Chapter 14
Mobile Learning in Science and Mathematics Teaching: A Systematic Review

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ABSTRACT

This chapter, the authors analyze mobile learning literature addressing formal teaching situations in the field of science/mathematics education. The chapter describes a systematic review of relevant literature, investigating work published between 2005 and 2014. Based on the findings of this review, the results reveal that since 2009 interest in the academic community for research involving m-learning in science and mathematics teaching has intensified. An emphasis on the growing need for research involving m-learning at undergraduate levels is evident. The study notes positive reported results on the impact of m-learning in science and mathematics teaching, notably in assisting ease of learning, promoting student interest and collaborating with positive, motivating attitudes, encouraging meaningful commitment among students in learning activities.

INTRODUCTION

M-learning, a teaching modality which makes use of innovative technological tools, including hardware and software platforms, arose from the expansion of new possibilities for distance learning (Tarouco, Fabre, Konrath & Grando, 2004), as well as online teaching (e-learning.) M-learning also became possible due to the rise of interest and usage of the internet and widespread dissemination of information and communication technologies (ICTs) in computer networks. Hence, research in m-learning now seeks to understand how students' academic mobility, favored by advances in private and public technologies, can contribute to the process of knowledge acquisition, skills and experience in education (Sharples et al, 2014.) Faced with a still controversial and limiting context surrounding the definition of m-learning,

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Parsons (2014) lists some myths and misconceptions surrounding this definition. For this study, the authors appropriated some of the m-learning characteristics identified and enumerated by Marçal et al (2005):

"...Provide access to educational content anywhere and at any time, according to web device connectivity; allow learners to personally shape their own knowledge; expand the internal and external boundaries of the classroom in a ubiquitous manner; provide means for the development of innovative teaching methods using contemporary computing dynamics and resources." (Marçal, Andrade & Rios, 2005, p.3.)

Mobile devices have led to changes in numerous segments of society. Embedded in our daily life, they reshape the way we live; communicate, relate, work and play. The spectrum of possibilities provided by mobile technologies, including portability, free access to information, flexibility and exchange of information, among others, lead us to question how society appropriates/incorporates these new features and how this affects socio-political, economic and, especially, learning spheres.

We must investigate specifically how these modern technological resources are inserted into teaching and learning subject study contents and specifically those related to Science and Mathematics. Studies like that of Chen (2009) point out that the teaching of Science and Mathematics is a continuous challenge to be overcome for many countries adopting many academic levels.

Drew (2011) also points to the lack of interest demonstrated by university students in scientific and technological careers, even in those who did well in math and sciences during High School. In this context, this chapter seeks to examine how mobile devices are used in formal teaching situations in the field of tutoring science and mathematics.

MOBILE TECHNOLOGIESS AND THE TEACHING-LEARNING PROCESS

Cook (2009) presents three stages of research on mobile learning, the first of which focuses on the devices involved; with widespread experimentation in PDAs, tablets, laptops and mobile phones, accentuating the advantages and disadvantages of using these devices in studies. The second stage concentrates on learning proposals *outside* of the classroom, including field trips, visits to museums, etc. The third stage of the research focuses on student mobility. This chapter focuses on student mobility, design/appropriation of learning spaces and lifelong learning experience.

Traxler (2009), while acknowledging progress thus far achieved, admits that this area still has far to go in technological as well as pedagogical terms. Mobile devices are mainly characterized by their mobility (wireless) and portability (small, lightweight devices) enabling the issuance, circulation and exchange of information during real time user movement.

The use of innovative strategies and tools assisting classroom or distance learning based on the expansion and accessibility of the internet enables new possibilities in the teaching and learning process. The educational process itself has also evolved with the advent of this rapidly advancing technology and its social, economic and cultural ramifications, since it constitutes an important link in inter-communication process mechanisms. In reference to this contemporary outline, technological developments in the expansion of online communication possibilities - now substantially mobile; anytime, anywhere and anyhow – enable learning through multiple dynamic interactive features in digital communication, bringing attention to the need to reformat different models and practices for educational purposes (Fedoce, 2010.)

As Metcalf (2006) suggested, communication functionality and increased data transfer speed favors the instructional value of mobile devices, thereby increasing learning opportunities. Pachler et al (2009) adds