Science and Controversy
Integrating Socially Sensitive Issues into the Science Classroom

Fatima Habash

Professor Percy
SCI 398 Y
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Introduction  
Scientific breakthroughs and deductions have manifested themselves beyond the stereotyped sphere of laboratories, textbooks and journals; finding themselves instead amongst the personal, ethical and cultural concerns of human beings. These breakthroughs are often translated into practical theories and are thus presented to the society through various channels, eventually reaching the curricula of educational systems and institutions. Teachers of science education are directed, by their given curricula, to provide students with an ‘acceptable literacy’ of science, and to in turn, pave the road for a future generation of responsible and well-informed voting citizens. Due to the governing role science and technology play in the day to day lives of human existence, a basic understanding of scientific concepts and theories is integral for human survival and progression.  

In a society which encourages a reflection of its diverse array of ethnic, racial, economic and religious make-up in its ideology, it is only natural to expect an absence of uniformity of thought. Many scientific issues are deemed socially sensitive due to their interference in personal and societal values, beliefs, ethics, economics and politics. While the list of socially sensitive issues is endless, several examples include abortion, euthanasia, cloning, animal testing, dissections, the origin of theories, the question of origins and many more. Scientific controversy is accordingly inevitable and should not be viewed negatively as it reflects a healthy societal state of independent and active thought and assessment of theories and their applications. Thomas Jefferson notes that
“Difference of opinion lead to inquiry, and inquiry to truth” (personal correspondence to P.H. Wendoues, March 13, 1815)

This paper strives to shed light on whether or not scientific controversy affords itself a seat in science classrooms. By indicating the possible teaching and learning obstacles associated with such issues, and offering possible solutions, this report strives to outline the complexities involved in incorporating socially sensitive issues in the science classroom. The importance of addressing controversial scientific issues in science classrooms is crucial, however difficult, and accordingly, these complexities ought to be overcome by all members of the science education team including teachers and those involved in curriculum development.

Misconceptions about the Nature of Science: Students, Teachers and Curricula

Many science courses fail to address controversial scientific issues in the effective and appropriate manner necessary for guiding voters of the democratic system to make well-informed and balanced decisions. By neglecting to teach students ‘how to think’, as opposed to ‘what to think’, the education system is digging an already deep hole. For the misconceptions held by teachers, students and curriculum developers of the scientific discipline with regards to the nature of science is creating an unwelcome barrier.

Teachers and curriculum developers of science education have in the past, and continue to, centralize science teaching and learning on content and theory, leaving little to no room for discussion of the relevance and applicability of science to society. Research performed by an interdisciplinary team from the Institute of Education in the University of London found that “[a] large proportion of teachers across the curriculum perceive the teaching of science to be about the delivery of facts, and not about values,
opinions or ethics. Almost half of all science teachers interviewed feel that their teaching of science should be ‘value free’- that it does not yield issues that have social or ethical implications. Others inferred that considering the ethical and social concerns raised by science might undermine the integrity of the subject overall” (Levinson et al., 2001).

On the other hand, the study also shows that “[t]he majority of all teachers interviewed felt strongly that students should have an opportunity to explore such issues. Teachers view this kind of exploration as vital in building self confidence, developing lines of critical thinking and enabling students to deal with socio-scientific issues in a balanced way. They also consider that it engenders sensitivity towards the rights and needs of others” (Levinson et al., 2001). Students are not however provided with this opportunity in the science classroom since curricula – for both science courses and teacher preparatory courses- do not direct, assist or equip teachers with the tools and skills necessary to deal with scientific controversy.

The vacuum alluded to in curricula reflects the misconceptions held by curriculum developers regarding the necessary elements of science education. For a concern on the developer’s part, regarding the incorporation of controversial scientific issues is expected to echo in the curricula. These concerns would for instance resonate through professional development for teachers, the production of appropriate educational materials, clearer guidance from awarding bodies and with greater flexibility in their teaching.

On the student’s end, science is predominantly deemed as infallible and indisputable. Accordingly, when students are faced with situations whereby strongly
held personal and religious values conflict with the science they learn in school, they may
feel lost and confused, or alternatively, become emotionally and psychologically
unsettled. Table 1 (Appendix A) lists the various misconceptions students have about the
nature of science.

