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Factors that Enhance or Hinder Acceptance and Use of Mobile Devices for Learning: A Meta-analysis of 60 Studies on Mobile Learning

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Abstract: This paper discusses the meta-analysis of 60 studies related to learning with mobile devices conducted between 2005 and 2013. It explores the factors indicated by research as enhancing or hindering the acceptance and use of mobile digital devices for learning. A review of the literature related to m-learning shows that there is a growing body of research on m-learning and mobile devices do offer promising potential to improving educational design and delivery. However, more future research work needs to be carried out in the area of outcomes and implications of mobile learning in relation to educational practices to deepen our understanding of the utility of mobile devices in enhancing pedagogical delivery processes.

Keywords: Mobile learning, E-learning

1. Aims and Significance of Study

The emergence of the digital native generation, that is children who grow up using and relating to modern ICTs, provides a strong motive for research of learning with mobile devices in order to understand and achieve the potential educational benefits of m-learning.Although the focus of this paper is m-learning in higher education contexts, m-learning also has implications for employers and industries as an educational resource for training (Mungania 2003). In February 2013 UNESCO held the second Mobile Learning Week (MLW) at its Headquarters in Paris, France to explore mobile learning as a unique and significant contribution to achieving the Education for All (EFA) goals of increasing education access, quality and equality. The importance of m-learning is also reflected in a review of the resources to complement UNESCO's Policy Guidelines for Mobile Learning (UNESCO, 2013).

The following key research question underpins the research goals of this meta-analysis study:

What factors are indicated by research as enhancing or hindering the acceptance and use of mobile digital devices for learning?

2. Literature Review

Defining mobile learning

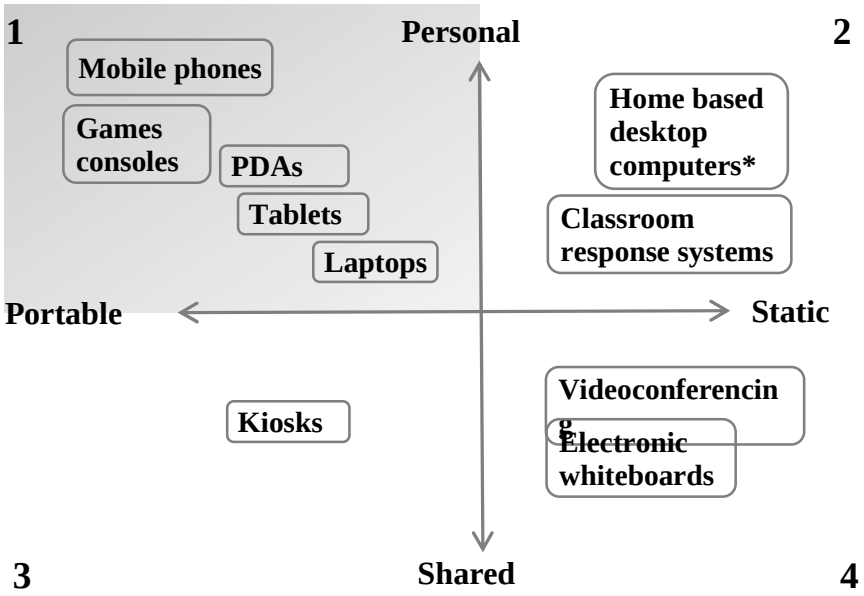
The definition of m-learning has changed significantly since the term was first used. Early definitions of m-learning tended to focus on the technologies involved: "elearning through mobile computational devices: Palms, Windows CE machines, even your digital cell phone" (Quinn, 2000); and, the portability of mobile technologies: "learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies" (O'Malley et al., 2003). Later definitions expand upon this, for example, the UK mobile learning project MoLeNet, identified m-learning as "the exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning … in any location, at any time, including traditional learning environments such as classrooms". More recent definitions of m-learning identify how mobile technology is used for educational purposes such as "the process of using a mobile device to access and study learning materials [and] to communicate with fellow students, instructors or institution" (Ally, 2009; Ali & Irvine, 2009 cited Pollara & Kee Broussard, 2011). And even more broadly, "any activity that allows individuals to be more productive when consuming, interacting with, or creating information, mediated through a compact digital portable device" (Wexler et. al., 2007). Kukulska-Hulme and Traxler's (2005) handbook for educators and trainers, which explores the use of portable devices for learning through a series of case studies in a range of different contexts, shows the recognition of m-learning as a significant field of study.

Defining characteristics of m-learning devices

Personal ownership and mobility are the principal characteristics associated with the use of mobile devices for learning. Naismith et al. (2004) used an x-y axis to classify learning technologies (see Figure 1). The horizontal x-axis describes the extent to which a device is portable and the vertical y-axis describes whether the device is personal or shared.

Other characteristics of mobile devices used for learning include informality and the possibility of learning over time (Naismith et al. 2004). Through mobile devices, learners have access to live streamed lectures and recorded pod-casts; live streaming, webinars and instant messaging are time specific but podcasting, message boards and other applications are not. Mobile devices can also be used by learners when and as they wish; learners can download printed and graphic resources for later use, correspond with others using instant messaging, message boards, emails and voice mail and participate in group discussions and 'webinars' using chat functions and applications like 'Skype'.

