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THE ROLE OF LEARNING THEORIES IN DESIGNING MOBILE LEARNING ENVIRONMENTS

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Abstract

Over the past five decades, education and training communities have witnessed series of innovations in learning environments from face-to-face to desktop computers and more recently to mobile devices where students can learn anytime and anywhere. Each of these innovations may be accompanied with additional learning theory, modified learning theory or using existing learning theory that help instructional designers in designing sound instructional materials for the new learning environments. It is against this backdrop that this paper examined five existing learning theories that are relevant to mobile learning and their possible applications to the design of instructions to be delivered on mobile devices. After the examination, such theories were found to be applicable to the design of instructions for mobile learning. This paper therefore, recommended among others that teachers designing instructions to be delivered via mobile devices should take the advantages of the aspects of the learning theories pointed out in order to develop valid and effective mobile learning materials.

Introduction

Mobile learning refers to the use mobile of device such as smart phones, personal digital assistants (PDAs), tablets and e-readers among others in learning at a fixed location or on the move. Mobile learning environments are therefore quite different from those of face-to-face and desktop or laptop counterparts and therefore may require additional learning theories and instructional design principles to guide the design and development of its learning materials. Accordingly, Ozdamli (2011) argued that the existing pedagogical frameworks are not sufficient when learning is delivered using mobile devices. Ozdamli (2011) further argued that while constructivist approach has been found to be the most helpful in terms of describing mobile learning, it fall short in including all aspects of mobile learning. Park (2011) builds on Ozdamli's idea and adopts an existing learning theory, transactional distance theory and adds new dimension to transactional distance theory to reflect the characteristics of mobile technologies which support both the individual and social aspects of learning. Park (2011) applied the modified theory to the design of mobile learning environment. Muyinda (2007) advocated developing additional theories and principles for mobile learning and recommended pre-requisites, but added that in the absence of these new theories and principles, existing learning theories can be used. These theories include constructivist learning theory, situated learning theory, collaborative learning theory and informal and lifelong learning theory.

The above literature points to the fact that existing learning theories or in modified form can be applied in the design and development of mobile learning environments. For example, Ally (2005) demonstrated how cognitive and constructivist learning theories can be applied to the design of instructional materials for mobile learning. This paper therefore, expanded the application of learning theories to include behaviourist learning theory and cognitive load learning theory among others.

Behaviourist Learning Theories

Behaviourists assume that a learner learns as result of responding to stimulus. In essence, learner's behaviuor is shaped through stimulus and response pair. It is in this context that J.B. Watson the father of behaviourism defined learning as a sequence of stimulus and response actions in observable cause and effect (Forrester & Jantizie, 1998). In order words, learning take place where there is behavioural change as result of stimulus and response. The dominance of stimulus and response make behavioural theories to be termed as stimulusresponse theories (S-R theories). One of the S-R theories that can be applied to the design of mobile learning and other learning environments is the Skinner's theory of operant conditioning. Burrhus Frederic Skinner, the profounder of Skinners theory of operant conditioning views learning take place through rewarding a certain behavior or withholding reward for undesirable behaviours. Rewarding certain behaviour, as positive reinforcement strengthens behaviour. Hence, mobile learning environment can be designed in such away that positive reinforcement in form of congratulatory messages appearing on the screen of a mobile device for the correct answer chosen and instant feedback for the incorrect answer in a multiple choice test or quiz. Montanaro (2013),

stresses that instant feedback is the most important part of quiz because student can learn which answer is correct, why it is the correct answer, potential reference links to the chapter and section where the answer can be found. Figures 1 and 2 show two instances where positive and negative reinforcement were used during the learning processes using mobile phone.

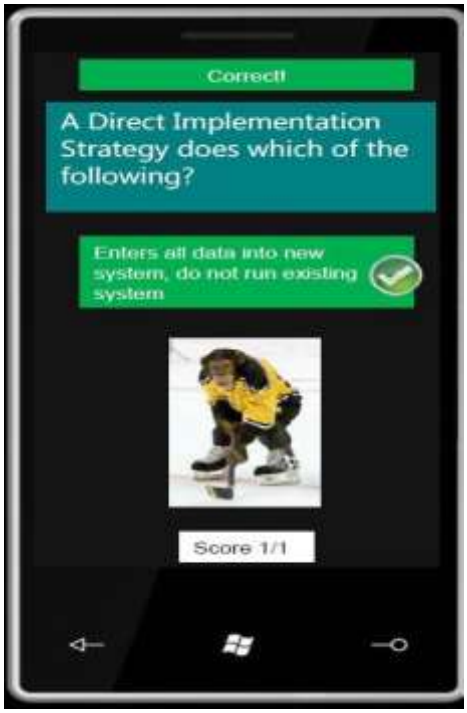

Figure 1: Snapshot showing positive reinforcement

(Adopted from Montanaro, 2012)

Figure 2: Snapshot showing negative reinforcement

(Adopted from Montanaro, 2012)

Cognitive Load Theory

Cognitive load refers to the total amount of mental activity imposed on working memory at any instant. Cognitive load theory distinguishes three different types of contributions to total cognitive loads; extraneous cognitive loadwhich is the unnecessary burden imposed on working memory by poor instructional design; intrinsic cognitive load is caused by the innate complexity of the instructional material relative to the level of learners prior knowledge and germane cognitive load refers to the work put into creating a permanent store of knowledge or a schema (Kalyung, 2014). Cognitive load theory assumes that human cognitive capacity in working memory is limited, and if it overloads, learning will

be hampered. De Jong (2010) recommends that the remedy is to design instructional system that optimizes the use of working capacity and avoid cognitive over load. Cognitive overload is the situation where the teacher gives too much information or too many tasks to learners simultaneously, resulting in the learners being unable to process these information.

