Chapter 4
Using Geospatial Technology to Promote Middle School Students’ Critical Thinking on Socioscientific Issues

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ABSTRACT

This chapter is a demonstration of how to use geospatial technologies to promote middle school students’ abilities to think critically and to argue persuasively on socioscientific issues. Forty-three sixth grade students from a summer enrichment program operated by a non-profit organization in the northeastern United States participated in this study. The duration of this curricular unit took place over five consecutive 1-hour period blocks. The researcher utilized qualitative procedures to analyze the students’ abilities to think critically and to argue persuasively on socioscientific issues. The results indicate that the students’ background knowledge on the impact of human activities on climate change was enhanced with the use of videos, graphics, audio-visuals, and other hands-on activities. Additionally, the knowledge the students gained from the events in this investigation enhanced their abilities to propose convincing arguments in opposition or support for the socioscientific issues investigated.

INTRODUCTION

Promoting middle school students’ critical thinking on scientific issues that impact their daily lives requires considerable efforts by researchers and education policymakers to invest in identifying and developing technology-enhanced learning strategies aimed at improving middle grades science instruction. While numerous studies have provided valuable guidance for using socioscientific issues (SSI) to promote inquiry (Walker & Zeidler, 2007), socioscientific reasoning (Glazewski & Ertmer, 2010), and argumentation (Suephathima, Bureerat, Faikhamta, Chatree, 2018), research that provide insight into how

DOI: 10.4018/978-1-7998-1770-3.ch004
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to scaffold different types of technology, such as geographic information systems (GIS), remote sensing (RS), global positioning systems (GPS), and digital globes, while investigating SSI has been relatively sparse. One way to stop this trend is to equip school teachers in general, and science teachers in particular with skills necessary to use these technologies in the classroom to promote critical thinking. The use of these technologies has the potential to make school science more relevant to the lives of students. This, in turn, will stimulate students’ interest, and thus provide opportunities for them to connect the science learned in the classroom to scientific issues in their communities. Additionally, these technologies have the potential to enhance their science content knowledge (Kerski, 2003). Such is vital in developing the next generation with the skills construct and evaluate evidence-based arguments.

This study focuses on a curricular unit of instruction that uses scaffolds to support the use of Geospatial Technologies (GST) to exposes middle school students to the potential impact of energy usage and its effects on their communities. The primary goal of this research is to demonstrate for science education researchers, policymakers, and practitioners how to use GST to promote middle school students’ critical thinking on SSI.

BACKGROUND

What Are Socioscientific Issues (SSI)?

The SSI framework seeks to involve students in decision making regarding everyday social issues with moral or ethical implications embedded within scientific contexts (Yap, 2014). The current discussion regarding the potential effects of climate change on underserved communities is an example of a socioscientific issue. Scientific issues such as climate change lack clear solutions. Therefore, exposing students to issues, such as climate change, has the potential to enhance their ability to analyze, synthesize, and evaluate information. These issues will help students to develop their moral reasoning and ethical decision-making skills, in addition to improving content knowledge and argumentation abilities (Dawson & Venville, 2010; Klosterman & Sadler, 2010; Sadler, Klosterman, & Topcu, 2011). In an attempt to expose students to the potential impact of climate change on their communities, the use of GST can become a valuable asset. The interactive nature of this technology can present students with imagery for them to make important comparisons, interpret data, and engage in decision making regarding everyday issues that moral and ethical undertones. However, for GST to enhance learning, teachers may need to be useful to scaffold and integrate this technology into the curriculum effectively.

What Are Geospatial Technologies (GST)

Geographic information systems, remote sensing, global positioning systems, and digital globes comprise the four core geospatial technologies (Baker et al. 2015). While it has long been suggested that GST has the potential to impact teaching, learning and problem solving (National Research Council 2006; Goodchild and Janelle 2010), widespread use GST in the K-12 classroom settings has been minimal. It has been reported that the sparsity of GTS usage in the K-12 system is partially due to the lack of detailed research-based evidence on its potential impact on students’ learning (Baker et al., 2015). Other researchers have also cited the lack of clear plans regarding how to use this type of technology in the classroom as other barriers to the widespread use of this technology in the K-12 curriculum (Baker &
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