Figure 1. A mobile devices classification (from Naismith et al. 2004, p.7)



*home based desktop computers are not included in Naismith et al.'s original grid.

Educational uses of mobile devices

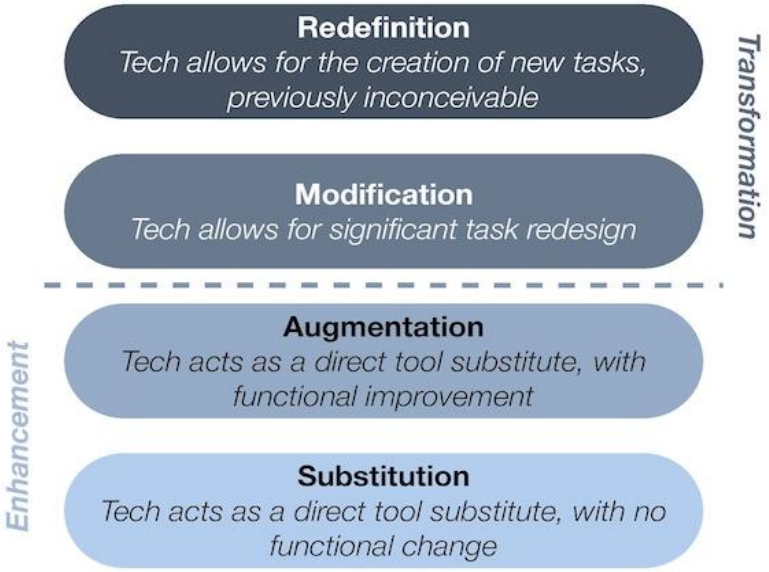
There are a wide range of applications which can be used with personal and portable mobile devices which give learners the opportunity to engage in a wide variety of learning activities both in the classroom and at other locations.

Quinn (2011) identified four different ways teachers and students can use mobile devices for learning which are referred to as the four C's of mobile learning:

- **Content:** Students can read documents, watch videos and listen to recorded media in a portable format.
- **Compute:** Through applications, mobile devices can be used to perform calculations, run programs and deliver computed solutions to student queries.
- **Capture:** Mobile devices can be used to easily record sound, video, images, and other information, all of which can be stored or shared.
- **Communicate:** Students can communicate with other students, teachers, and others through text, audio and video using mobile devices.

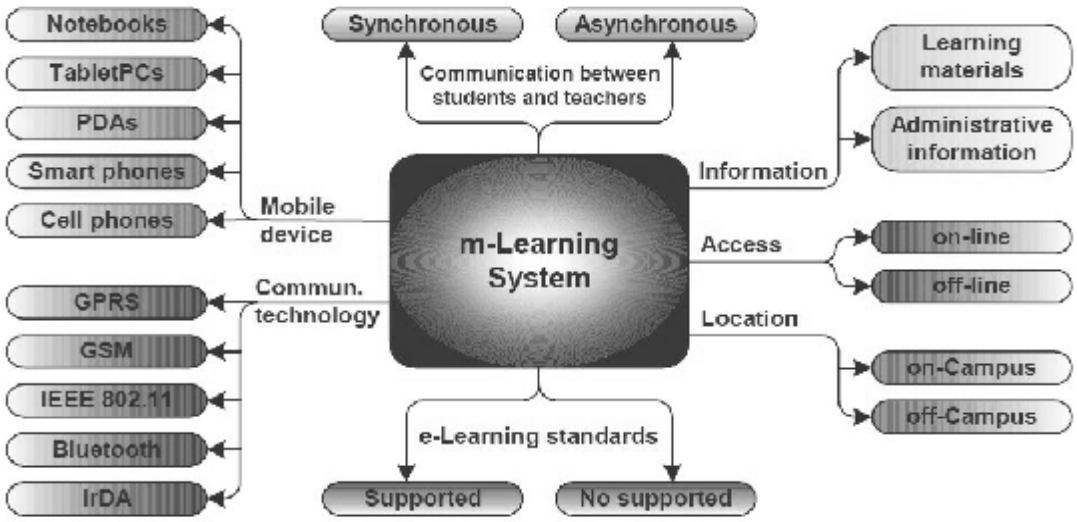
Another way of looking at how m-learning may affect teaching and learning is through Puentedura's Substitution Augmentation Modification Redefinition Model (see Figure 2). Although not specific to m-learning, the SAMR model shows the many ways as to how mobile devices may be used to enhance learning.

Figure 2. SAMR model (Puentedura, 2013)



M-learning represents a multi-dimensional approach to teaching and learning. This is expressed in Georgieva et al. (2005) general classification of m-learning systems which shows the different components of m-learning (see Figure 3). Georgieva et al. (2005) classification of m-learning systems considers the type of mobile devices used, for example: notebooks, TabletPCs, PDAs, cell phones or smart phones and also the communication technology used. It also considers the type of communication between students and teachers and if it occurs at the same time (synchronous) or at different times (asynchronous).

