Pedagogical Issues in Designing Mobile Learning Application: A Review Study

Ayoade, Olusola Bamidele

Department of Computer Science
Emmanuel Alayande College of Education, Oyo, Oyo State, Nigeria
Email: Ayoadebamidele2014@yahoo.com

ABSTRACT

Mobile technologies are more powerful and portable nowadays because, it embedded with varieties of useful tools which assist peoples in handling their daily life. Mobile learning provides unique learning experiences for learners in both formal and informal environments, supporting various pedagogies with the unique characteristics that are afforded by mobile technology. Mobile learning, as a growing topic of interest, brings challenges of design for teachers and course designers alike. Current research on mobile learning covered various aspects such as personalization, context sensitivity, ubiquity and pedagogy. With the advance of mobile technology, the issue of mobile learning has been widely investigated in e-learning research. Many researchers suggested that it is important to integrate pedagogical and technical strengths of mobile technology into learning environments. This review study focuses on the definition of mobile learning. The study surveyed recent researches on pedagogical strategy of designing mobile learning. Through this review study, essential steps to create and developed effective mobile learning strategy and guidelines to create interactive and engaging mobile learning courses were identified and discussed.

Keywords: Educational apps, Drill and Practice, I pad, LMS, Mobile Learning, Social Networks

INTRODUCTION

The ubiquity of emerging mobile technology devices has resulted in debate and research on how it can benefit teaching and learning, as much as it benefits business, industry, and other social activities (Ntloedibe-Kuswani, 2008). Mobile learning provides users with the opportunity to personally control their learning as well as to creatively own their learning processes and easily communicate with their peers (Wong, 2012).

Agha and Ayse (2011) pointed out that mobile learning provides a personalized platform of learning

content where convenience in the access of resources is very critical. Wong (2012) in his study mentioned that mobile learning is about increasing learners' capability to physically move their personal learning environment as they move. Bruck, Motiwalla and Foerster (2012) explained that mobile learning could better cater for the learners' need for learning in situations of limited time or real time. As a mobile device is generally owned and always carried by a student, a one-to-one relationship is created which could provide the ability to learn anywhere, anytime and at any pace.

However, research has consistently shown that designing a mobile learning application to support pedagogical purposes is a very challenging task mainly due to the different value systems of users from various backgrounds and experience (Huang, Zhang, Li and Yang, 2012b). Despite the flexibility and affordability of mobile learning, it is still lacks standardization with respect to specific requirements for educational practices (Filho and Barbosa, 2014). As indicated by Churchill (2011), contemporary research on technology in teaching and learning pays insufficient

attention to the pedagogical design of educationally useful of mobile applications and their roles in learning experiences. One of the pedagogical challenges is how to connect the theories and case studies to students' experience in a mobile learning environment.

Mobile learning is diverse from traditional electronic learning, thus the conventional pedagogical theory should be revised to fit the characteristics of mobile environment (Jeng, Wu, Huang, Tan and Yang, 2010). The enhanced pedagogical learning process is utilized to facilitate the learning in mobile learning activities. For example, blog articles were applied to construct a learning map called blog-based dynamic learning map (Wang, Huang, Jeng and Wang, 2008). It is designed to provide informative and structured blog articles to assist students' learning. Therefore, a collaborative learning process can be facilitated by utilizing a mobile blogging system (Huang, Jeng and Huang, 2009). In the mobile collaborative learning process, the blogging system is employed as a data collector and an information sharing platform for mobile learners. Chen, Chang and Wang (2008) designed mobile

application system for modelling, coaching and scaffolding the authentic activities and faded the support during the mobile learning process. They facilitate collaboration and support some of the social practices associated with learning. Therefore, the traditional pedagogical theory can take advantage of mobile technology and bring more efficient learning process to mobile learners. The combination of collaborative, contextual, constructionist and constructivist principles should be derived from augmented pedagogical learning process (Jeng *et al.*, 2010).

Mobile devices will continue to evolve and it will be necessary to remain current with instructional design applications. While there is a considerable amount of research on the effectiveness of mobile learning, research in instructional design of educational apps for mobile learning delivery remains in its infancy (Park 2011). To maximize the use of mobile technologies for learning delivery, instructional designers must first and foremost understand how to most effectively design mobile apps and how instructional design for mobile learning delivery differs from other

delivery methods (Shroff, Keyes and Linger, 2015).

An examination of instructional design processes and instructional strategies necessitates a conceptual framework rich in instructional design and pedagogy (Richey, Klein, and Tracey, 2011). The instructional design process is the comprehensive method of how instruction is designed, developed, and implemented (Reigeluth and Carr-Chellman, 2009). Guided by learning theory and instructional theory, instructional designers are tasked with designing pedagogically sound instruction that leads to learner achievement of learning outcomes (Reigeluth and Carr- Chellman, 2009).

