.
- Linnard, M. (1995). New debates on learning support. *Journal of Computer Assisted Learning, 11*(4), 239-253.
- Liu, Y., Han, S., & H. (2010). Understanding the factors driving m-learning adoption: A literature review. *Campus-Wide Information Systems, 27*(4), 210-226.
- Liu, Y., Li, H., & Carlsson, C. (2010). Factors driving the adoption of m-learning: An empirical study. *Computers in Education, 55*(3), 1211-1219.
- Ljung, L. (2001, May). Black-box models from input-output measurements. In *Instrumentation and Measurement Technology Conference, 2001. IMTC 2001. Proceedings of the 18th IEEE* (Vol.1, pp. 138-146). IEEE.
- Loo, R. (1983). Caveat on sample sizes in factor analysis. *Perceptual and Motor Skills, 56*, 371-374.
- Mahat, J., Ayub, A. F. M., & Luan, S. (2012). An assessment of students' mobile self-efficacy, readiness and personal innovativeness towards mobile learning in higher education in Malaysia. *Procedia-Social and Behavioral Sciences, 64*, 284-290.
- Maniar, N., Bennett, E., Hand, S., & Allan, G. (2008). The effect of mobile phone screen size on video based learning. *Journal of software, 3*(4), 51-61.
- McCarthy, M. A., Franklin, D. C., & Burgman, M. A. (1994). The importance of demographic uncertainty: an example from the helmeted honeyeater *Lichenostomus melanops cassidix*. *Biological Conservation, 67*(2), 135-142.
- Mansouri, S., Kaghazi, B., & Kharmali, N. (2010). Survey of students' attitude about M-learning in Gonbad Payam-noor University. The first conference of Iran's mobile value-added. *IRIB Conference Center, 1-9*.
- Marshall, M. N. (1996). Sampling for qualitative research. *Family practice, 13*(6), 522-526.
- Martin, F., & Ertzberger, J. (2013). Here and now mobile learning: An experimental study on the use of mobile technology. *Computers & Education, 68*, 76-85.
- Mason, M. (Ed.). (2008). *Critical thinking and learning*. Blackwell Publishing.
- Mausfeld, R. (2010). 6 Intrinsic multiperspectivity. Cognition and neuropsychology: *International Perspectives on Psychological Science, 1*, 95.
- Maxcy, S. J. (2003). Pragmatic threads in mixed methods research in the social sciences: The search for multiple modes of inquiry and the end of the philosophy of formalism. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 51-89). Thousand Oaks, CA: Sage.
- Mayer, R. E. (2002). Multimedia learning. *Psychology of learning and motivation, 41*, 85-139.

- Mayer, R. E. (2003). The promise of multimedia learning: using the same instructional design methods across different media. *Learning and Instruction, 13*(2), 125-139.
- Mayer, R. E., & Wittrock, M. C. (1996). Problem-solving transfer. *Handbook of educational psychology, 47-62*.
- McKeown, T. J. (1999). Case studies and the statistical worldview: Review of King, Keohane, and Verba's *Designing social inquiry: Scientific inference in qualitative research*. *International organization, 53*(01), 161-190.
- Mehdipour, Y., & Zerehkafi, H. (2013). Mobile learning for education: Benefits and challenges. *International Journal of Computational Engineering Research, 3*(6), 93-101.
- Mellow, P. (2005). The media generation: Maximise learning by getting mobile. In *Ascilite*, 470-476.
- Memon, A., Meissner, C. A., & Fraser, J. (2010). The Cognitive Interview: A meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy, and Law, 16*(4), 1-62.
- Merriam, S. B., & Caffarella, R. S. (1991). *Learning in adulthood. A comprehensive guide*. San Francisco: Jossey-Bass.
- Merriam, S. B., & Caffarella, R. S. (1999). *Learning in adulthood (2nd ed.)*. San Francisco: Jossey-Bass.
- Mingfong, J., Yam San, C., & Ek Ming, T. (2010). Unpacking the design process in design-based research. *Paper presented at the Proceedings of the 9th International Conference of the Learning Sciences - Volume 2*.
- Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *The Teachers College Record, 108*(6), 1017-1054.
- Mitchell, M. (1993). *Analogy-making as perception: A computer model*. Portland State University: MIT Press.
- Moon, J. (2001). PDP working paper 4 reflection in higher education learning. *Higher Education Academy*. Retrieved May 18 from <http://www.heacademy.ac.uk/resources.asp>.
- Moon, J. A. (2013). *Reflection in learning and professional development: Theory and practice*. London: Routledge.
- Moore, M. G. (1973). Toward a theory of independent learning and teaching. *The Journal of Higher Education, 661-679*.
- Motiwalla, L. F. (2007). Mobile learning: A framework and evaluation. *Computers & education, 49*(3), 581-596.
- Nelson, B., Ketelhut, D. J., Clarke, J., Bowman, C., & Dede, C. (2005). Design-based research strategies for developing a scientific inquiry curriculum in a multi-user virtual environment. *Educational Technology, 45*(1), 21-27.