Figure 3. A general classification of m-learning systems (from Georgieva et al. 2005)

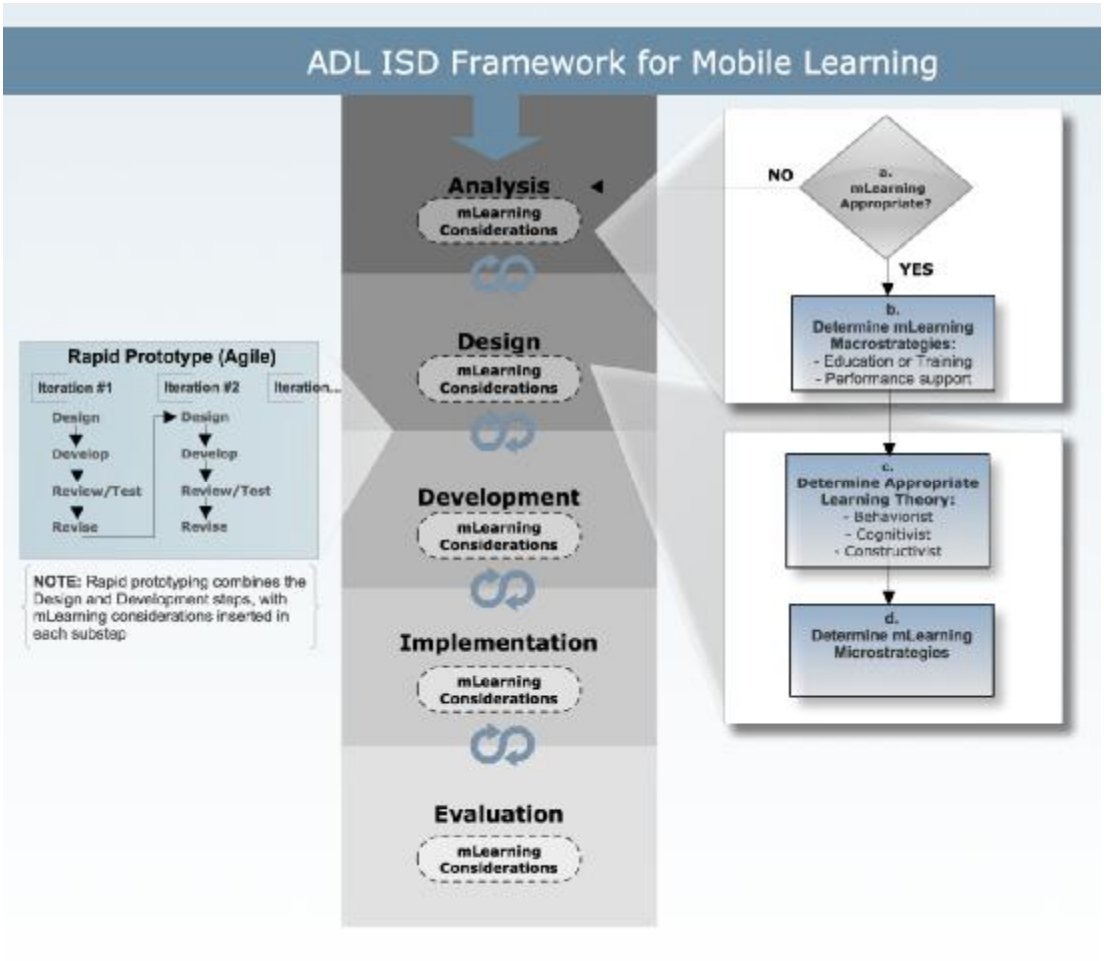


Design of m-learning

Mobile devices may be used for educational purposes without being part of a formal mobile learning system. For example, Uzunboylu, Cavus and Ercag (2008) found that students using mobile phones to record and transmit pictures of their local environments increased the environmental awareness of students without a conspicuous intention to do so. Although this result suggests that even when there is no planned instructional design embedded in the use of mobile devices, valuable learning opportunities are provided, it has to be noted that using mobile devices without attention to instructional design may reduce their effectiveness as educational aids.

Nordin, Embi and Yunus (2010) suggested that designing content for m-learning requires an approach specific to learning with mobile devices. Nordin et al. linked the processes of m-learning to the development of informal and lifelong learning skills and the educational theories of educator John Dewey, that consider that all communication is educative. Berking, Haag, Archibald and Birtwhistle (2012) also argued that mobile devices should not be considered just another delivery method for e-learning, and instructional design for m-learning requires special attention. They suggest that while many writers address rationale for using mobile devices including the appropriate types of learning activities with mobile devices, few address what steps to follow in designing mobile learning. Berking et al. (2012) looked at the concepts, considerations, decisions, and guidelines specific to mobile learning and advocate using a modified ADDIE (Analysis, Design, Development, Implementation, Evaluation) model (see Figure 4). It is recommended that at the analysis and design stage, the appropriate m-learning macro and micro strategies for education or training are identified. The design stage should also identify the appropriate learning theory for the activity. Another feature of their model is the use of rapid prototyping in the design and development stages to review test and revise m-learning activities.