In order to obtain all of mobile learning's potential benefits, instructional design development models are needed to guide designers and instructors unfamiliar with the pedagogical applications of mobile learning (Herrington and Herrington, 2007). The advent of technology has provided a new avenue for instructional design and mobile delivery. The use of mobile applications acts as a natural mechanism to support formative assessment during instruction,

providing both the instructor and students with feedback on how well the class is grasping the concepts under study, promoting more active learning and highlighting the reasoning processes that students use to solve problems (Shroff, Keyes and Linger, 2015). Research has shown that that the use of educational mobile applications creates successful learning environments from four perspectives: (1) challenging and supporting learners' higher level thinking; (2) promoting learners' deep and flexible understanding on the basis of introductory knowledge acquisition; (3) enhancing learners' conversations and collaborations; (4) facilitating learners' self-regulation during learning (Gulikers, Bastiaens, and Martens, 2005). As such, the use of apps provides "real world" learning activities, problem-based learning, embedded interactive applications, flexibility and control of learning and an increased sense of learning and academic success.

CLASSIFICATION OF MOBILE LEARNING APPLICATIONS

Goodwin and Highfield (2013) categorised educational apps as instructive, manipulable, and constructive apps. Also, based on the categorisation of Goodwin and Highfield (2013), Cherner, Dix and Lee (2014) categorised educational apps as skill-based, content-based and function-based apps.

Instructive or Skill-Based Apps

Instructive apps proposed by Goodwin and Highfield (2013) or skill-based apps proposed by Cherner, Dix and Lee (2014), promote rote memorization of content through recall and drill-and-practice activities that deliver instruction and students are able to select an answer as a response (Goodwin and Highfield, 2013; Cherner, Dix, and Lee, 2014). These apps provide routine exercises to reinforce rudimentary skills within a structured format, thereby requiring students to practice a skill repeatedly in order to increase their accuracy (Cherner, Dix, and Lee, 2014). Hence, most of the problems provided on these apps are somewhat similar and repetitive in nature as they are meant to expand students' knowledge in a specific subject area (Handal, Boris, Chris Campbell, Michael Cavanagh and Kashmira Dave, 2014). When using these types of instructive or skill-based apps, instructors should be cognizant of the fact that the rigor (objectivity, precision, consistency

seem more appropriate) of these apps ranks low on Anderson, Krathwohl and Bloom's (2001) taxonomy of educational objectives because learners are typically recalling and remembering previously learned knowledge to answer questions. Remembering is to promote the retention of the presented material, i.e., the individual learner is able to retrieve applicable knowledge from long-term memory. The related cognitive processes are recognizing and recalling. However, the feedback these apps provide students about their performance is instant, which allows students to readily track their learning by presenting them with information regarding their performance after answering a question or a series of questions (Walker, 2011). Although low on rigor, the significance of these apps ranks high because students are able to apply the subject area knowledge these apps develop as they engage in more challenging learning tasks (Yarmey, 2011).

Manipulable or Content-Based Apps
Manipulable apps proposed by Goodwin and Highfield (2013) or content-based apps proposed by Cherner, Dix and Lee (2014), offer students digital manipulatives for guided discovery, thus enabling them to make choices about the topic/concepts they are learning and by virtue of which they are able to demonstrate this learning using a pre-constructed context, template, or structure (Cherner, Dix, and Lee, 2014; Goodwin and Highfield, 2013). A common characteristic of manipulable or content-based apps is that they do not assess students or require them to complete a learning task; instead, these apps are intended for students to read texts and view images and videos related to specific topics, analogous to moving from exhibit to exhibit in a museum. As digital manipulatives, the tasks fall within pre-determined and scripted parameters, but still provide students some degree of freedom to explore (Hirsh-Pasek *et al.*, 2015). These apps also rank high on Anderson, Krathwohl and Bloom's (2001) taxonomy of educational objectives because learners are typically applying and analyzing in a given situation to perform exercises or solve problems. Another feature of manipulable apps is that they give students access to vast amounts of information, data, or knowledge by conducting searches or through exploring pre-programmed content.

Constructive or Function-Based Apps

Constructive apps proposed by Goodwin and Highfield (2013) or function-based apps proposed by Cherner, Dix and Lee (2014), assist students in transforming learned information into usable forms, presenting students with templates, open-ended contexts or structures, thereby subsequently enabling them to create learning artifacts (e.g., videos, text or images) (Cherner, Dix, and Lee, 2014; Goodwin and Highfield, 2013). Since students use constructive or function-based apps to create these learning artifacts, these apps rate on the upper two hierarchical levels (e.g., creating and evaluating/evaluating and synthesizing) on Anderson, Krathwohl and Bloom's (2001) taxonomy of educational objectives. Creating promotes transfer and is placing elements together to form a coherent whole i.e., the learner is mentally reorganizing some elements or parts into a pattern or structure not clearly presented before. Evaluating also promotes transfer and involves making judgments based on criteria and/or standards. Moreover, constructive apps do not emphasize assessments nor are they comprised of academic content; rather, students often utilize these apps to specifically create learning artifacts, which may include multimedia presentations visual representations or textual descriptions of their learning (Beutner and Pechuel, 2014). Hence, constructive-based apps use the literacy and numeracy skills students learned from instructive apps to display the knowledge they learned from manipulable apps (Zosh, Jennifer and Hirsh-Pasek, Roberta, Golinkoff, Michael Robb and Jordy Kaufman 2013).