- Newmann, F. M. (1996). *Authentic achievement: Restructuring schools for intellectual quality*. San Francisco: Jossey-Bass.
- Niero, M. (2014). The invisible interviewer: old and new methodological issues in online research. *Italian Sociological Review*, 4(3), 315-340.
- Noor, T. M., Skoumetou, D., Seco-Granados, G., & Lohan, E. S. (2014). User perception on Location Based Services: The more you know, the less you are willing to pay? In *International Conference on Localization and GNSS 2014 (ICL-GNSS 2014)* (pp. 1-6). IEEE.
- Norris, S. P., & Ennis, R. H. (1989). *Evaluating Critical Thinking. The Practitioners' Guide to Teaching Thinking Series*. Critical Thinking Press and Software, California.
- Novak, J. D. (2002). Meaningful learning: The essential factor for conceptual change in limited or inappropriate propositional hierarchies leading to empowerment of learners. *Science Education*, 86(4), 548-571.
- Oblinger, D. G., & Oblinger, J. L. (2005). *Educating the Net Generation*. Boulder: Colorado.
- Oha, E., & Reeves, T. (2010). The implications of the differences between design research and instructional systems design for educational technology researchers and practitioners. *Educational Media International*, 47(4), 263-275.
- Oliver, D. G., Serovich, J. M., & Mason, T. L. (2005). Constraints and opportunities with interview transcription: Towards reflection in qualitative research. *Social forces*, 84(2), 1273-1289.
- Ouimet, J. A., Bunnage, J. C., Carini, R. M., Kuh, G. D., & Kennedy, J. (2004). Using focus groups, expert advice, and cognitive interviews to establish the validity of a college student survey. *Research in Higher Education*, 45(3), 233-250.
- Pachler, N., Bachmair, B., & Cook, J. (Eds.) (2010). *Mobile learning: Structures, agency, practices*. New York: Springer.
- Palmer, S. (1978). Fundamental aspects of cognitive representation. In E. Rosch, & B. Lloyd (Eds.), *Cognition and categorization* (pp. 259-303). New Jersey: Lawrence Erlbaum Associates.
- Parasuraman, A. (2000). Technology Readiness Index (TRI) a multiple-item scale to measure readiness to embrace new technologies. *Journal of service research*, 2(4), 307-320.
- Park, Y. (2011). A pedagogical framework for mobile learning: Categorizing educational applications of mobile technologies into four types. *The International Review of Research in Open and Distributed Learning*, 12(2), 78-102.
- Parker, B. J., & Plank, R. E. (2000). A uses and gratifications perspective on the Internet as a new information source. *American Business Review*, 18(2), 43-49.
- Parten, M. (1950). *Surveys. Polls and Samples*, NY: Harper and Brothers.
- Pask, G. (1975). *Conversation, cognition and learning*. Amsterdam: Elsevier.