Figure 4. ADL Mobile Learning Framework (Berking et al., 2012)



Elias (2011) identified some of the problems of and opportunities for mobile learning and suggests how the application of universal instructional design (UID) principles in online and distance education may provide useful guidelines for the design of educational materials for a range of mobile devices (see **Table 1**).

Table 1. UID recommendations for inclusive m-learning (Elias, 2011 p.148-9)

UID Principles	Online/Distance education recommendations	M-learning recommendations
1. Equitable use	- put content online - provide translation	- deliver content in the simplest possible format - Use cloud-computing file storage and sharing sites
2. Flexible use	- present content and accept assignments in multiple formats - offer choice and additional information	- Package content in small chunks - consider unconventional assignment options - Leave it to learners to illustrate and animate courses
3. Simple and intuitive	- simplify interface - offer offline and text-only options	- keep code simple - use open-source software
4. Perceptible information	- add captions, descriptors and transcriptions	
5. Tolerance for error	- allow students to edit posts - issue warnings using sound and text	- scaffold and support situated learning methods
6. Low physical and technical effort	- incorporate assistive technologies - consider issues of physical effort - check browser capabilities	- use available SMS readers and other mobile-specific assistive technologies
7. Community of learners and support	- include study groups and tools - easy-to-find links to support Services	- encourage multiple methods of communication - group learners according to technological access and/or preferences
8. Instructional climate	- make contact and stay involved	- push regular reminders, quizzes and questions to students - pull in learner-generated content

With respect to m-learning, Elias (2011) recommends that educators "should not look exclusively for the next great technological advancement but rather should focus on the accessible design of materials using tools that are currently available" (p.153). This is important when considering the educational potential of learning with mobile devices.

Other considerations are the types of information involved, learning materials and/or administrative information involved; the availability of permanent internet connection between the mobile learning system and the users; the location of the users – on-campus or off-campus; and, if there is support of e-learning standards. In terms of educational considerations this last criterion is perhaps the most important because unless they support learning standards the use of mobile devices in educational contexts may be gratuitous and "gratuitous use of technology for the sake of technology will not necessarily improve teaching and learning processes" (Laxman, 2013, p.48).

Limitations and barriers to m-learning

Dyson, Litchfield, Lawrence, Raban and Leijdekkers (2009) pointed out that "though m-learning lends itself to a more active approach to education, it does not automatically guarantee that good learning will occur" (p. 263). Quinn (2011) suggested that "to truly take advantage, [of m-learning] you have to think beyond formal learning, and start thinking about performance support. As of yet, the characteristically quick access of these devices as needed is more suited to in situ help than it is to large-scale skill development" (p.1).

Educators' readiness for m-learning must also include the question of pedagogical preparedness. Even when mobile technologies are available there is not always understanding or acceptance of m-learning. This can be due to many reasons but the literature suggests that lack of knowledge and experience is a significant factor in determining readiness for m-learning. Kukulska-Hulme (2012) make some suggestions about how the higher education workforce can adapt to advancements in technology for teaching and learning. This includes training and identifying exemplars in workplaces to assist teachers become more knowledgeable. There are other as yet un-confronted barriers to m-learning. For example, Pollara (2011) found that over half the teachers surveyed were less interested in performing tasks that may require higher level of efficiency, for example, interacting with m-devices. It is clear that there are many challenges associated with the implementation of m-learning. Wallace (2011) suggests that "[s]orting out the promises and perils for m-learning is itself a challenge because research in this area is limited and the technology's capabilities are changing rapidly". Georgiev et al. (2004) argued that regardless of any existing disadvantages associated with the implementation of m-learning, with the progress of information and communication technologies "m-Learning will became more and more popular" (p.IV.28-5). For this reason it is important that educators prepare for a future which includes learning with mobile devices.

3. Research Methodology

Search Process

To identify relevant literature and studies in this meta-analysis study a combination of keyword and snowball searching was carried out. Five different databases: ERIC, Google Scholar, ProQuest, A+Education and PsycINFO were searched for articles in peer reviewed journals using the keywords: 'mobile learning' and 'higher education'. In addition to peer reviewed journals a search of conference proceedings, papers and reports was carried out using the same keywords. The bibliographies of relevant articles and reports were also used to identify relevant material. Additional search terms: 'impact',' acceptance',' readiness', 'outcome' and 'achievement', were added to the original keywords to refine the search and filter the results. 'Theory' and 'model' were added as supplemental search terms part way through the search process. The search was limited to material published in English after 2005.

Inclusion and exclusion criteria

In addition to excluding studies published before 20051 and articles which were not based on original research, studies which could be identified primarily as product evaluations were excluded. Studies which examined m-learning in other than higher educational contexts, or only in K-12 educational settings were also excluded.

