Chapter 41
Effective Integration of Technology in Inquiry Learning: Themes and Examples

Lisa J. Lynn
University of Illinois at Chicago, USA

ABSTRACT

For education leaders (teachers, professors, curriculum designers, and administrators), there are well-documented benefits to using inquiry learning in a wide variety of grade levels, content levels, and contexts. Besides promoting deep learning and critical thinking, inquiry learning is readily adaptable to 21st century skills such as information and communication technologies literacy. However, the combination of sophisticated pedagogy and cutting-edge technologies can be overwhelming to education leaders when planning an inquiry learning curriculum. Faced with a wide variety of technology options, education leaders have little research-based guidance for choosing the ones that are best suited to an inquiry learning curriculum. This chapter reviews recent findings on the use of technology in inquiry learning and provides suggestions and guidelines for incorporating technology in inquiry learning in order to maximize the pedagogical affordances of technology.

INTRODUCTION

Educational technology is a large and rapidly growing global business with investments of more than $8 billion in 2017 (Adkins, 2018). However, barriers to the adoption of educational technology persist; namely, that many educators are skeptical of the effectiveness of new technologies (Bill & Melinda Gates Foundation, 2015). One reason for this is a lack of research and recommendations for pairing cutting-edge technology with the most effective pedagogies; in too many educational settings, technology continues to be used for less effective learning activities like memorization (Lawless, 2016). In order to fully realize the educational potential of technology, it must be paired with excellent pedagogy that maximizes learning. One such pedagogy is inquiry learning. **Inquiry learning** is learning that is motivated by curiosity, often guided by a question: why do things sink or float? How was the Constitution written? How do we

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know? As will be shown in example studies, inquiry learning is flexible across different content and skills, and any number of technologies could be used in inquiry learning. This same flexibility can be overwhelming to education leaders when planning an inquiry learning curriculum. Faced with a wide variety of technology options, education leaders have little research-based guidance for choosing the ones that are best suited to an inquiry learning curriculum. The purpose of this chapter is to review some of the most recent findings on the use of technology in inquiry learning. This chapter will provide suggestions and guidelines for incorporating technology in inquiry learning in order to maximize the pedagogical affordances of technology.

BACKGROUND

For education leaders (teachers, professors, curriculum designers, and administrators), there are well-documented benefits to using inquiry learning in a wide variety of grade levels, content levels, and contexts (Barrows & Tamblyn, 1980; Dochy, Segers, Van den Bossche, & Gijbels, 2003; Hmelo-Silver, 2004; Hmelo-Silver, Duncan, & Chinn, 2007; Walker & Leary, 2009). Besides promoting deep learning and critical thinking, inquiry learning is readily adaptable to **21st Century Skills** such as information and communication technologies (ICT) literacy (Trilling & Fadel, 2012). Thus, curricular resources are maximized as students learn about a content area, practice thinking and reasoning skills, and practice using technology, all within the context of an inquiry learning setting.

Inquiry learning is learning that is driven by curiosity, the intrinsic desire of a learner to know something. It does not necessarily require technology to enact, and it has existed for at least a century (Barrow, 2006; Dewey, 1913). Inquiry learning begins with a question and requires students to develop solutions, ask more questions, solve problems, and actively build their knowledge (Savery, 2006). Ideally, inquiry learning uses an authentic, relevant question; students work collaboratively to investigate by collecting data, developing explanations or solutions, and communicating their ideas; the teacher in this setting is a facilitator of learning, not a sole source of knowledge (Hmelo-Silver et al., 2007). The specific procedures of inquiry learning vary across contexts. For instance, in project-based learning, the goal is to develop a pre-determined artifact, such as a computer program; students may be free to choose what the program should do and will solve problems along the way to developing it (Savery, 2006). Problem-based learning takes a slightly different approach: students receive a problem and the goal is to solve it, but the solution can take any form. One group might design a computer program as a solution, while another designs a board game (Savery, 2006). In all cases, the questions or scenarios used in inquiry learning are meant to inspire curiosity and drive the process of inquiry, and a key feature is that students build knowledge in an active role rather than passively receiving it.

Inquiry learning has yielded many positive effects: it has been shown effective in promoting the acquisition of skills, especially problem-solving skills, more so than facts and rote knowledge (Dochy, Segers, Van den Bossche, & Gijbels, 2003; Hmelo-Silver, 2004). Inquiry learning has been especially successful in science, technology, engineering and mathematics (STEM) subjects, where inquiry is not merely a means to an end but a skill in its own right (Minner, Levy, & Century, 2010; NGSS Lead States, 2013). Similarly, the contextual use of technology can be viewed as a skill in its own right, as well as being an enhancement to inquiry learning and the specific content or skills being learned. Researchers have outlined the ways technology can be used to support inquiry learning, such as providing support to students, providing background information, and overcoming some of the practical limitations of