- Patten, B., Sánchez, I. A., & Tangney, B. (2006). Designing collaborative, constructionist and contextual applications for handheld devices. *Computers & education*, 46(3), 294-308.
- Pedró, F. (2010). Are the new millennium learners making the grade? *Technology use and educational performance in PISA*. Paris: CERI.
- Pekrun, R. (2009). *Emotions at school. Handbook of motivation at school*. Oxford: Elsevier.
- Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. *Educational Psychologist*, 37(2), 91-105.
- Peters, B. (2002). The future of wireless marketing. *Carat Interactive Study*.
- Peters, K. (2007). m-Learning: Positioning educators for a mobile, connected future. *The International Review of Research in Open and Distributed Learning*. Retrieved March 14, 2016, from <http://www.irrodl.org/index.php/irrodl/article/view/350/894>
- Poland, B. D. (2002). Transcription quality. In J. Gubrium & J. Holstein (Eds.), *Handbook of interview research* (pp. 629-650). London: Sage.
- Poland, B. D. (2003). Transcription quality. *Inside interviewing: New lenses, new concerns*, 267-287.
- Presser, S., Couper, M. P., Lessler, J. T., Martin, E., Martin, J., Rothgeb, J. M., & Singer, E. (2004). Methods for testing and evaluating survey questions. *Public opinion quarterly*, 68(1), 109-130.
- Putnam, R. T., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher*, 29(1), 4-15.
- Quinn, C. (2000). mLearning: Mobile, wireless and in-your-pocket learning. Line Zine Magazine. Retrieved May 24, 2016, from <http://www.linezine.com/2.1/features/cqmmwiyp.htm>
- Reiser, R. A., & Dempsey, J. V. (2007). *Trends and issues in instructional technology and design*. NJ: Pearson.
- Rendas, A. B., Fonseca, M., & Pinto, P. R. (2006). Toward meaningful learning in undergraduate medical education using concept maps in a PBL pathophysiology course. *Advances in Physiology Education*, 30(1), 23-29.
- Rennie, F., & Morrison, T. (2013). *E-learning and social networking handbook: Resources for higher education*. London: Routledge.
- Rick, S., & Weber, R. A. (2010). Meaningful learning and transfer of learning in games played repeatedly without feedback. *Games and Economic Behaviour*, 68(2), 716-730.
- Rieber, L. P. (1992). Computer-based microworlds: A bridge between constructivism and direct instruction. *Educational Technology Research and Development*, 40(1), 93-106.
- Riel, M. (1993). Global education through learning circles. *Global networks*, 221-236.

- Rismark, M., Solvberg, A. M., Stromme, A., & Hokstad, L. M. (2007). Using mobile phones to prepare for university lectures: student's experiences. *TOJET: The Turkish Online Journal of Educational Technology*, 6(4), 1-5.
- Robbins, L. R. B. (1963). Higher education: *Report of the committee appointed by the Prime Minister under the chairmanship of Lord Robbins, 1961-63* (No. 2). HM Stationery Office.
- Rossing, J. P., Miller, W. M., Cecil, A. K., & Stamper, S. E. (2012). iLearning: The Future of Higher Education? Student Perceptions on Learning with Mobile Tablets. *Journal of the Scholarship of Teaching and Learning*, 12(2), 1-26.
- Rovai, A. P., & Barnum, K. T. (2007). On-line course effectiveness: An analysis of student interactions and perceptions of learning. *International Journal of E-Learning & Distance Education*, 18(1), 57-73.
- Ruokamo, H., & Pohjolainen, S. (2000). Distance learning in a multimedia networks project: main results. *British Journal of Educational Technology*, 31(2), 117-125.
- Ruokamo, H., Hakkarainen, P., & Eriksson, M. (2012). Designing a model for enhanced teaching and meaningful e-learning. In A. D. Olofsson & J. O. Lindberg (Eds.), *Informed Design of Educational Technologies in Higher Education* (pp. 375-392). Hershey, PA: IGI Global.
- Ruokamo, H., Tuovinen, H., Tella, S., Vahtivuori, S., & Tissari, V. (2002). Pedagogical models in the design and assessment of Network-based education. In P. Barker & Rebelsky (Eds.), *Proceedings of ED-MEDIA 2002: World Conference on educational Multimedia, Hypermedia & Telecommunications* (pp. 1676-1681). Denver: Eric.
- Ryan, K., Gannon-Slater, N., & Culbertson, M. J. (2012). Improving survey methods with cognitive interviews in small-and medium-scale evaluations. *American Journal of Evaluation*, 33(3), 414-430.
- Ryu, H., & Parsons, D. (2012). Risky business or sharing the load? — Social flow in collaborative mobile learning. *Computers & Education*, 58(2), 707-720.
- Salomon, G. (1983). The differential investment of mental effort in learning from different sources. *Educational Psychologist*, 18(1), 42-50.
- Scherer, K. R., Wallbott, H. G., & Summerfield, A. B. (1986). *Experiencing emotion: A cross-cultural study*. Cambridge University Press.
- Schoenfeld, A. H. (2010). *How we think: A theory of goal-oriented decision making and its educational applications*. New York: Routledge.
- Schwonke, R., Berthold, K., & Renkl, A. (2009). How multiple external representations are used and how they can be made more useful. *Applied Cognitive Psychology*, 23(9), 1227-1243.
- Seels, B., & Richey, R. (1994). *Instructional technology: The definition and domains of the field*. Association for Educational Communications and Technology.

