Chapter 101
Research Trends in the Use of Mobile Learning in Mathematics

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ABSTRACT

The use of mobile learning in education is growing at an exponential rate. To best understand how mobile learning is being used, it is crucial to gain a collective understanding of the research that has taken place. This research was a systematic review of 36 studies in mobile learning in mathematics from the year 2000 onward. Eight new findings emerged: (1) The primary purpose of most studies was to focus on evaluating mobile learning. (2) Case studies and experimental design were the main research methods. (3) Most studies report positive learning outcomes; (4) Mobile phones were the mobile device used most often. (5) Elementary school settings were the most common research context. (6) The majority of researchers did not identify a specific mathematical concept being studied. (7) The majority of the studies took place in formal educational contexts; and (8) research on mobile learning in mathematics is geographically diverse.

There is a growing interest in exploiting the affordances of mobile devices for educational purposes (Ally, Prieto-Blazquez, 2014; Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009). Empirical evidence suggests that teachers are interested in using mobile devices in their classrooms (Hodges and Prater, 2013) and in the United States (US), seven in ten elementary students (71%), two-thirds of middle school students (67%) and over half (56) of high school students state that they would like to use mobile devices for learning (Pearson Education 2014). Nonetheless, few teachers are choosing to use mobile devices within formal and informal classroom settings (Groff & Mouza, 2008; Levin & Wadmany, 2008). This can be attributed to a lack of teacher training and understanding (Crompton, Olszewski, & Bielefeldt, 2015; Cheon et al. 2012) and a lack of pre-service and in-service teacher training in how to use mobile devices for educational purposes (Goktas, Yildirim, & Yildirim, 2009).

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To support best practices in the use of mobile learning it is important to provide stakeholders, such as policy makers, teachers, and students, information and examples of how mobile learning can be used effectively. Past researchers have analyzed mobile learning studies with the focus on the learner (viz., Capretz & Alrasheedi, 2013; Wu, Wu, Chen, Kao, Lin, & Huang, 2012) and on technologies (viz., Pereira & Rodrigues, 2013). Although these reviews provide a rich source of information on mobile learning, they do not provide data on a particular subject area. Therefore, these reviews can only be used as generalizable information across all subjects which is not helpful for those looking at a particular subject area.

The purpose of this study is to aggregate and explore empirical evidence of the use of mobile learning in mathematics. This is the first review to provide a comprehensive collection of mobile learning and mathematical studies to initiate an evidence -based discussion on mobile learning in mathematics teaching.

BACKGROUND

As the field of mobile learning has developed and devices have advanced, there have been a number of ephemeral definitions of mobile learning. Earlier definitions have named a particular device which quickly becomes dated, or they have been technocentric (Crompton, 2013a). Nonetheless, trends have emerged from these definitions that highlight the four central constructs of mobile learning as pedagogy, technological devices, context, and social interactions (Crompton, 2013b). Aligned to these constructs, Sharples, Taylor, and Vavoula (2007) define mobile learning as "the processes of coming to know through conversations across multiple contexts amongst people and personal interactive technologies" (p. 224).

Using these constructs, (Crompton, 2013b) defined mobile learning as "learning across multiple contexts, through social and content interactions, using personal electronic devices" (p. 4). This is the definition selected for this article.

Determining which devices are included in m-learning has also been a topic of debate among scholars (Traxler, 2009). For this study, Crompton's (2013a) criteria have been used (see p. 48) to define what qualifies as a mobile device. She proffers that the device must be portable and incorporate a prompt on-off button. The latter is extremely problematic with traditional laptops, as they take a while to start and they are typically not left on standby mode to use quickly. For this reason, laptops were not included as mobile devices in this study.

As mobile learning is a relatively new field of study, there is a paucity of studies that collectively review and analyze mobile learning research. The major reviews of mobile learning in education include a critical analysis of mobile learning projects conducted by Frohberg, Goth, and Schwabe (2009) as they focused on six criteria: context, control, tools, communication, subject, and objective. Using a framework to systematically analyze and position mobile learning projects, Frohberg et al. reported screening 1469 publications to finally analyze 102 publications. Frohberg et al. found that although mobile devices were primarily for communication, they found few connections to the research regarding communication or collaboration. The researchers also found that the majority of the studies supported novice learners.

Hung and Zhang (2012) conducted a study of mobile learning research trends from 2003 to 2008. Text mining techniques were used to provide basic bibliometric statistics, trends in frequency of topics, predominance of topics by country, and preference for each topic by journal. The researchers found that: 1) mobile learning articles increased from eight in 2003 to 36 in 2008; 2) effectiveness, evaluation, and personalized systems were the most popular area of study; and 3) Taiwan conducted the most mobile learning studies.