

Societal Issues in Social Studies and Science Education: Promoting Responsible Citizenship

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Abstract

Pedagogies that promote authentic student involvement are increasing as communities continue to grow and to change. In this manuscript, teacher candidates in an elementary education methodology class involving social studies and science instruction became engaged in a Science, Technology, and Society (STS) planning investigation to understand the impact science and technology have on society. Involving teacher candidates in the Science, Technology, and Society (STS) process through focusing on the impact of a local development, the teacher candidates became engaged and began to understand the impact science has on the community. Through the planning process, teacher candidates became aware of the importance of implementing STS investigations with future classes of elementary students to promote scientific literacy and responsible citizenship.

Keywords: Science, Technology, and Society, social studies, community, scientific literacy, responsible citizenship

1. Introduction

Science-Technology-Society (STS) is defined as a curriculum that integrates economic, ethical, social, and political aspects with scientific and technological developments. STS principles demonstrate how personal and social perspectives are related to societal as well as community issues and presents information about how societal issues affect many members of the community.

The *National Science Education Standards* discuss the importance of students achieving scientific literacy (NSES 1996, p.21). “Understanding the relationship among science, technology, and society is essential for achieving basic science literacy” (Yager & Akcay, 2007, p.13). In addition, the *National Social Studies Standards* (NCSS) also includes a thematic strand specifically addressing how to incorporate science, technology, and society. According to *National Council of Social Studies* (NCSS), “an understanding of science and technology in their social contexts allows learners to question and analyze the impact of science and technology on society, both in the past and the present, as well to evaluate what the future may bring in these areas” (Adler, 2010, p. 150).

“The STS framework is based on an interdisciplinary constructivist philosophy that promotes the genuine and active engagement of students in the learning process” (Amirshokoochi, 2010, p. 57). Therefore, “the central premise of STS teaching is helping students develop the knowledge, skills, and effective qualities in order to take responsible citizenship action on science and technologically oriented issues” (Hassard, 2005, p. 400). Additionally, in the 2012, *A New Framework for K-12 Science Education: Practices, Crosscutting, Concepts, and Core Ideas*, present the idea that elementary students should be prepared to be responsible citizens in a complex and increasingly technologically rich world. Therefore, educators must present broad societal issues to in elementary classrooms. This article describes using the STS curriculum as a means for teacher candidates to learn about the importance of science, technology, and society and to see how to plan an investigation that would incorporate social studies and science.

2. Using the Four Phases of STS in the Undergraduate Classroom

Dass’s Four Phases of Science, Technology, and Society are presented to the teacher candidates. Dass’s four phases include (a) invitation, (b) exploration, (c) proposing explanations and solutions, and (d) taking action (Dass, 2005). Dass states, “Recent science education reform efforts have focused on science instruction that enhances student understanding of the nature of science, enables them to critically analyze scientific information as well as to apply it in real-life situations, and sets them on a path of life-long learning in science” (Dass, 2005, p. 95). After discussing Dass’s research and the four phases of Science, Technology, and Society, teacher candidates realize elementary students need to analyze real-life situation within the local community.

2.1 Invitation Phase

Teacher candidates begin by thinking about the connections between science, technology and society. Teacher candidates relate the STS information to a controversial vehicle manufacturing plant being built in the local area. Teacher candidates begin to realize the connections and interconnectedness between science, technology, and social education. Teacher candidates research and find an area newspaper article about the vehicle manufacturing plant. After a discussion about the newspaper article, it is extremely obvious that some teacher candidates have very narrow mindsets about the car manufacturing plant. Most of the teacher candidates’ attitudes are based solely on how the vehicle plant would impact the surrounding communities where they currently live. Some are optimistic about the situation having family members who were hopeful about job opportunities, while others are quite disgruntle due to family members being coerced into selling their land to allow room for the vehicle plant and highway systems.

During the invitation phase, teacher candidates return to the STS acronym and discuss how each one relates to the car manufacturing plant issue. For the science portion, conversations include the physics behind the construction of the plant such as gravity and force. Environmental science is explored through discussions about erosion including finding the correct soil type that exists where the facility is built and if additional soil is needed in the area. Life science is examined and teacher candidates became keenly aware of what wildlife would be affected by the construction of the plant. In addition, during post-construction of the plant, the teacher candidates examine the physics behind the vehicles that are produced at the plant.

For the technology portion of STS, teacher candidates include plans to guide students to the idea of “quality control” behind the vehicle manufacturing plant. The teacher candidates plan discussions about how the vehicle manufacturing plant mass-produces vehicles with a goal that all models would be exactly the same. In addition, teacher candidates include grand discussions about safety concerns and the technology used in testing the vehicles for safety and the crash dummies simulations.

Also included in technology portion is the importance of communication within the different departments of the plant.

At the car manufacturing plant, the Information Technology (I.T.) is of vast importance to share real time production data not only within the main factory, but also with supplier plants for scheduling and shipping purposes. While discussing the technology portion of the plant, teacher candidates begin to realize the importance of the marriage of science and technology for the success of the plant.

For the society portion, teacher candidates want elementary students to understand the big picture of how the plant affects more than what meets the eye. Plans are made to question elementary students and ask them to consider all the citizens as well as the important societal issues surrounding the car manufacturing plant. In addition, teacher candidates think about how in a community citizens engage in responsible civic action on issues and problems that face the community.