- Selim, H. M. (2007). Critical success factors for e-learning acceptance: Confirmatory factor models. *Computers & Education, 49*(2), 396-413.
- Seppälä, P., & Alamäki, H. (2003). Mobile learning in teacher training. *Journal of Computer Assisted Learning, 19* (2003), 330-335.
- Sharples, M. (2000). The design of personal mobile technologies for lifelong learning. *Computers & Education, 34*(3), 177-193.
- Sharples, M. (2002). Disruptive devices: mobile technology for conversational learning. *International Journal of Continuing Engineering Education and Life Long Learning, 12*(5-6), 504-520.
- Sharples, M., Arnedillo, Sánchez, I., Milrad, M., & Vavuola, G. (2009). Mobile learning. Small devices, big issues. In N. Balacheff, S. Ludvigsen, T. de Jong, A. Lazonder & S. Barnes (Eds.), *Technology-enhanced learning: Principles and products* (pp. 233-249). Heidelberg: Springer.
- Sharples, M., Taylor, J., & Vavuola, G. (2005). *Towards a theory of mobile learning. Proceedings of mlearn*. New York. Springer.
- Sharples, M., Taylor, J., & Vavuola, G. (2007). A theory of learning for the mobile age. In R. Andrews & c. Haythornthwaitre (Eds.), *The Sage handbook of E-Learning Research* (pp. 221-247). London: Sage.
- Shepherd, C. (2001). M is for Maybe. Tactix: Training and communication technology in context. Retrieved May 30, 2016, from <http://www.fastrak-consulting.co.uk/>
- Shuler, P., Hutchins, G., & LaShell, B. (2010). Student perceptions of tablet computers in a cooperative learning environment. *NACTA Journal, 54*(2), 11-17.
- Shulman, L. S. (1999). Taking learning seriously. *Change: The Magazine of Higher Learning, 31*(4), 10-17.
- Sipilä, K. (2013). *No pain, no gain? educational use of ICT in teaching, studying and learning processes: teachers' and students' views* (Doctoral dissertation). Lapland University Press.
- Slavin, R. E. (1996). Research on cooperative learning and achievement: What we know, what we need to know. *Contemporary educational Psychology, 21*(1), 43-69.
- Smyth, J. (1992). Teachers' work and the politics of reflection. *American Educational Research Journal, 29*(2), 267-300.
- Soini, H. (1999). *Education students' experiences of learning and their conceptions about learning disabilities: Towards a comprehensive theory of learning*. Oulun yliopisto.
- Snyder, M. M. (2009). Instructional-design theory to guide the creation of online learning communities for adults. *Tech Trends, 53*(1), 48-56.
- Spence, K. W. (1958). A theory of emotionally based drive (D) and its relation to performance in simple learning situations. *American Psychologist, 13*(4), 131-141.