One of the pedagogical implications of cognitive load theory is that instructional designers and educators should design instructional systems with minimal cognitive load. There are several empirical studies that demonstrate the effects of reducing cognitive load on student's performance (Gillmor, Paggio & Emorerson, Dwyer& Dwyer, 2006; Takir, 2011). These studies show improvement in student's performance as a result of reduction in cognitive load. Instructional designers and educators have implemented a number of cognitive load reduction strategies in face-to-face learning environments. The advent of e-learning provided opportunities for instructional designers, researchers and educators to invent new strategies for reducing cognitive load in elearning environments. The following are some of the ways of reducing cognitive load in e-learning environments:

Putting interactivity, putting adaptivity, use of multimedia, learning how to operate computer, browsing and posting assignments prior to learning, avoidance of inclusion of unnecessary information in instructional materials, use of direct manipulation interface, motivate learner, use of collaborative agents, logical arrangements of instructional materials, putting animations, inclusion of formative assessment, augmented reality and making learning environment aesthetic. As mobile learning is rapidly dominating web-based desktop or laptop learning environment, researchers need to find the effects of the above independent variables on dependent variables like achievement, retention, interest, perception and attitudes among others in mobile learning environments.

Piviors Dual Coding Theory

Piviors dual coding theory is a theory based on information processing theory. The theory assumes that information for memory is processed and stored by two interconnected systems and set of codes (Clark & Paivior, 1991). These set of codes include visual codes and verbal codes. When learners are presented with both visual and verbal codes, which are functionally independent, this has additive effects on their recall (Suh & Moyer-Packemham 2007). On issue of which code is easier to recall, Rieber (1994), reported that it is easier to recall information from visual processing codes than verbal codes. By implication, piviors dual coding theory supports the use of multimedia in learning. Such multimedia includes text, graphics, pictures, video, sound and animations.

There are ample empirical evidences that show the effectiveness of multimedia in instructional materials (Yamauch, 2008; Aloraini, 2012; Shah, & Khan, 2015). Therefore, mobile learning materials should contain multimedia to enhance students learning **Constructivist Learning Theory**

In constructivist perspective, learners construct knowledge themselves, as opposed to receiving and processing information that is given to them, a feature of other cognitive and information processing learning theories (Withers, 2005). Constructivism as originally discussed by Swiss psychologist, Jean Piaget, involves transferring some degree of responsibility for and control over learning from the educator to the learner (de Jong, 1998; Fisler, 1991; Hung, 2001). Discovery learning, exploratory learning and inquirybased instruction are some of the offshoots of constructivism and it found to be effective in teaching and learning (Balim, 2009; Sokolowski, 2013).

The emergence of computer assisted instruction paved way for the use of simulation as a tool for learning by doing, with its roots from constructivist idea of learning. Some of the simulation learning environment developed for teaching procedural and maintenance skills include Sophie (Brown & Declear, 1982), Steamer**(**Hollan, Hutchus & Weitzman, 1984) Ahab (Fath, Mitchel & Goundaraj, 1988), Sherlock (Lesgold, Lajole, Buzo & Eggan, 1988), Fuel Cell Tutor (Weiderholt, Mortor, Johnson & Browning, 1992) and Turbania-Vysa (Va Saudani & Govindaraj, 1993). In simulation instructional environments, students perform variety of tasks such as identifying simulated device components, performing operating steps, performing maintenance steps or diagnosing faulty devices and fix or replace defective parts (Murry, 2003). As mobile learning is gaining more attention, equipment maintenance training based on simulation can be incorporated into mobile learning environment. Research in this area and positive result will go a long way in reducing the cost of equipment maintenance training.

Resource-Based Learning

Resource-based learning is a form of learning that enable learners to learn from their own interaction with information resources. Resource-based learning actively involves students, teachers and teacherlibrarians in the effective use of wide range of print, non-print and human resources (Melendres, 2015). In resource-based learning teachers can plan cooperatively with teacher librarian to tailor resources and learning activities to meet the learning outcomes of individual students and classes (OLV, 2012). Melendres (2015) reported the benefits of resourcebased learning to include accommodating individual differences in learning styles, abilities, needs, interest and prior knowledge for their own learning. It promotes the development of problem-solving, decision-making and evaluating skills. It provides opportunities for students to become effective users of information technology.

In the light of resource-based learning features, effectiveness and benefits; mobile learning can be designed with the same features and characteristics of resource-based learning. In this way, students are to communicate with others in their own cooperative working group as well as those in the other partnering places.

Conclusion

Advances in computer hardware and softwares couple with rich web technologies make it possible for students to receive instructions via mobile devices such as smart phones, personal digital assistants, tablet and e-readers among others. Instructional designers must use existing, modified or new learning theories in order to design a sound instructional material. As theorist, educators and researchers are making effort to invent new learning or modified learning theories for mobile learning. This paper reviewed five existing learning theories and found them to be applicable in design of instructional materials for mobile learning. Some of the strategies or techniques suggested for supporting mobile learning as derived from the learning theories reviewed need to be verified empirically.

Recommendations

Based on the reviewedlearning theories, the following recommendations were made:

1. Teachers should be attending workshops, seminars or conferences on the design of instructions for mobile learning using learning theories on regular basis.
2. Teachers designing instructions to be delivered via mobile devices should take the advantages of the aspects of the learning theories pointed out in order to develop valid and effective mobile learning materials.

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