8 STEPS TO CREATE AND DEVELOP AN EFFECTIVE MOBILE LEARNING STRATEGY

Christopher (2014) identified eight steps to be follows in developing mobile learning strategy:

(i) **Identify your target audience and the primary objectives of your Mobile Learning Course:** The first step in developing a successful mobile training strategy is to identify who will actually be accessing the information. In other words, who is your *target audience* and, most importantly, what do they hope to achieve by taking the

mobile training course? You must keep in mind that, for the most part, learners who participate in mobile training courses are pressed for time. Therefore, you will need to design mobile training courses that help them to develop the skill sets or offer the information that they need quickly, conveniently, and without wasting time on irrelevant course content. That is why you will need to identify their primary *learning objectives* even before begin the design process. Also, you must consider the background of your audience and their learning needs. For example, what is their level of education and work experience? Should you include industry-specific jargon, or are they beginners in the field? What previous knowledge about the topic do they already possess? Do they respond more favorably to visual learning tools or audio elements? What is their learning environment (i.e. on-the-job, at home, or at school)?

(ii) **Determine how your mobile training content will be distributed:** Are you going to make your content available on all platforms, such as iOS and Android? Are you going to include graphics that can be accessed on all devices? Ideally, you must support as many devices as possible, so that you give all learners the opportunity to benefit from your Mobile Learning course or modules. You should also consider the screen sizes of mobile devices. For example, if you design your mobile training course

with an iPad screen in mind, then be sure to verify that a learner using an iPhone will be able to read your text or view your smaller graphics. The delivery method of your mobile training content is yet another significant consideration. While some Mobile Learning developers might focus on web delivery when they are creating their mobile training strategy, others might center their Mobile Learning course design on native apps, which can be downloaded from the app store. So, you must decide which delivery options are best suited for your content, subject matter, and audience.

(iii) **Create high quality and mobile-friendly content:** This is one of the most important aspects of a mobile training strategy, given that Mobile

Learning content you are currently using may not be ideal for mobile training purposes. For example, some of the Mobile Learning courses you already have in your LMS may be too long or too complex for mobile training applications. Ultimately, you must consider short, *bite-sized mobile training courses* that can be effectively completed on-the-go, and elements that are easy to use on a mobile device. For instance, create mobile training courses that require the learner to speak rather than type, or modules that can be navigated on a smaller mobile device.

(iv) **Boost user engagement through emotional involvement:** Given that learners may be on-the-go when they are accessing your mobile training

courses or modules, you need to ensure that your content is engaging and draws the learner in from the very start. *Emotional involvement* is the key to keeps them interested and motivated to learn, such as games that offer rewards or real life examples that help the learner relate to the content being offered. If you are able to capture this emotional aspect of the learning experience, then users will be getting much more out of your mobile training deliverable.

(v) **Integrate Social Learning strategies:** Much of the mobile training experience is asynchronous, meaning that students learn on their own. However, you can easily transform it into an interactive and engaging social learning course by

integrating social media into your strategy. Social networks, collaborative learning tools, and group projects completed remotely are all examples of social learning elements that can make your mobile training course even more effective.

(vi) **Ensure the security of your mobile training platform:** One of the primary concerns of mobile training is security, given that smart phones and other mobile devices have the capacity to download information. As such, it's important to ensure that your mobile training platform has some sort of encryption or password protection, or a security measures in place in the event that the system is hacked. Be sure that all personal information is

encoded or carefully guarded, so that you don't have to deal with security concerns down the road.

(vii) **Test, revise, and launch:** Before you officially launch your mobile training course, it's essential to test and revise. Try to identify areas that may need to be fine-tuned or catch any glitches before allowing learners to log on. While many Mobile Learning course developers may not allocate many hours to testing, it's vital that you do allocate a fair amount of time to ensure that your finished product is ready for public consumption. This will not only allow you to uphold your professional name and brand, but enable learners to get the most out of their learning experience. Try accessing the mobile training course on a variety of different devices and browsers to ensure that everything is in proper working order, both functionally and *aesthetically*. When first launching your mobile training course, get a core group of learners to give it a try beforehand and ask them to provide their honest opinion about what they have learned and how they value their overall educational experience.