- Stevens, S. S. (1946). On the theory of scales of measurement. *Science, New Series*, 103(2684), 677-680.
- 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 & education*, 50(4), 1183-1202.
- Sung, E., & Mayer, R. E. (2012). Students' beliefs about mobile devices Vs. desktop computers in South Korea and the United States. *Computers & Education*, 59(4), 1328-1338.
- Szolnoki, G., & Hoffmann, D. (2013). Online, face-to-face and telephone surveys—Comparing different sampling methods in wine consumer research. *Wine Economics and Policy*, 2(2), 57-66.
- Säljö, R. (2004). Learning and technologies, people and tools in co-ordinated activities. *International Journal of Education Research*, 41(6), 489-494.
- Sølvberg, A. M., & Rismark, M. (2012). Learning spaces in mobile learning environments. *Active Learning in Higher Education*, 13(1), 23-33.
- Taleb, Z., & Sohrabi, A. (2012). Learning on the move: the use of mobile technology to support learning for university students. *Procedia-Social and Behavioral Sciences*, 69, 1102-1109.
- Taylor, J., Sharples, M., O'Malley, C., Vavuola, G., & Waycott, J. (2006). Towards a task model for mobile learning: A dialectical approach. *International Journal of Learning Technologies*, 2(2-3), 138-158.
- Tenenbaum, J. B., Griffiths, T. L., & Kemp, C. (2006). Theory-based Bayesian models of inductive learning and reasoning. *Trends in Cognitive Sciences*, 10(7), 309-318.
- Thomson, P. (2013). The digital natives as learners: Technology use patterns and approaches to learning. *Computers & Education*, 65(1), 12-33.
- Tilley, S. A. (1998). Conducting respectful research: A critique of practice. *Canadian Journal of Education/Revue canadienne de l'education*, 316-328.
- Timmis, S. (2012). Constant companions: Instant messaging conversations as sustainable supportive study structures amongst undergraduate peers. *Computers & Education*, 59(1), 3-18.
- Ting, R. Y. L. (2005). Mobile learning: current trend and future challenges. In *Fifth IEEE International Conference on Advanced Learning Technologies (ICALT'05)* (pp. 603-607). Piscataway, NJ: IEEE.
- Tinto, V. (1997). Colleges as communities: Taking research on student persistence seriously. *The Review of Higher Education*, 21(2), 167-177.
- Totten, S., Sills, T., Digby, A., & Russ, P. (1991). Collaborative learning: A guide to research. *Scandinavian Journal of Educational Research*, 33(4), 231-243.
- Tough, A. M. (1967). Learning without a teacher (No. 3). Ontario Institute for Studies in Education. *Adult Education*, 28(4), 250–263.

- Tough, A. M. (1971). *Adults' learning projects: A fresh approach to theory and practice in adult education*. Ontario Institute for Studies in Education. B.S.W: Toronto.
- Tourangeau, R., Rips, L. J., & Rasinski, K. (2000). *The psychology of survey response*. Cambridge University Press.
- Traxler, J. (2007). Defining, discussing and evaluating mobile learning: The moving finger writes and having writ. *International Review of Research in Open and Distance Learning*, 8(2), 1-12.
- Traxler, J. (2010). Sustaining mobile learning and its institutions. *International Journal of Mobile and Blended Learning*, 2(4), 58-65.
- Turkle, S. (2011). *Alone together: Why we expect more from technology and less from ourselves*. New York, NY: Basic Books.
- Tynjälä, P. (2008). Perspectives into learning at the workplace. *Educational Research Review*, 3(2), 130-154.
- Tynjälä, P., Mason, L., & Lonka, K. (2001). *Writing as a learning tool: Integrating theory and practice* (Vol. 7). Springer Science & Business Media.
- Valk, J., Rashid, A. T., & Elder, L. (2010). Using mobile phones to improve educational outcomes: An analysis of evidence from Asia. *International Review of Research in Open and Distance Learning*, 11(1), 117-140.
- Van den Akker, J., Gravemeijer, K., McKenney, S., & Nieveen, N. (Eds.). (2006). *Educational design research*. New York: Routledge.
- Van Deursen, A. J. A. M. (2010). *Internet skills. Vital assets in an information society*. Enschede, the Netherlands: University of Twente.
- Van Teijlingen, E., & Hundley, V. (2002). The importance of pilot studies. *Nursing Standard*, 16(40), 33-36.
- Vehovar, V., & Manfreda, K. L. (2008). Overview: Online surveys. In N. Fielding, R. M. Lee, & G. Blank (Eds.), *The SAGE handbook of online research methods* (pp. 177-194). Los Angeles: Sage.
- Viola, S. R., Giretti, A., & Leo, T. (2007). Detecting differences in "meaningful learning" behaviours and their evolution: a data driven approach. *International Journal of Computing and Information Sciences*, 5(2), 63-73.
- Virvou, M., & Alepis, E. (2005). Mobile educational features in authoring tools for personalised tutoring. *Computers & Education*, 44(1), 53-68.
- Vuojärvi, H. (2013). *Conceptualising personal and mobile learning environments in higher education: focus on students' perspective* (Doctoral dissertation). Lapland University Press.
- Vuojärvi, H., Eriksson, M. J., & Ruokamo, H. (2011). Developing a pedagogical model for decentralized tourism education. In *International Conference on Mobile Learning* (pp. 188-192).

