Chapter 9
Using Socioscientific Issues to Enhance Evidence–Based Reasoning Among Middle School Students

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ABSTRACT

This study investigated the implementation of a socioscientific issue curricular unit that was designed to enhance evidence-based reasoning among middle school students. Forty-three middle school students (11-12 years old; 20 males, 23 females) 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 researchers utilized qualitative procedures to analyze students' abilities to engage in evidence-based reasoning and the impact it might have on students' argumentation quality on whether the air we breathe makes us sick. Comparison of the findings from pre-test and post-test indicate that students were able to use evidence-based reasoning to enhance their argumentation quality. The results from this investigation suggest that perhaps the use of socioscientific issues as a critical pedagogical tool does enhance students' abilities to engage in evidence-based reasoning.

INTRODUCTION

It is no secret that air pollution in the United States and around the world may have adverse effects on human health as well as the health of the environment. Several studies have shown that exposure to air pollution has been associated with a wide range of health-related effects including respiratory diseases, cancers, and even death. Equally troubling is the fact that children from marginalized groups within the

general population are exposed to more pollutants and are at higher risks of developing health complications, such as asthma, due to air pollution. While the prospect of finding solutions to the pollution crisis in impoverished communities occur very slowly, one thing seems evident is that school-based science has the potential to equip students with the knowledge and skills necessary for them to think and act on pollution issues as well-informed citizens would. The use of socioscientific issues (SSI) to teach scientific concepts has the potential to enhance students' abilities to use evidence to substantiate their claims during argumentation practices in the classroom settings. This, in turn, will increase critical thinking skills, and thus students' abilities to act. In this chapter, we will demonstrate to the science education community, policymakers, and practitioners how to use SSI to engage middle school students in evidence-based reasoning and the results that are achieved when this practice is implemented. Described below is the SSI unit we created, the teaching strategies we adapted, and the results we obtained from a group of middle school students in the northeastern United States who engaged in evidence-based reasoning on the effects of asthma on the health of marginalized populations. This chapter will:

1. Define what are socioscientific issues.
2. Describe the Understanding by Design tenets embedded within the SSI Unit of study to provide long-term achievement gains by students.
3. Discuss how the SSI Unit increased access to and mastery of science content, concepts, and inquiry skills critical for evidence-based reasoning.
4. Describe the population of learners and their unique characteristics.
5. Discuss students' findings and arguments on the disproportionate asthma cases in communities throughout the northeastern United States.

We hope this unit will show that through contemporary teaching methods paired with SSI, we can increase critical thinking skills of students as well as their abilities to make evidence-based decisions as well-informed citizens.

BACKGROUND

What Are Socioscientific Issues?

Socioscientific issues are those issues that are typically contentious in nature, can be considered from a variety of perspectives, do not possess simple conclusions, and frequently involve morality and ethics (Zeidler & Kahn, 2014). Examples of SSI include a range of dilemmas such as biotechnology, hydraulic fracking, environmental issues, health effects of diets, as well as genetic engineering (Sadler & Murakami, 2014; Zeidler, et al., 2009; Zeidler & Kahn, 2014). The SSI framework seeks to involve students in decision making regarding everyday social issues with moral or ethical implications embedded within scientific contexts (Powell, 2014; Yap, 2014; Zeidler, 2007). The disproportionate cases of asthma in underserved communities throughout the United States is a socioscientific issue. Teaching students about what asthma is, the causes, symptoms, and triggers of asthma, the prevalence of asthma in their communities, the relationships between socioeconomic status and the incidence of asthma, and potential ways to reduce asthma cases is best done through the use of socioscientific issues as a critical

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