(viii) **Continually assess the effectiveness of your mobile training strategy:** As is the case with all things in the world of Instructional Design and Mobile Learning, a mobile training strategy should always be a work in progress. Don't hesitate to survey your learners to get invaluable feedback or assess how effective your mobile courses are via other methods (such

as on-the-job skill assessments), in order to gauge your strategy's weaknesses and strengths. A successful mobile training strategy is one that is constantly being improved upon and polished. So, if you find that something simply isn't working, take action to fix it, and then carry out another round of feedback to determine whether or not the issue has been resolved. Ensure that the primary objectives are still the focal point and that your audience is getting the most out of the mobile training strategy that you've worked so hard to develop

5 Guidelines to Create Interactive and Engaging Mobile Learning Courses

Darshan (2017) identified five guidelines to create interactive and engaging mobile learning courses:

(i) **Consider different screen sizes:** Screen size is not a crucial issue with computer screens as designers have plenty of real estate to work on. You can develop the course for a standard screen size; even if the screen sizes of desktops differ, the ratio remains the same most of the time. Mobile devices, however, differ in both screen size and ratio (smartphones, tablets, iPads). Considering these differences, you need to choose an authoring tool that offers responsive output so that the course automatically adjusts to the screen size of the mobile device it is accessed on.

(ii) **Chunck content:** Unlike computer screens, the screen size of mobile devices ranges from 3 inches to 12 inches. It becomes very difficult to accommodate content on such small

screens. For better readability of content, split it into small chunks or pieces. However, ensure you do not inadvertently exclude important information or change the meaning. In a few cases, the entire content may be important or it may be difficult to chunk content to fit smaller screens. In such situations, substitute heavy text with a representational image or animation with explanation in the audio.

(iii) **Keep design simple**: You cannot just reformat your e-learning courses to be mobile-compatible as the small screen size of mobile devices eliminates room for complex designs; in a restricted space, you also have to accommodate navigational features. Hence, you will be left with minimum space

to accommodate your content and communicate the message effectively. Keep the design simple so that the screen does not appear cluttered; a simple design helps you ensure content is readable.

(iv) **Design convenient navigational buttons:** Small navigational buttons in mobiles will not be comfortable as learners will have to be very precise in clicking them. If learners have to concentrate on such things apart from the learning content, it will not be a great mobile learning experience. Ensure navigational buttons are of a convenient size so that learners will be able to click them easily, without having to concentrate much. Design navigational features in a way that helps learners operate them

(v) **Use different delivery formats:** Mobile learning need not always be in the form of online courses that are typically hosted on an LMS. They can be in different formats that are easily accessible on mobile devices, such as videos, info-graphics, eBooks, apps, or podcasts. As mobile device owners mostly use these formats in their day-to-day use, your mobile training material in these formats will go well with learners. While these tips will help you approach mobile learning from a fresh perspective, this is by no means a full list of tips for creating mobile learning courses. You need to check out various things such as how mobile learning can be combined with your existing training programs, learning design strategies that are unique to mobile learning, and other factors.

PEDAGOGICAL PERSPECTIVES OF MOBILE LEARNING

There are various kinds of activities that can be enabled through the use of mobile devices under the categorization of relevant theories from the study of learning and, in particular, learning with technology. Therefore, when structured the classification of activities around the main theories and areas of learning relevant to learning with mobile technologies, Shroff, Keyes and Linger (2015) explained the following theories:

(i) **Behaviourist Theory:** activities that promote learning as a change in observable actions.

(ii) **Constructivist Theory:** activities in which learners actively construct new ideas or concepts based on both their previous and current knowledge.

(iii)**Social Learning Theory:** activities that promote learning within an authentic context and culture.

Behaviourist Learning Theories and Mobile Learning

Behaviourism is an approach to learning based on the ability to perform an observable behaviour (Schunk and Zimmerman, 2012). The Behavioural learning theory is rooted in an approach to learning that focuses on stimulus and response (Richey, Klein, and Tracey, 2011). Richey *et al.,* (2011) presented three core behavioural learning theories including connectionism, classical conditioning, and operant conditioning. Many of the initial behaviourist learning theories provided a framework for instruction and instructional design. Systematic instructional design, learner practice, and feedback are also based on early behaviourist learning theories (Richey et al., 2011). These foundational behaviourist learning theories also impact instructional design for delivery in mobile learning environments.