- Wagner, E. D. (2008). Realizing the promise of mobile learning. *Journal of Computing in Higher Education*, 20(2), 4-14.
- Wakefield, R. L., & Whitten, D. (2006). Mobile computing: a user study on hedonic/utilitarian mobile device usage. *European Journal of Information Systems*, 15(3), 292-300.
- Walls, S., & Pardy, J. (2010). *Crediting Vocational Education and Training for Learner Mobility*. Adelaide: NCVET
- Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning Environments. *Educational Technology Research & Development*, 53(4), 5-23.
- Wang, Y. S., Wu, M. C., & Wang, H. Y. (2009). Investigating the determinants and age and gender differences in the acceptance of mobile learning. *British Journal of Educational Technology*, 40(1), 92-118.
- Wann, J. P., Rushton, S., & Mon-Williams, M. (1995). Natural problems for stereoscopic depth perception in virtual environments. *Vision research*, 35(19), 2731-2736.
- Warrell, J. G., & Jacobsen, M. (2014). Internet research ethics and the policy gap for ethical practice in online research settings. *The Canadian Journal of Higher Education*, 44(1), 22-37.
- Whittlestone, K., Bullock, J., Pirkelbauer, B., & May, S. (2008). The significant factors affecting engagement of veterinary students with mobile learning. In I. Arnedillo-Sánchez & P. Isaias (Eds.), *Proceedings of IADIS International Conference on Mobile Learning* (pp. 135-139). Algarve: Portugal.
- Willis, G. B. (2004). *Cognitive interviewing: A tool for improving questionnaire design*. Sage Publications.
- Wu, W. H., Wu, Y. C. J., Chen, C. Y., Kao, H. Y., Lin, C. H., & Huang, S. H. (2012). Review of trends from mobile learning studies: A meta-analysis. *Computers & Education*, 59(2), 817-827.
- Wurst, C., Smarkola, C., & Gaffney, M. A. (2008). Ubiquitous laptop usage in higher education: Effects on student achievement, student satisfaction, and constructivist measures in honors and traditional classrooms. *Computers & Education*, 51(4), 1766-1783.
- Xie, Y., Ke, F., & Sharma, P. (2008). The effect of peer feedback for blogging on college students' reflective learning processes. *The Internet and Higher Education*, 11(1), 18-25.
- Yeh, Y. F., Chen, M. C., Hung, P. H., & Hwang, G. J. (2010). Optimal self-explanation prompt design in dynamic multi-representational learning environments. *Computers & Education*, 54(4), 1089-1100.
- Yengin, I., Karahoca, A., Karahoca, D., & Uzunboylyu, H. (2011). Is SMS still alive for education: Analysis of educational potentials of SMS technology? *Procedia Computer science*, 3(2011), 1439-1445.
- Zahedi, F. (1986). The analytic hierarchy process—A survey of the method and its applications. *Interfaces*, 16(4), 96-108.

APPENDIXES

Appendix I: Mobile Learning Assessment Questionnaire

1. What is your gender?

Female

Male

2. What is your year of birth?

3. Do you work during term time?

I work regularly full time

I work regularly part time

I work occasionally

I do not work

4. Do you have children under the age of 18?

Yes

No

5. How old is your youngest child?

(under 1year old)

6. What type of degree are you pursuing?

Bachelor's Degree

Master's Degree

Doctoral Degree

Non-degree student

Something else – if so, then what?

7. What are you majoring in?

.....

8. When did you begin your studies?

.....

9. What mobile devices do you have in your personal use?

A laptop

A smartphone

A tablet computer

10. To what degree do you use mobile devices on university premises (any devices, not just your own)?

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

11. To what degree do you use mobile devices for study purposes outdoors (any devices, not just your own)?

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

The following statements concern your experiences of using mobile devices for learning (either with your own devices or those provided by the university). Please answer separately for each type of device (laptop, tablet, and smartphone) presented after each statement.

12. Participating in synchronous discussions via applications based on written communication (e.g., Facebook and Skype chats) has promoted my learning.

(Synchronous = occurring at the same time, simultaneously)

Not at all A little Some A lot

Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

13. Participating in asynchronous discussions (either in social media sites or course management systems) has promoted my learning.

(Asynchronous = not occurring at the same time, nonsimultaneous)

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

14. Producing pictorial and / or audio-visual content (e.g., pictures, videos, animations) with my fellow students has promoted my learning.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

15. Participating in discussions via video conferencing or video calls (e.g., Skype) has promoted my learning.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

16. Participating in discussions via calls through phone or skype (without video) has promoted my learning.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

17. Working asynchronously online with my fellow students on a common written document (e.g., wikis, Google Docs) has promoted my learning.