2.2 Exploration Phase

With a solid understanding of the meaning of STS and how it directly applies to the car manufacturing plant, teacher candidates plan to use a familiar science approach—inquiry learning. Teacher candidates plan a class discussion that includes guided inquiry. Questions such as these are planned for the elementary students, “What are the societal needs behind the plant?” “Why were the Community Development Foundation and the state governor aggressively recruiting the plant?” “Do they believe it would help make the state more industrial and provide a boost in economic growth?” Teacher candidates determine ways the elementary students could gather information from local resources and plan small group brainstorming activities including using resources such as: Internet, newspaper articles, journals, guest speakers, etc. Teacher candidates realize through all of the informational reading and research, elementary students would see how different citizens and organizations are affected by the vehicle manufacturing plant.

Next, teacher candidates plan discussions for students about the plant and how each group of citizens would be affected in both positive and negative ways. In addition, teacher candidates create an Observational Checklist to guide plans for the Open Forum where students would be involved in a role playing situation (see Appendix B).

2.3 Proposing Explanations and Solutions Phase

During the proposing explanations and solutions phase, teacher candidates plan class discussions for elementary students to brainstorm thoughts about which groups of citizens would be most affected. Each group of citizens affected by the car manufacturing plant would be charted. This list would include people such as (a) local business owners, (b) farmers/landowners, (c) environmentalists, and (d) new employees. Plans include having the elementary students divide into four groups that represent each group of citizens. After engaging in the topic, teacher candidates would include plans that encourage elementary students to synthesize information and form opinions about the plant and how each group would be affected (see Appendix B).

2.4 Action Phase

In the final action phase, teacher candidates include a role-playing activity where elementary students create a town meeting. Each group of responsible citizens presents the positive and/or negative views of how their group would be affected. One elementary student could portray a newspaper reporter and circulate around the room asking each group’s opinion. Group discussion activities include plans where students present either pro or con views in open forum. With these ideas in place, teacher candidates create a checklist as a valuable evaluation instrument to assess the group discussions (see Appendix B).

3. Conclusion

Dass’s Four Phases Approach of Science, Technology, and Society (Dass, 2005) successfully allowed teacher candidates to plan an inquiry investigation for social studies and science. Groups were able to take a stance and actively defend positions related to their own community and to appreciate the influence large companies have on society. The STS strategy allowed teacher candidates to gain a broader mindset and to realize the effect on the local community. Discussing global awareness and the importance of scientific literacy and how it affects society proved to be an important issue and teacher candidates realized the need to address these ideas with elementary students. Through the STS teaching approach, teacher candidates could see how vital issues such as the unemployment rate, energy crisis, environmental concerns, and health and medical ethics all relate to our growing population around the world.

By providing a local issue such as the vehicle manufacturing plant, teacher candidates were able to appreciate and consider all aspects and the impacts on the community.

Through planning this investigation, teacher candidates realized the interconnectedness of science, technology, and society. In addition, teacher candidates realized the importance of including projects for elementary students that uses a local community problem or societal issues.

Therefore, four goals were accomplished through the STS investigation. Through planning the STS investigation, the teacher candidates' successfully broaden their mindset to a view of how the plant affects all the people in the community as well as the state and even the nation. Secondly, with the broader mindset, teacher candidates understood the value and the importance of integrating science and social studies content in the elementary classroom. Thirdly, teacher candidates could see how societal issues impact the lives of everyone in society and realize when advancements in science occurs society is affected in many ways much as a ripple effect. Fourthly, teacher candidates could see how using issues that are socially and personally related to elementary students would serves as a way to promote responsible civic action in the local schools and communities (see Appendix C).

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Appendix A

Four Phases of Science, Technology, and Society (Dass, 2005)

Invitation	During this phase, students brainstorm, search, and select issues, questions, or problems (henceforth referred to as TOPIC) based on real life situations, which formed the basis for the rest of the explorations.
Exploration	Students explore topics in terms of two components: (1) Identifying critical questions that need to be addressed in order to explore the topic at the high school level; and (2) Gathering and analyzing scientific information and/or data needed to address their critical questions.
Proposing Explanations and Solutions	During the third phase, students synthesize information to formulate hypotheses, design explanations, and propose solutions.
Taking Action	Students propose explanations and solutions and take specific positions and suggest appropriate civic actions.

Appendix B

Observation Checklist: Open Forum

The groups:	Completed:
Decide on your group's title (landowner, farmers, business owners, etc.)	Title: 5pts.
Assign roles for each member	List all Members: 5pts.
Display relevant research during skits/role-playing	List all Research Facts: 10pt.
Interact with other groups in a respectful manner	List each Group Members' Role: 5pts
Teacher Comments:	____/25

Appendix C

Teacher Reflections

The STS approach is an excellent teaching strategy. It really made me think a lot deeper about the two subject areas of science and social studies. Beforehand, I only thought about job opportunities. Many of us neglected to think about all of the other people that would be affected by the vehicle manufacturing plant moving into our local community.
STS is an innovative strategy to use in the classroom because it helps students realize that they can become more involved in their community. Using this strategy would help students understand things that are going on around them in the community.
The STS approach is an excellent teaching strategy because it: 1) incorporates more than one content area, 2) engages students by giving students overall questions that makes them think, 3) creates hands on activities to set the learning into the students mind.
STS investigations helps students to realize the need for higher-level thinking about many different topics surround society, especially ones dealing with our community where they live.
STS is a beneficial teaching strategy because it allows students to be more involved in the community and aware of situations around them. This allows students to gain a deeper understanding of topics which increases interest and involvement related to important ideas in the community. Students would be allowed to express ideas without criticism and this would allow for a better educational experience.