Chapter 41
Active Learning, Mentoring, and Mobile Technology:
Meeting Needs across Levels in One Place

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ABSTRACT

Educators are creating authentic settings that utilize active learning, mobile technology, and mentoring in efforts to promote students' success in developing 21st Century skills, motivation, and interest in STEM domains and STEM careers. Each of these approaches has been found to promote and transfer knowledge, as well as to develop problem-solving and communication skills in STEM. Little information, however, is available about the interactive effect of mobile technology and active learning in promoting learning in settings that use a hierarchical model of mentoring to promote the transfer of skills and knowledge. This chapter presents findings of a program that used mobile technology in active learning environments for five interrelated levels of an active, authentic environment, facilitated by mobile technology and hierarchical mentoring. Positive outcomes were documented at each level of participation; use of the mobile technology integrated within active learning settings supported by hierarchical mentoring increased learning in STEM content, skills, and affect.

INTRODUCTION

A major goal for the implementation of technology within educational settings is to provide an environment that engages students in opportunities to actively participate in the learning process (Wangler & Ziliak, 2013). When used appropriately, technology not only meets this goal, but also extends the engagement process, allowing students to reach beyond the onsite context by interacting with information as it is used in everyday life. Mobile technology is particularly useful in this setting in that it promotes applied learning by helping students gather information anytime and anywhere (Fisher & Baird, 2006). Research has found that when learning is supported by on-demand access to information it not only fosters short-term goals, but also promotes development

of lifelong learners (Naismith, Sharples, Vavoula, & Lonsdale, 2004).

The implementation of mobile technologies as a support for learning is becoming more popular in educational settings (Kim, Mims, & Holmes, 2006). In 2012, over 50% of high school students and 40% of middle school students owned or had access to smartphones or tablets (Nonono, 2012) and 82% of college freshman had access to online resources via handheld devices before they even arrived on campus (UCAS Media, 2013). As a result, instructors are looking for ways to not only use mobile devices as instructional resources, but also are attempting to find ways to blend them into other educational goals. One specific goal which can be supported via the use of mobile technology is mentoring, especially hierarchical mentoring. This model of mentoring, which involves cyclical, structured authentic interactions between a series of mentors and mentees across both formal and informal settings is now being used by many colleges and universities to help attract and retain STEM undergraduates (George & Neale, 2006; Olson & Riordan, 2012; Wilson, et al., 2012).

This chapter discusses the use and outcomes of experiential STEM learning using mobile technology embedded within a hierarchical mentoring setting. By using the mobile technology within an authentic educational setting, program planners were able to support active learning across five levels of mentor/mentee relations–higher education STEM faculty, STEM graduate students, STEM undergraduate students, secondary STEM educators, and STEM secondary education students. The chapter will describe the technology, the settings of implementation, the cognitive and affective outcomes of the participants, and the influence of hierarchical support for learning across levels.

OVERVIEW OF THE LITERATURE

Olson and Riordan (2012) note that during the 20th century, the interactive status of science, technol-ogy, and higher education had a major effect on the U.S. economy. During that latter part of the 20th century, more students were graduating from colleges and universities with STEM degrees than ever before, creating and supporting an economy based on new technologies and industries. Now, in the second decade of the 21st Century, societal demands require that we continue to reinforce and develop skills that are directly related to the use of technology such as information, media, and technology literacy; concurrently we must also develop skills related to career content and professional activities such as innovation, self-direction, adaptability, productivity, critical thinking, problem-solving, collaboration and communication (U.S. Department of Education, 2010).

To encourage the development of these skills amongst our youth and emerging adults, it is imperative that technology be incorporated within all aspects of education, and that student learning and pedagogy reflect technology integration, as well as technology content (U.S. Department of Education, 2010). The domain of STEM education is highly touted as a leader in this change. As of 2010, 46 of the 50 states in the United States now require that teachers implement technology within their instruction (National Science Board, 2010) in hopes that aligning instruction and technology will promote a growing workforce in STEM-related fields and a population prepared to take on STEM-related and STEM-supported careers.

The need for this change is further supported by workforce projects. According to the National Science Board, "the number of workers in STEM occupations from 1950-2007 (182,000 to 5.5 million) represents an average annual growth rate of 6.2%, nearly 4 times the 1.6% growth rate for the total workforce during this period" (2010, p. 6). The societal demands for improved and newer technologies, however, are increasing at a disproportionate rate to the number of students now obtaining STEM degrees and it is estimated that it will take the addition of approximately one million more STEM professionals to the current

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