Chapter 10
Technology–Supported Inquiry in STEM Teacher Education: From Old Challenges to New Possibilities

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ABSTRACT

The chapter describes the implementation of collaborative educational technologies in STEM teacher education to support teacher-candidates in acquiring inquiry-based teaching skills and positive attitudes about inquiry learning. The focus is on five different collaborative technology-enhanced pedagogies: (1) Peer Instruction, (2) collaborative design of conceptual questions with PeerWise, (3) data-driven STEM inquiry via using live data collection and analysis, (4) computer modeling-enhanced inquiry, and (5) collaborative reflection on peer teaching. Teacher-candidates experienced these pedagogical approaches first as learners, then reflected on them as future teachers, and lastly incorporated some of them during the practicum. As a result, teacher-candidates gained experience in promoting technology-enhanced inquiry in STEM education and began developing positive attitudes towards technology-enhanced inquiry-based STEM education.

INTRODUCTION

This chapter explores how modern collaborative educational technologies can be implemented in STEM teacher education in order to support teacher-candidates in (1) acquiring inquiry-based teaching skills, (2) forming positive attitudes about inquiry-based STEM education, and (3) building resiliency in the face of initial
failure of inquiry-based pedagogies (Milner-Bolotin, 2016b). The last two points are especially important, as there is ample research evidence that when instructors lack adequate support, they are likely to give up on implementing innovative research-based pedagogies in the face of early adoption failure (Lasry, Guillemette, & Mazur, 2014; Mazur, 1997a; Wieman & Perkins, 2005). Thus, inadequate support for K-12 and post-secondary STEM educators for reforming their teaching coupled with the limited opportunities for teacher collaboration result in an ever growing gap between research-informed and classroom-enacted educational practices (Cole & Knowles, 2000; Milner-Bolotin, 2014a). This explains why increased access to educational technologies does not necessarily guarantee a wider adoption of inquiry-based pedagogies and improved learning. In order to promote inquiry-based learning and active student engagement in STEM, K-12 and post-secondary instructors have to be supported in adopting new pedagogical approaches (Harris & Hofer, 2011; Shelton, 2015). This requires reimagining STEM teacher education, pedagogical preparation of post-secondary instructors, as well as in-service professional development (Lee & Tsai, 2010; Niess, 2005). If we fail to do so, many instructors will continue to ignore the mounting research evidence about how students learn and how STEM subjects can be taught more effectively (Bransford, Brown, & Cocking, 2002). Moreover, a large number of STEM instructors will inevitably revert to much safer but also less effective teacher-centered pedagogies they had experienced as students (Shelton, 2015; Wieman, 2012; Wieman & Perkins, 2005). This is one of the key reasons why the substantial governmental investments and half-a-century long education reform efforts in North America and in Europe aimed at promoting inquiry-based education have rarely brought the desired outcomes (Feder, 2010; Krajcik & Mun, 2014; National Research Council, 2012; Pollock, 2004).

The goals of STEM education, the role of inquiry, the tools available to modern students, as well as the population of students in K-12 STEM classrooms have changed dramatically over the last few decades (Cuban, 1990; National Research Council, 2013). In the 21st century we cannot afford to leave the majority of our population outside of STEM fields, as every student who disengages from STEM in K-12 closes multiple future opportunities for themselves inside and outside of STEM-related professions (Chachashvili-Bolotin, Milner-Bolotin, & Lissitsa, 2016; Let’s Talk Science, 2013, 2015). In the current economic reality, STEM engagement should not be limited to a select few students, as it was common in North America during the post-Sputnik era, but should become an integral part of K-12 education for all (DeBoer, 1991; Let’s Talk Science, 2012).

In this chapter we investigate how modern educational technologies can help to prepare the next generation of teachers who will be open to and capable of engaging
Technology's Role in Supporting Elementary Preservice Teachers as They Teach: An Urban STEM Afterschool Enrichment Program
Anne Pfitzner Gatling (2016). *Improving K-12 STEM Education Outcomes through Technological Integration* (pp. 362-379).
[www.igi-global.com/chapter/technologys-role-in-supporting-elementary-preservice-teachers-as-they-teach/141196?camid=4v1a](www.igi-global.com/chapter/technologys-role-in-supporting-elementary-preservice-teachers-as-they-teach/141196?camid=4v1a)

Graphic Novels and STEAM: Strategies and Texts for Utilization in STEAM Education
Alex Romagnoli (2017). *Teaching Cases Collection* (pp. 22-37).
[www.igi-global.com/chapter/graphic-novels-and-steam/177506?camid=4v1a](www.igi-global.com/chapter/graphic-novels-and-steam/177506?camid=4v1a)