Chapter 35
Mini-Robots as Smart Gadgets: Promoting Active Learning of Key K-12 Social Science Skills

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ABSTRACT

The chapter proposes to outline best practices in the use of a set of mini-robots (i.e., smart gadgets) to promote active and meaningful learning in the Social Sciences. Key K-12 social science skills supported by their use include coding, sequencing, including time lining, map making, planning, organizing, peer collaboration, and the comprehension and interpretation of maps and written texts. The theoretical foundation supporting the use in the Social Sciences of is examined in this chapter. Next, barriers to use are explored before moving into an examination of one strategy for integration into the Social Sciences. Finally, the chapter concludes with an exploration of issues and recommendations for mitigating those issues will be discussed along with linkage of use to specific Social Science concept (i.e., discovery, exploration, and technology).

INTRODUCTION

Meaningful and successful civic life in the 21st century requires a global citizenry "literate in both computer science and computational thinking" (Megan Smith, U.S. Chief Technology Officer, Office of Science and Technology Policy, 2015). As such, agreement about coding as a necessary skill for success within our global society has emerged in recent years within many disciplines. This agreement should not exclude any areas of academic inquiry. K-12 Social Science educators must carefully consider whether or to what extent they must share in this global civic mission. While this proposed area of academic inquiry may not be immediately apparent to all Social Science teachers, it does present a global need for educators to integrate innovative use of technology with an exploration of its impact on

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society across time and place. Given these obligations, Social Science teachers cannot easily ignore this obligation and must identify innovative and effective ways that allow learners to think about technology and its evolving impact on society, both locally and globally. We cannot fail in our obligation to identify ways to appropriately integrate use of current and emerging technologies, such as the smart gadgets examined here, into our instructional practices (Bennett & Berson, 2007). Integration and use is further supported by the critical mission of assisting students to acquire and hone critical thinking, problem solving, computational, technology, and decision making skills, each of which can be further supported via the use of coding activities such as the exemplar activity presented later in this chapter.

Background

Smart gadgets are small electronic devices that operate independently or by attaching to larger electronic devices using Bluetooth or other wireless connections. Most smart devices are interactive and many are autonomous devices that allow users to connect and share information with the device. Many, but not all, allow users to interact with other users as well. Examples include mini-robots, smartphones, smartwatches, exercise monitors, and streaming devices for televisions (Techopedia, 2016). As one example of a smart gadget, a mini-robot is a small, usually less than 10 centimeters in size, robot designed to perform a specific set of tasks. Most function using a wireless connection to a tablet or other computing device. Because of their size they tend to be among the more inexpensive robots (Friends, 2013) and, therefore, have useful applications for teaching computational thinking in varied K-12 learning environments.

Theoretical Foundation for the Use of Smart Gadgets

The supporting principles and defining purposes of civic education are integral to the mission of the Social Sciences. In fact, those purposes are inextricably tied to society's need for an informed global citizenry. An American educational philosopher, John Dewey, made explicit the relationship between the need for competent citizens and the purpose of civic education in 1916 stating, "…a government resting upon [democratic principles] cannot be successful unless those who elect and who obey their governors are educated" (p. 88). Drawing inspiration from this foundational purpose in many countries around the globe, Social Science instruction is centered on a set of subject area that provides K-12 learners with subject matter knowledge, skills, and dispositions that they can apply to the study of the human experience whether on an individual, local, national, or international scale. Across the globe, Social Science curriculums strive to help K-12 learners make sense of the world around them even as they strive to equip learns with the critical skills, including technology skills, needed for responsible citizenship within a diverse, global society (NCSS, 2010). As such, use of purposeful, meaningful, and authentic technology supported learning tasks, grounded in an understanding of Constructivism, are critical for the field's continued well-being. As a category of technology, smart gadgets provide one way of doing so.

K-12 students learn best and remember more over longer periods of time when learning occurs as a part of authentic and meaningful activities (Darling-Hammond, 2006). This includes those grounded in technology use (Maxim, 2014). Furthermore, learning theorists know that learning is closely aligned with learners' cognitive, social, and emotional development (Bloom, Mesia, & Krathwohl, 1964). Given this understanding of learning theory, effective Social Science educators recognize that not all children learn at the same pace or, even, in the same way. As such, they know that they must rely on both cognitive and developmentally appropriate teaching strategies, including use of technologies such as the