Behaviourist learning theories in mobile learning delivery primarily focus on the dissemination of information, drill and practice, or receiving and providing immediate feedback (Keskin and Metcalf, 2011). Mobile devices allow for the use of response applications that provide both the student and instructor immediate feedback on student learning. Palalas (2011) proposed that behaviourist-based learning activities are well suited for English language learning delivery on mobile devices; specifically, when learners are continually practicing or reinforcing a skill individually. For example, (1) students are able to send frequent vocabulary messages and revision material via their mobile devices using an instant messaging app,(2) the mobile app is designed to enable students to access multiple choice questions, answers and exercises, (3) the mobile app is also designed to allow students to listen, review and practice speaking, and provides tools for phrase translation, quizzes and live coaching, and (4) the mobile app is used to present content specific questions, collect student responses promptly and anonymously, and gather an aggregate display, to illustrate variations in the group's ideas. Hence, the use of mobile apps to present teaching materials/content

specific questions (stimulus), obtain responses from learners (response), and provide appropriate feedback (reinforcement) – provide 'drill and feedback' activities –, fits within the behaviourist learning paradigm (Shroff, Keyes and Linger, 2015).

Constructivist Learning Theories and Mobile Learning

Constructivism is an approach to learning based on the creation or construction of knowledge (Schunk and Zimmerman 2012). The basic tenets of constructivism include individualized knowledge construction, self-regulated learning, and internalized meaning making (Peng, Hsinyi, Yi-Ju Su, Chien and Tsai, 2009). Piaget's theory of constructivism posits that knowledge is constructed from interaction with the environment (Harlow, Cummings and Aberasturi, 2007). Throughout the past decade, there has been much debate over the effectiveness of the constructivist approach to learning. Some argue that the constructivist approaches such as inquiry-based learning are not well suited for the classroom because they lack structure and scaffolding (Sweller, Kirschner and Clark, 2007). However, supporters of the constructivist model argue that

constructivist-learning approaches facilitate the type of learning that will be required in and beyond the 21st century (Kwan, 2008). Through constructivist learning experiences, students are able to view their learning as purposeful and applicable to a greater context outside of the classroom.

Combined with the individual and personal nature of hand-held computing devices, mobile learning is distinctively appropriate for constructivist learning scenarios. An example of this could be on-demand information and knowledge access in a learner's authentic environment, enabled via a mobile device that learners make use of to augment their everyday experiences and eventually construct their own understandings and meanings (Patten, Sánchez, and Tangney, 2006). Constructivist instructional principles reflect the foundational tenets of constructivism, characterized by authentic, active, and social learning (Reigeluth and Carr-Chellman, 2009).

Constructivist learning theories heavily influence mobile learning and translate into instructional design application for mobile delivery (Ally, 2004). The

instructional design for mobile learning delivery necessitates the application of constructivist theory in design in order to create rich learning experiences for the mobile learning environment and affords student-centered, individualized learning that promotes a self-regulated approach to learning (Karagiorgi and Symeou, 2005).

Social Learning Theories and Mobile Learning

The Social Learning Theory integrated the Behavioural and Cognitive Theories of learning in order to provide a comprehensive model that could account for the wide range of learning experiences that take place in the real world. The Social Learning Theory is based on the premise that learning takes place through social interaction (Wenger, 2010). The impact of the social environment on the learner's behaviour is based on reinforcement (Richey et al., 2011). The Social Learning Theory draws heavily on the concept of learning by observing behaviour. Moreover, instructors can shape the classroom behaviour of students by modelling appropriate behaviour. By emphasizing the instructor's role as their model and encouraging students to assume the position of

observer, the instructor is able to make knowledge and practices explicit to students, thereby augmenting their learning outcomes.

Research on the role of technology in transforming learning revealed that considerable change in education over the last several decades has been defined by discussion of content as opposed to the model and process of learning design and delivery in a technology-permeated world. Siemens and Tittenberger (2009) suggested different types of technologies, demonstrating the methods by which they could be used in teaching and learning. Although the views of various social theorists differ, there is a general agreement that dialogue, interaction and collaboration are essential elements for learning (Rambe, 2012). A key example of this new learning trend is social learning.

Social learning means learning in social structures and networks via the Internet. For example, social networking apps help to mediate learning by increasing collaboration and interaction among learners (Park, 2011).

CONCLUSION

Mobile learning can be seen as a combination of mobile technology and its affordances that create a unique learning environment and opportunities for learning that can span across time and place (Stanton and Ophoff, 2013). Mobile technology is growing at a rapid rate around the world, and becoming ever more accessible. Technology is emerging and closing the gap towards being a viable tool for mobile learning. It's a social platform that creates environments for communication, understanding, and transfer of information (Stanton and Ophoff, 2013). Its ability to cater for varying learning styles through various features, its link to communication and its social context make it a very attractive tool for learning. The main characteristics that have been identified with mobile technology are nomadic, ubiquity, context sensitivity, personalisation, and interaction (Stanton and Ophoff, 2013). Mobile apps offer many opportunities for educational reform; however, instructors and app creators need to pay special attention to design, along with content and functionality, to enable its full potential (Keyes, Shroff and Linger, 2015).