Coding Procedure

The next stage of the research process was the coding of the selected studies. Once a study had met the inclusion criteria, it was assigned a unique code based on the author initial and dates of publication, then a brief description of the study and the study findings were entered in a table. When supplied by the researchers the participant numbers, gender and underlying theory or models used are also identified. Additional alphabetical coding was then carried out using a letter or letters to identify: the main subject of the study: student (S), teacher (T) or institution (I); the focus of the study, based on the previously identified search terms: acceptance (A), readiness (R) and outcome (O); the type of research: survey (SU), experimental (EX) or action research (AR); and, the research methods: quantitative (QN), qualitative (QL) and mixed method (MX). The coded data was then transferred to an Excel spreadsheet and Excel was used to filter and sort the studies according to the assigned codes.

Data analysis method

A combination of manual counting and computer assisted tabulation using Excel filters was used to analyse the data. Because the emphasis of this study is on qualitative description rather than statistical analysis, numerical counts and not percentage figures are used in the meta-

[1] It should be noted that although all of the meta-analysis of m-learning arepublished after 2009 they include studies carried out before 2005.

analysis of m-learning reviews. Both percentage figures and numerical counts were used in the original meta-analysis of 60 m-learning studies conducted between 2005 and 2013.

4. Results and Discussions

Meta-analysis of m-learning studies

An original meta-analysis of sixty (n=60) studies meeting the research criteria explicated in the earlier sections was carried out using a combination of manual counting and computer assisted tabulation using Excel filters with the alphabetic coding system which used a letter or letters to identify the main subject of the study (student, teacher or institution); the focus of the study, based on the previously identified search terms: acceptance, readiness and outcome; the types of research: survey, experimental or action research; and, the research methods used: quantitative qualitative or mixed method. A preliminary analysis of the studies was made after a reading of the study abstracts and conclusions (see Appendix). Further analysis produced the findings presented in Table 2. Primary focus of m-learning research, and

Table 6. Additional or supplementary focus of m-learning **studies**.

This meta-analysis confirmed that the majority of studies of m-learning focus on acceptance of and/or readiness for m-learning (83%, n=50). Acceptance and readiness are considered separately and also in combination with each other and outcome (see 2). A total of 30% of the studies (n=18) consider outcome alone (n=10) or in combination with acceptance or readiness (n=8).

Table 2. Primary focus of m-learning research

Focus of study	Count	%
Acceptance	17	28%
Readiness	7	12%
Outcome	10	17%
Acceptance and Readiness	18	30%
Acceptance and Outcome	7	12%
Readiness and Outcome	1	2%
Total	60	100%

The majority of studies are concerned with student acceptance or readiness for m-learning and only a few examine teacher acceptance and readiness alone (5%) or in combination with students (12%). Only one of the studies in this meta-analysis examined institutional preparedness for m-learning (see Table 3).

Table 3. Analysis of studies by subject participants

Subject of the study	Count	%
Students	52	87%
Teachers	3	5%
Students and Teachers	4	7%
Institution	1	2%
Total	60	100%

The types of research and research methods used in the m-learning studies examined in this meta-analysis reflects the findings of the meta-analyses studied - survey has been the dominant research method (see 4).

Table 4. Analysis of studies by type of research and research methods

Type of research	Count	%	Research methods	Count	%
Survey	35	58%	Quantitative	40	67%
Experimental	21	35%	Qualitative	3	5%
Action Research	4	7%	Mixed method	17	28%
Total	60	100%	Total	60	100%

This meta-analysis found that in relation to the acceptance of and readiness for m-learning and the use of mobile devices for learning the overall response is a positive one, 78% of the studies (n=47) reported a positive response (see Table 5). There are however a number of studies which report a mixed or negative response to m-learning and these are considered further in the next section.

Table 5. Finding in relation to m-learning

Finding	Count	%
Positive result	47	78%
Negative result	3	5%
Mixed result	10	17%
Total	60	100%

In addition to the primary focus (see table 2) a number of studies had a clear secondary or supplementary focus. A summary of these are presented in Table 6. Some studies considered

more than one additional factor so no total count is provided. All percentages are based on (n=60).

Table 6. Additional or supplementary focus of m-learning studies

General focus	Specific focus	Count	%
Influence of context	Institutional support	4	7%
	Cultural Impact	1	2%
Factors influencing learning outcomes	Effectiveness of m-learning	8	13%
	Learning language	6	10%
	Pedagogical practices	3	5%
Theoretical framework	TAM	12	20%
	Theories of learning with mobile devices	5	8%
	Self-efficacy	5	8%
Factors which enhance m-learning	Familiarity with m-learning	3	5%
	Behavioural intentions	10	17%
	Previous experience	3	5%
Barriers to m-learning	Accessibility to internet	2	3%
	Availability of devices	3	5%
	Students' income/cost	5	8%
	Gender/ Age	8	13%
	Instructors' adaptation	1	2%

This analysis of additional or supplementary focus of m-learning studies also reflects the findings of the meta-analysis examined in this study. The number of studies that use TAM (20%) or focus on behavioural intentions (17%) provide further evidence that m-learning research is dominated by studies concerning the acceptance of m-learning and not other factors which concern implementation and evaluation.

