Chapter 6
Enhancing Socioscientific Reasoning Through Nature of Technology

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ABSTRACT

Fostering informed Socioscientific Reasoning (SSR) is an essential component of developing scientific literacy. In this chapter, the authors suggest that enhancing Nature of Technology (NOT) understanding can be one way to leverage students' informed socioscientific reasoning. The authors describe a proposed NOT conceptual framework with four dimensions and detailed components, and present an analysis of students' reasoning of various socioscientific issues using this framework. Finally, the authors present the finding that NOT components were present in student discussions with varying levels of understanding. The SSR analysis reveals that students with NOT informed understanding can appreciate the integrated characteristics of technology, so as to make sophisticated decisions about science and technology that will change society in fundamental ways, for both better and worse.

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INTRODUCTION

Fostering informed Socioscientific Reasoning (SSR) is an essential component of developing scientific literacy (Davies, 2004; Kolstø, 2001; Romine, Sadler, & Kinslow, 2017; Sadler, Barab, & Scott, 2007; Sadler, & Zeidler, 2009; Zeidler et al., 2005). Science educators have implemented various strategies to enhance students' SSR. One of the conventional approaches was the Nature of Science (NOS) instruction in the context of socioscientific issues (SSI), which argues that understanding of NOS – an epistemology of scientific knowledge and its development – would influence the way students apply scientific evidence to SSIs. However, empirical findings in previous studies did not sufficiently support the relationship between NOS and SSR. For example, Bell and Lederman (2003) found that two groups of people who had different NOS views did not show significant differences in their SSR. Although Walker and Zeidler (2007) reported a significant increase in students' NOS understanding after implementing the NOS program in the context of SSI, students' actual discussions did not represent their NOS understanding.

In this chapter, the authors suggest that utilizing Nature of Technology (NOT) would be a promising approach to enhance students' SSR. One reason for considering NOT is that many cases of SSIs have been derived from cutting-edge technology and engineering with natural science. Examples of SSI are not limited to science, but also include technology and engineering; biotechnology (e.g., GMOs, vaccines, etc.), energy technology (e.g., nuclear power plants, renewable energy resources, etc.), and environmental engineering (e.g., pollution, reclamation, etc.). Indeed, specific examples of SSI often encompass aspects of technology. Another reason is that students spontaneously consider the impacts of technical artifacts in their lives and society to negotiate SSIs. They often regard technology as, "a solution for real-world problems," compare the advantages and drawbacks in the process of technology development, and consider "multiple stakeholders," including consumers and producers. It indicates that students might apply NOT aspects in SSI contexts. Moreover, NOT instruction would assist students in understanding what technology is, how technology is developed with social, cultural, economic, and other factors, how individuals and society interact with technology, and a Faustian bargain of technology. Effectively addressing these and multifaceted aspects of NOT would cultivate habits of thought and SSR for citizenship in society with advanced science and technology (Clough, 2013).

Understanding NOT, like NOS, has long been regarded as an integral part of scientific literacy (AAAS, 1990). However, there has been little research exploring the features of technology or how students and teachers in the fields of technology, engineering, or science education approach technology in the context of SSIs. This has not been the case for NOS, which has had its aspects and assessments of students'