(Asynchronous = not occurring at the same time, nonsimultaneously)

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

18. Working synchronously online with my fellow students on a common written document (e.g., Google Docs) has promoted my learning.

(synchronous = occurring at the same time, simultaneously)

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

19. Working face-to-face with my fellow students on a common written document has promoted my learning.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

20. Scheduling a meeting with my fellow students and / or instructors has promoted my learning.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

21. Reading someone else's online documents (e.g., articles, journals, blogs) has promoted my learning.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

22. Discussing about someone else's online documents (e.g., articles, journals, blogs) has promoted my learning.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

23. Being constantly connected with my fellow students through mobile devices has promoted my learning.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

24. Mobile device applications (e.g., calendars, reminders) have helped me to manage my time while studying.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

25. Mobile devices have helped me to achieve my personal learning goals.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

26. Mobile devices have enabled receiving instant feedback and / or advice from my instructors.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

27. Mobile devices have enabled receiving instant feedback and / or advice from my fellow students.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0

Tablet	0	0	0	0
Laptop	0	0	0	0

28. Mobile devices have provided me opportunities to use my creativity in my studies

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

29. Mobile devices have been useful to me when solving studying-related problems.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

30. Mobile devices have positively contributed to my satisfaction with studying.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

31. I have shared online my learning assignments during my studies through mobile devices.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

32. I have shared my off-campus learning experiences on the spot (e.g., in a workplace, or “in the field”)

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

33. I have received useful comments on my learning assignments from persons outside university context through mobile devices.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

34. Mobile devices have been useful to me when interacting with off-campus experts through mobile devices.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

35. I have evaluated my own learning (e.g., via learning journals) through a mobile device.

	Not at all	A little	Some	A lot
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Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

36. Mobile devices have been useful to me when picking up incidental ideas related to studying (e.g., pictures, videos, notes).

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

37. I have searched for course-related information through mobile devices.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

38. Mobile devices have been useful to me when constructing new ideas on an abstract / theoretical level (e.g., mind maps, modelling).

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

39. Mobile devices have been useful to me when critically evaluating and analyzing information related to my field of study.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

40. Mobile devices have been beneficial to my learning by enabling me to get up-to-the-minute news and information.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

41. I have listened to study-related audio materials (e.g., podcast, lectures) through mobile devices.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

42. I have watched study-related audio-visual materials (e.g., videos) through mobile devices.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

43. I have produced textual course assignments through mobile devices.

	Not at all	A little	Some	A lot
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Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

44. I have produced audio-visual course assignments through mobile devices.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

45. Being constantly connected through mobile devices often impedes my concentration while studying.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

46. I have encountered technical problems when using mobile devices for learning.

	Not at all	A little	Some	A lot
Smartphone	0	0	0	0
Tablet	0	0	0	0
Laptop	0	0	0	0

47. Comments or feedback

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Appendix II: Cognitive Protocols on the Mobile Learning Assessment

Questionnaire

- Pay attention to the time; how long does it approximately take to answer the survey?
- Ask the participants to think aloud as much as possible
- Probe questions to be asked after the participant has responded to the questionnaire:
 1. Question 12 was about how much participating in synchronous discussions via applications based on written communication (e.g., Facebook and Skype chats) has promoted your learning. In your own words: what does synchronous mean?
 2. Question 13 was about participating in asynchronous discussions (either in social media sites or course management systems) has promoted your learning. In your own words: what does asynchronous mean?
 3. Question 28. Mobile devices have provided me opportunities to use my creativity in my studies. What kinds of thoughts this question brings to your mind? What kind of creativity are you thinking about?
 4. Question 33 asked if you have received useful comments on my learning assignments from persons outside university context. Who do you think these persons could be?
 5. Question 34 asked if you find mobile devices useful when interacting with off-campus experts. Who do you think these off-campus experts could be?
 6. Did you find some question(s) abstract or hard to understand? Please explain.
 7. Did you find some question(s) irrelevant? Please explain.
 8. Were the scales usable / suitable to describe your experiences of using mobile tools in learning?
 9. Was the survey clear? Did it proceed logically?
 10. Does the questionnaire cover all aspects on how mobile tools could be used in learning?
 11. Do you think a web-based questionnaire is a suitable tool for conducting such a survey?

Appendix III: Bar Chart Frequency Distributions of Individual Variables