5. Significant Findings and Variations

As noted earlier, in any meta-analysis, variations between studies "provides an opportunity to ask additional questions, and to investigate more closely the reasons for the observed differences in effect size across studies" (Denson & Seltzer, 2011, p.216). Nineteen studies of the 60 m-learning studies identified revealed variations sufficient to consider further analysis (see

Appendix). Of particular significance are studies which returned a negative result with respect to the acceptance of or readiness for m-learning, and studies which reported variant findings regarding the determinants of m-learning acceptance. Studies which focused on teachers, institutions and outcomes are also considered significant because there are so few of them. The variations found are considered before the discussion of pertinent issues raised are presented.

Acceptance of mobile learning

Trifonova, Georgieva and Ronchetti (2006) looked at the acceptance of and readiness for learning with mobile devices by 800 students using survey methods and quantitative analysis. Trifonova et al. found students to be mainly positive about the prospect of mobile learning and that their attitude towards m-learning is influenced by their previous experiences and current habits of using mobile devices. Although some gender differences were noticed, nationality and subjects studied did not seem to influence attitude. The availability of devices and students' income were more influential on student acceptance and readiness. What makes this study significant is that it revealed general lack of understanding of m-learning even with students accustomed to using mobile devices. Kinash, Brand and Mathew's (2012) survey of 135 students found that students used their mobile devices more for non-educative purposes than they did to engage in learning. The students were mostly neutral when asked about learning improvement via mobile learning and only slightly in agreement with the perceived benefit of learning motivation.

Hafeez-Baig, Gururajan and Gururajan (2006) also examined student acceptance of learning with mobile devices but through a qualitative study using a focus group of five student participants. They reported a negative response to using mobile devices for learning. Participants of the focus group raised a number of factors acting as barriers to the adoption of m-learning ranging from a perception of m-learning as less beneficial than traditional methods to reservations about cost and technology of mobile devices. Jacob and Issac (2008) also reported a negative response to the prospect of learning with mobile devices from their survey of 151 students focusing on student readiness for learning with mobile devices. They found that although the majority of participants expected true mobile learning to be in vogue within the next 3-5 years, their perceptions of technology as a distracter to serious study time, fear that technology would replace direct teacher-student interactions and concerns about the non-affordability of mobile devices for some students were found to be reported barriers. Another negative response among the studies reviewed is the findings of Suki, Suki, Eshaq and Choo (2011) who surveyed 20 students to determine their readiness for m-learning. This study found students to be not receptive to m-learning even though familiar with mobile device features. Students did not rely on their mobile phones to access learning materials from lectures or lab sessions when available and preferred studio-based and face-to-face learning approaches.

Al-Ammari and Hamad (2009) survey of 155 students which used the TAM framework to assess the acceptance of learning with mobile devices found that perceived usefulness and perceived ease of use have a positive effect on students' behavioural intentions to use learning technology. Al-Ammari and Hamad found that computer self-efficacy and content quality also have a positive indirect effect on students' behavioural intention to use educational technology. This study also identified other factors affecting students' intention to use m-learning: distance, uncertainty avoidance, long term vs. short term orientation and perceived cultural diversities of

power. A survey of 177 students based on the theory of planned behaviour (TPB) by Cheon, Lee, Crooks and Song (2012) found that subjective norms and behavioural control both influence students' attitudes towards and intention to adopt m-learning. A survey of 91 students by Hussin, Manap, Amir and Krish (2012) found the students to be highly familiar with computing and generally welcomed the prospect of integrating mobile learning into their studies. However, cost was identified as a possible barrier to use as students were uncertain as to how much money they would need to spend on Internet connections in addition to software and hardware requirements.

Role of gender and age in mobile learning

Unlike the majority of studies which did not mention gender, Wang, Wu and Wang's (2009) survey of 330 students which used the UTAUT model to identify determinants of intention to use m-learning, identified significant gender and age differences in relation to behavioural intention. This variation is not explained but may be the result of cultural influences. Age was also identified as a significant determinant in Wilkowska and Ziefle's (2009) study of 60 students using the TAM where it was found that individuals' self-confidence and learning history with technology has a strong influence on their intention to use mobile devices for learning. The study also found that acceptance of m-learning is mainly influenced by the individuals' learning history with technology and their computer-related knowledge and technical self-confidence independent of age. In contrast, although Lowenthal's (2010) survey of 113 students using the TAM identified a positive relationship between prior experience with video capable mobile devices, effort expectancy and the behavioural intent of the user, no significant age or gender differences were found.

Institutional readiness to mobile learning

Some of the concerns regarding m-learning were also evident in the case study of institutional readiness conducted by Wains and Mahmood (2008). This study is one of the few to consider institutional readiness for m-learning and found that most of the learning resources available were not optimized to deliver learning via mobile devices - in this study, mobile phones. Wains and Mahmood (2008) concluded that to effectively use m-learning, courses needed to be formatted and presented in a way that accommodates user needs and mobile phone limitations. Serin's (2012) study is significant because the 355 students surveyed were prospective teachers and second, because it reports a negative response to m-learning. The study found that the prospective teachers' mobile learning perceptions were poor and many of them had no information about mobile learning. Further, prospective teachers who had knowledge about mobile learning often had inaccurate knowledge about it. Many believed that mobile learning would diminish effective communications. There was no significant difference in mobile learning perceptions and mobile learning ability levels of the prospective teachers according to department and gender variables.