It is important to note that mobile learning exists within a specific pedagogy and that designers must understanding the contexts very well so as develop mobile learning application which favour various learning styles and which can be deliver through different delivery methods. Learning is knowledge that is transferred through communication and mobile learning has the ability to support varying learning styles. Today's learning environments have the technological means to support interaction styles that are fundamentally different from those encountered in the instructor-centred paradigm (Keyes, Shroff and Linger, 2015).

This reviewed study introduced a definition of mobile learning, outlined the categories of educational apps, discussed the various steps to create and develop an effective mobile learning strategy, and explained guidelines to create interactive and engaging mobile learning courses. Though, there are various kinds of activities that can be enabled through the use of mobile devices under the categorization of relevant theories from the study of learning and, in

particular, learning with technology. This study explained three learning theories (i.e. Behaviourist Theory, Constructivist Theory and Social Learning Theory) as it relevant to learning with mobile technologies based on the suggestion of Shroff, Keyes and Linger (2015). Specifically, this study try to unify existing learning theories to facilitate an understanding of the pedagogical issues in designing mobile learning application that could encourage future academic endeavours.

Nevertheless, a more important thing about mobile learning application is to understand issues surrounding the designing of customized mobile learning applications that embedded different pedagogical learning strategies. Mobile technology does not aim to complicate learning process but facilitate mobile learners' learning process (Jeng *et al.*, 2010). To create new innovative learning opportunities, one needs to take into account the usability and the rationality (Jeng et al., 2010). I believe that if developers of mobile learning application carefully study this write up, it will guide them in designing an appropriate educational apps for mobile

learning that suit specific learners with different learning styles.

REFERENCES

Anderson, L. W., Krathwohl, D. R. & Bloom, B. S. (2001). A Taxonomy for Learning,Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives: Allyn & Bacon. Boston, MA (Pearson Education Group). Retrieved on March 28, 2017 from: http://thesecondprinciple.com/wp-content/uploads/2014/01/Anderson-and-Krathwohl-revised-10-2016.pdf

Agah, T. K. & Ayse, A. (2011). Differences between m-learning (mobile learning) and e-learning, basic terminology and usage of m-learning in education. *Procedia - Social and Behavioural Sciences*, 15, 1925-1930. Retrieved on March 28, 2017 from: http://www.sciencedirect.com/science/article/pii/S1877042811005751.

Ally, M. (2004). Foundations of Educational Theory for Online Learning. *Theory and Practice of Online Learning* 2:15-44.

Beutner, M. & Pechuel, R. (2014). Modern Ways of Learning with educational Apps. In T. Bastiaens (Ed.), *Proceedings of E-Learn: World*

Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2014 (pp. 188-196). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Bruck, P., Motiwalla, L. & Foerster, F. (2012). Mobile Learning with Micro-content: A Framework and Evaluation. 25th Bled e-Conference e-Dependability: Reliable and Trustworthy e-Structures, e-Processes, e-Operations and e-Services for the Future June 17, 2012 – June 20, 2012; Bled, Slovenia. Retrieved on March 28, 2017 from: http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1041&context=bled2012.

Chen, G. D., Chang, C. K., & Wang, C. Y. (2008). Ubiquitous learning website: scaffold learners by mobile devices with information-aware techniques. *Computers and Education,* 50(1), 77–90. Retrieved on March 28, 2017 from: http://www.sciencedirect.com/science/article/pii/S0360131506000650.

Cherner, T., Dix, J. & Lee, C. (2014). Cleaning Up that Mess: A Framework for Classifying Educational Apps. *Contemporary Issues in Technology and Teacher Education* 14 (2):158-193. Retrieved on March 28, 2017 from: http://www.citejournal.org/volume-14/issue-214/general/cleaning-up-that-mess-a-framework-for-classifying-educational-apps/

Christopher, P. (2014). 8 Steps To Create and Develop an Effective Mobile Training Strategy. Retrieved on March 28, 2017 from: https://elearningindustry.com/8-steps-create-develop-effective-mobile-training-strategy.

Churchill, D. (2011). Conceptual Model Learning Objects and Design Recommendations for Small Screens. *Educational Technology & Society*, 14 (1), 203–216. Retrieved on March 28, 2017 from: http://www.ifets.info/journals/14_1/18.pdf.

Darshan, D. (2017). How to Create Interactive and Engaging Mobile Learning Courses. Retrieved on March 28, 2017 from: http://blog.commlabindia.com/elearning-development/create-interactive-mobile-learning-courses

Filho, N. F. D. & Barbosa, E. F. (2014). Defining a set of Architecture Requirements for Service-Oriented Mobile Learning Environments.

10th International Conference Mobile Learning 2014. pp 183-190. Retrieved on March 28, 2017 from: http://files.eric.ed.gov/fulltext/ED55 7227.pdf.