Outcomes of mobile learning

Wang, Shen, Novak and Pan's (2009) study was one of the few studies to specifically focus on outcomes and it was based upon both quantitative and qualitative analysis of data from the study on using mobile devices for learning. It had a sample size of 178 student participants.

Wang, Shen, Novak and Pan (2009) reported that the experiment produced positive results in a traditional didactic learning environmentand fared well in eliciting active student participation and voluntary engagement with the learning process. Karadeniz (2011) also focused on outcomes in an experiment with 20 student participants. The effect was reported as positive and students' gender and levels of test anxiety did not have significant effects on their achievements. Karadeniz (2011) found that students attained high achievement levels in the mobile based test and suggested that employing ICT in assessment is potentially advantageous although it was also cautioned that instructors' adaptation to new technologies is an important issue for technology integration. Nassuora's (2012) survey of 80 students which also used the UTAUT model found that students'perceptions and university policies are the two major factors influencing the successful adoption of m-learning systems. Student acceptance of m-learning was also linked to personal attitudes. Camacho Marti and Tur Ferrer's (2012) study is significant because it looked at both student acceptance levels and learner outcomes using action research. The study found that most of the 26 participants in the study had positive attitudes towards the construction of electronic portfolios and the use of mobile devices for learning. They suggested that the use of m-learning and e-portfolios can lead to a better understanding of the nature of learners' cultural and social experiences.

Readiness for mobile learning

Ismail, Bokhare, Azizan, and Azman's (2013) survey of 38 teachers returned mixed results with regards to acceptance of and readiness for m-learning. This study found that levels of technology acceptance in terms of awareness and motivation, training and courses, training design, IT support and facilities were high. However, teachers' readiness for the use of mobile devices (mobile phones) in teaching and learning was found to be low. A second study which surveyed 216 prospective teachers (Ozdamli, Soykana & Yıldız, 2013) also returned mixed results. It found that male students' use of mobile devices was higher than that of female students. The study found that overall, teacher candidates had a good level of access to mobile devices and most used the internet every day. The researchers recommended that to improve teachers' competence in using m-learning applications extensive training workshops with expert users to model best practices should be organised.

6. Conclusion

A review of the literature related to m-learning shows that there is already a large body of research about m-learning - however, the majority of studies continue to focus on the attitudes and perceptions of the users rather than the consequences of using mobile devices for learning or the problems of integrating m-learning with pedagogic practices. The imbalance of the research focus of m-learning studies and the use of weak experimental methods and concentration on self-reported data identified by Cheung and Hew (2009) support the argument that there has not been enough rigorous research around learning outcomes from m-learning or the implications of m-learning for assessment. To gain a true picture of the impact of m-learning in higher education more longitudinal observational studies need to be carried out.

Our understanding of m-learning is still continually developing as more research is being carried out in this area. M-learning is a complex balance between technology and pedagogy. Without reference to theoretical and pedagogical underpinnings, research studies in the field of m-learning will not necessarily further our knowledge on how m-learning can contribute to successful learning processes and outcomes.

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Appendix

Preliminary analysis of m-learning studies by focus

Focus	Author(s)/Year	Count
Acceptance (perception)	Lee, Cheung & Chen (2005); Baig, Gururajan & Gururajan (2006);Maag (2006); Trifonova, Georgieva & Ronchetti (2006); Fozdar & Kumar (2007); Huang, Lin & Chuang, (2007); Motiwalla (2007); Jacob & Issac (2008);Al-Fahad (2009); Al-Ammari &Hamad (2009); Abas, Peng & Mansor (2009);Jairak, Praneetpolgrang & Mekhabunchakij (2009); Wang, Wu & Wang (2009); Wilkowska & Ziefle (2009), Al-Hawari & Mouakket (2010); Bhaskar & Govindarajulu (2010);Chen & Huang (2010); Ismail, Baharum & Idrus (2010); Liaw, Hatala & Huang (2010); Liu, Li & Carlsson (2010),Marcos et al (2010); Sek, Lau, Teoh, Law &Parumo (2010);Suki, Suki, Eshaq & Choo (2011); Cheon, Lee, Crooks & Song (2012);Tan, Ooi, Sim &Phusavat (2012); Hamata, Embib & Abu Hassan (2012); Huanga, Wangb, Hsieh (2012); Kinash, Brand & Mathew (2012);Nassuora (2012);Serin (2012); Hsua, Hwang & Chang (2013); Irby &Strong (2013); Martin & Ertzberger (2013); Ozdamli, Soykana & Yıldız (2013); Tarhini, Hone & Liu (2013);	35
Readiness (usability)	Corlett, Sharples, Bull & Chan (2005); Lee, Cheung & Chen (2005); Trifonova, Georgieva & Ronchetti (2006); Fozdar & Kumar (2007); Motiwalla (2007); Jacob & Issac (2008); Stockwell (2008);Wains& Waqar (2008);Al-Fahad (2009); Abas, Peng & Mansor (2009); Wang, Wu & Wang (2009); Mayberry, Hargis, Boles, Dugas, O'Neill, Rivera& Meler (2011); Lowenthal (2010); Liu, Li & Carlsson (2010),James (2011); Lim, Fadzil & Mansor (2011); Rahimia & Asadollahi (2011); Tan, Ooi, Sim &Phusavat (2012); Hamata, Embib & Abu Hassan (2012); Hussin, Manap, Amir & Krish (2012);Kinash, Brand & Mathew (2012); Kenny, Neste-Kenny, Burton, Park & Qayyum (2012); Marti & Ferrer (2012);Nassuora (2012);Serin (2012); Nassuora (2012); Ismail, Bokhare, Azizan & Azman (2013); Ozdamli, Soykana & Yıldız (2013);	28
Outcome (impact)	Maag (2006); Shih & Mills (2007); McConatha&Praul (2008);Williams (2009); Wang,Shen, Novak & Pan, (2009); Bhaskar & Govindarajulu (2010);Cochrane (2010); Marcos et al (2010);Georgievaa, Smrikarova & Georgieva (2011);Karadeniz (2011);Lim, Fadzil & Mansor (2011);Wu, Hwang, Tsai, Chenc & Huang (2011); Davies, Rafique, Vincent, Fairclough, Packer, Vincent & Haq, (2012); Marti & Ferrer (2012);Hsua, Hwang & Chang (2013);Martin & Ertzberger (2013);	16
Gender/ Age	Uzunboylu, Cavus & Ercag (2009);Wang, Wu & Wang (2009);Lowenthal(2010);Karadeniz (2011); Hamata, Embib & Abu Hassan (2012); Nassuora (2012); Ismail, Bokhare, Azizan & Azman (2013); Ozdamli, Soykana & Yıldız (2013);	8