Goodwin, K. & Highfield, K. (2013). A Framework for Examining Technologies and Early Mathematics Learning. In *Reconceptualizing Early Mathematics Learning*, 205-226. Springer.

Gulikers, J., Bastiaens, T. & Martens, R. (2005). The Surplus Value of an Authentic Learning Environment. *Computers in Human Behaviour* 21 (3):509. Retrieved on March 28, 2017 from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.512.9968&rep=rep1&type=pdf.

Handal, Boris, Chris Campbell, Michael Cavanagh & Kashmira Dave (2014). Appraising Mobile Maths Apps: The TPACK model. Paper read at ACEC 2014: Australian Computers in Education Conference. Retrieved on March 28, 2017 from:http://www.academia.edu/198 99017/APPRAISING_MOBILE_ MATHS_APPS_THE_TPACK_MOD EL.

Harlow, Cummings, S. R. & Aberasturi, S. M. (2007). Karl Popper and Jean Piaget: A Rationale for Constructivism. Paper read at The Educational Forum. Retrieved on March 28, 2017 from: https://eric.ed.gov/?id=EJ796332.

Herrington, A. & Herrington, J. (2008). Authentic Mobile Learning in Higher Education. In: Australian Association for Research in Education (AARE) International Education Research Conference (2007).

Hirsh-Pasek, Kathy, Jennifer, M. Z., Roberta, M. G., James, H. G., Michael, B. R. & Jordy, K. (2015). Putting Education in Educational Apps Lessons from the Science of Learning. *Psychological Science in the Public* Interest, 16 (1),3-34. Retrieved on March 28, from: http://kathyhirshpasek.com/wp-content/uploads/2015/09/Psychologi cal-Science- in-the-Public-Interest-2015-Hirsh-Pasek-3-34.pdf

Huang, Y. M., Jeng, Y. L., & Huang, T. C. (2009). An educational mobile blogging system for supporting collaborative learning. *Educational Technology & Society*, 12(2), 163–175. Retrieved on March 28, 2017 from: https://pdfs.semanticscholar.org/37f

b/3d04c53e28eb855a10cb528b9f8b5f528ced.pdf.

Huang R., Zhang H., Li Y., Yang J. (2012b). A Framework of Designing Learning Activities for Mobile Learning. In: Cheung S.K.S., Fong J., Kwok LF., Li K., Kwan R. (eds) Hybrid Learning. ICHL 2012. Lecture Notes in Computer Science, vol 7411. Springer, Berlin, Heidelberg

Jeng, Y. L., Wu, T. T., Huang, Y. M., Tan, Q. & Yang, S. J. H. (2010). The Add-on Impact of Mobile Applications in Learning Strategies: A Review Study. *Educational Technology &Society*, 13(3), 3-11. Retrieved on March 28, 2017 from: http://www.ifets.info/journals/13_3/2.pdf.

Karagiorgi, Y. & Symeou, L. (2005). Translating Constructivism into Instructional Design: Potential and Limitations. *Educational Technology & Society* 8 (1):17-27. Retrieved on March 28, 2017 from: http://www.ifets.info/journals/8_1/5.pdf.

Keskin, N. O. & Metcalf, D. (2011). The Current Perspectives, Theories and Practices of Mobile Learning. *Turkish Online Journal of Educational Technology-TOJET* 10 (2):202-208. Retrieved on March 28, 2017 from: https://eric.ed.gov/?id=EJ932239.

Keyes, C., Shroff, R. H. & Linger, W. (2015). Addressing Design Issues in Mobile Applications Supporting Ubiquitous Learning. *Advances in Scholarship of Teaching and Learning*, 3(1), 1-12. Retrieved on March 28, 2017 from http://repository.hkbu.edu.hk/cgi/viewcontent.cgi?article=1001&context=ulip_ja

Kwan, T. Y. L. (2008). Student-teachers' Evaluation on the Use of Different Modes of Problem-based Learning in Teacher Education. *Asia-Pacific Journal of Teacher Education* 36 (4):323-343. Retrieved on March 28, 2017 from: http://www.tandfonline.com/doi/abs/10.1080/13598660802375933?journalCode=capj20.

Ntloedibe-Kuswan, G. S. (2008). Exploring the Use of Electronic Mobile Technologies among Distance Learners in Rural Communities for Safe and Disruptive earning. Retrieved on March 28, 2017 from http://surface.syr.edu/cgi/viewcontent.cgi?article=1061&context=idde_etd.

Palalas, A. (2011). Mobile-assisted Language Learning: Designing for Your Students. *Second Language Teaching and Learning with Technology: Views of Emergent Researchers*: 71. Retrieved on March 28, 2017 from: https://www.research-publishing.net/publication/chapters/978-1-908416-00-1/Palalas_7.pdf

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. Retrieved on March 28, 2017 from: http://files.eric.ed.gov/fulltext/EJ920735.pdf.