Institutional support	Corlett, Sharples, Bull & Chan (2005); Ismail, Baharum & Idrus (2010);Nassuora (2012); Ismail, Bokhare, Azizan & Azman (2013);	4
Behavioural intentions	Baig, Gururajan & Gururajan (2006); Al-Ammari &Hamad (2009); Al-Hawari & Mouakket (2010);Lowentha (2010); Liu, Li & Carlsson (2010),Yi, Liao, Huang & Hwang (2010);Cheon, Lee, Crooks & Song (2012);Nassuora (2012); Irby &Strong (2013);Martin & Ertzberger (2013);	10
Previous experience	Trifonova, Georgieva & Ronchetti (2006); Wilkowska & Ziefle (2009),Lowenthal (2010);	3
Availability	Trifonova, Georgieva & Ronchetti (2006); Jacob & Issac (2008); Uzunboylu, Cavus & Ercag (2009);	3
Students' income/cost	Trifonova, Georgieva & Ronchetti (2006); Jacob & Issac (2008);Bhaskar & Govindarajulu (2010); Ismail, Baharum & Idrus (2010);Hussin, Manap, Amir & Krish (2012);	5
Effectiveness	Fozdar & Kumar (2007); Jacob & Issac (2008);McConatha&Praul (2008);Al-Fahad (2009); Abas, Peng & Mansor (2009); Georgievaa, Smrikarova & Georgieva (2011);Mayberry, Hargis, Boles, Dugas, O'Neill, Rivera& Meler (2011);Hsua, Hwang & Chang (2013);	8
TAM	Huang, Lin & Chuang, (2007);Al-Ammari &Hamad (2009);Abas, Peng & Mansor (2009);Williams (2009);Wilkowska & Ziefle (2009),Al-Hawari & Mouakket (2010); Chen & Huang (2010);Liaw, Hatala & Huang (2010);Liu, Li & Carlsson (2010),Sek, Lau, Teoh, Law &Parumo (2010); Tan, Ooi, Sim &Phusavat (2012);Tarhini, Hone & Liu (2013);	12
Pedagogical practices	Motiwalla (2007); Abas, Peng & Mansor (2009);Serin (2012);	3
Theories of m-learning	Motiwalla (2007); Uzunboylu, Cavus & Ercag (2009); Liaw, Hatala & Huang (2010); Cheon, Lee, Crooks & Song (2012);Serin (2012);	5
Learning trends	Jacob & Issac (2008); Bhaskar & Govindarajulu (2010);Liaw, Hatala & Huang (2010);	3
Learning language	Stockwell (2008); Wains & Waqar (2008);Wang,Shen, Novak & Pan, (2009); Wang,Shen, Novak & Pan, (2009);Ismail, Baharum & Idrus (2010); Hsua, Hwang & Chang (2013);	6
Self-efficacy	Al-Ammari &Hamad (2009); Wilkowska & Ziefle (2009),Lowenthal(2010);Kenny, Neste-Kenny, Burton, Park & Qayyum (2012); Irby &Strong (2013);	5

Instructors' adaptation	Karadeniz (2011);	1
Familiarity with m-learning	Suki, Suki, Eshaq & Choo (2011); Rahimia & Asadollahi (2011);Hamata, Embib & Abu Hassan (2012);	3
Culture	Marti & Ferrer (2012);	1
Accessibility	Ozdamli, Soykana & Yıldız (2013); Uzunboylu, Cavus & Ercag (2009);	2