Patten, B., Sa´nchez, I. A., & Tangney, B. (2006). Designing collaborative, constructionist and contextual applications for handheld devices. *Computers & Education,* 46(3), 294–308. Retrieved on March 28, 2017 from: http://www.sciencedirect.com/science/article/pii/S0360131505001636.

Peng, Hsinyi, Yi-Ju Su, Chien, C., & Chin-Chung Tsai, C. (2009). Ubiquitous Knowledg Construction: Mobile Learning Re-defined and a Conceptual Framework. *Innovations in Education and Teaching International* 46 (2):171-183. Retrieved on March 28, 2017 from: http://www.aprender.ead.unb.br/.../2009%20 Peng%20Su%20Chou%20Tsai%20QUADRO%20D…/2009 Peng SU Chou Tsai QUADRO DE DEFINICEES.pdf.

Rambe, P. (2012). Activity Theory and Technology Mediated Interaction: Cognitive Scaffolding Using Question-based Consultation on Facebook. *Australasian Journal of Educational Technology* 28 (8):1333-1361. Retrieved on March 28, 2017 from: https://ajet.org.au/index.php/AJET/article/view/775.

Reigeluth, C. M. & Carr-Chellman, A. A. (2009). Understanding Instructional Theory. *Instructional-design Theories and Models* 3:3-26.

Richey, R. C., Klein, J. D. & Tracey, M. W. (2011). The Instructional Design Knowledge Base: Theory, Research, and Practice, New York: Routledge.

Schunk, D. H. & Zimmerman, B. J. (2012). Motivation and Self-

regulated Learning: Theory, Research, and Applications: Routledge.

Shroff, R. H., Keyes, C. & Linger, W. (2015). A Proposed Taxonomy of Theoretical and Pedagogical Perspectives of Mobile Applications to Support Ubiquitous Learning. Retrieved on March 28, 2017 from: http://repository.hkbu.edu.hk/cgi/viewcontent.cgi?article=1000&context=ulip_ja.

Siemens, G. & Tittenberger, P. (2009). Handbook of Emerging Technologies for Learning: University of Manitoba Manitoba,, Canada.

Stanton, G. & Ophoff, J. (2013). Towards a Method for Mobile Learning Design. *Issues in Informing Science and Information Technology*,10, 501-523. Retrieved on March 28, 2017 from: http://iisit.org/Vol10/IISITv10p501-523Stanton0091.pdf.

Sweller, J., Kirschner, P, A & Richard, E. C. (2007). Why Minimally Guided Teaching Techniques Do Not Work: A Reply to Commentaries. *Educational Psychologist* 42(2):115-121. Retrieved on March 28, 2017 from: http://www.vincematsko.com/Talks/WorkedExamples/sweller_kirschner_clark_reply_ep07.pdf.

Wang, K.T., Huang, Y.M., Jeng, Y.L., & Wang, T.I. (2008). A blog-based dynamic learning map. *Computers &Education*, 51(1), 262-278. Retrieved on March 28, 2017 from: http://www.sciencedirect.com/science/article/pii/S036013150700053X.

Walker, H. (2011). Evaluating the Effectiveness of Apps for Mobile Devices. *Journal of Special Education Technology*, 26 (4):59-63. Retrieved on March 28, 2017 from:https://teacheroftech.wikispaces.com/file/view/Research_article_How_to_Evaluate_Apps.pdf.

Wenger, E. (2010). Communities of Practice and Social Learning Systems: The Career of a Concept. In *Social Learning Systems and Communities of Practice*, 179-198. Springer. Retrieved on March 28, 2017 from: http://link.springer.com/chapter/10.1007%2F978-1-84996-133-2_11.

Wong, L. H. (2012). A learner-centric view of mobile seamless learning. *British Journal of Educational Technology*, 43(1), 19–23. Retrieved on March 28, 2017 from:

https://www.researchgate.net/public
ation/230470268_A_learner-
centric_view_of_mobile_seamless_l
earning/BJET-Colloquium   on
seamless Learning -pre-print.pdf

Yarmey, K. (2011). Student
Information Literacy in the Mobile
Environment. *Educause Quarterly* 34
(1). Retrieved on March 28, 2017
from:
http://er.educause.edu/articles/2011/
3/student-information-literacy-in-
the-mobile-environment

Zosh, Jennifer M, Hirsh-Pasek, K.,
Roberta, M. K., Golinkoff, J. G.,
Michael Robb, and Jordy Kaufman
(2013). Harnessing the Science of
Learning to Promote Real
Educational Apps: A proposed
Contribution for Psychological
Science in the Public Interest.
Retrieved on March 28, 2017 from:
https://teacheroftech.wikispaces.co
m/file/view/Research_article_How_t
o_Evaluate Apps.pdf