In order to ensure that students have the opportunity to ‘make sense of’ and take
educated stances on socio-scientific issues, teachers and curriculum developers must
reconsider their preconceived notions about the nature of science and what counts as
scientific literacy in the classroom. Since the chains linking science and society are so
strong, emphasis should be placed on dealing with STSE (Science/Technological/Social/
Environmental) issues in the classroom.

Taboos and Noas: The Need for Guidelines

The term ‘taboo’ refers to the beliefs or notions that “constrain action by making
those behaviours perceived as threatening by the members of the social group forbidden
and improper for discussion. In other words, taboos are constructed by the social group
to control behaviours that threaten the culture’s belief structures” (McGinnis et al., 1998).

With regards to discussing socially sensitive issues in the science classroom, ‘taboos’
refer to issues teachers shy away from as they perceive them to be matters of an
unspeakable, inappropriate and almost forbidden nature. This perception is expected to
stem from the overwhelming exclusion of controversial scientific issues in the
curriculum, and rightly so, as Figure 1, (Appendix A) indicates.

A less familiar term, ‘noa’ is defined as “those instructional topics that teachers
generally perceive as not forbidden and as proper topics for discussion in local culture”
(McGinnis et al., 1998). The current report suggests that topics of ‘noa’ status are not
perceived as threatening at all and are often factual and theoretical in nature, leaving secondary, if any room for controversial potential.

To continue with the extension of terms to controversial science, it is unaccidentally telling that the term STSE clusters issues of science, technology and society together. Members of the science education team need to realize their responsibility of specifying clear guidelines for science teachers, particularly in the realm of controversial scientific issues. This form of action will by no means undermine the teacher’s sense of judgment. Instead, the need to set clear guidelines for teachers to work from highlights the truly sensitive nature of such issues, and is sure to relieve some pressure from the teacher.

Dealing with Controversial Science: The Teacher’s Stance

While many science educators realize the importance of dealing with socio-scientific issues in the classroom, they are quite frequently uncertain of the stance they ought to take in presenting such controversial scientific topics. For in addition to equipping students with the knowledge and decision making skills necessary, teachers must maintain a certain level of professionalism as they are questionable (principally) to administration and parents. In addressing socially sensitive issues, teachers can really assume one of two stances, either enacting the role of a neutral mediator or playing the equally active role of a committed participant.

The former of the two alternatives apparently provides the teacher with the ability to assume an objective position, leaning on neither side of the fence. If in this situation the teacher is concerned about involving his or her subjectivity into the teaching and learning processes, studies by Southerland et al. suggest that he or she looks closer.
Some teacher education researchers have focused on the “intersection of classroom practice and [the way] teacher[s think] about practice. As such, much of the thinking they focus on—what a teacher knows of her practice—must be defined in highly subjective, personal terms” (Kagan, 1990) and thus would be considered beliefs. However, teacher thinking can also have a significant empirical component and so could be considered knowledge. Recognizing this complexity, teacher education researchers describe teacher thinking as having a basis in both knowledge and belief and recognize that these two constructs are ‘intertwined in ways that may not be precisely disentangled but should never-the-less be acknowledged’ (Woodbury, Submitted)” (Southerland et al., 2001). Accordingly, it appears that even nua science, that of the factual and theoretical nature, is presented subjectively.

Given that the teacher still maintains the former stance of neutral mediator, one cannot help question the message teachers unintentionally impart to students regarding the importance of formulating an informed opinion. Enacting such a role is certainly successful in placing all students on equal footing, as no one student feels intellectually superior to the other on the basis of the teacher ‘siding with him or her’. The teacher or educator must still, however, assess his or her position as role model and realize how loud his or her actions speak.

Having discussed the mediator option, the teacher’s choice to actively engage as a committed participant, is also a viable alternative. This stance certainly addresses the concern raised about the teacher passing as role model, for in so doing, students are provided with a direct and living decision-making exemplar. Nevertheless, particulars of this stance can also be complicated and problematized. For students adopting or
advocating for positions other than that of the teacher may feel somewhat threatened, fearing having jeopardized their grades.

Regardless of the stance the teacher chooses to employ, he or she must recognize—and meet—his or her goal of guiding students to realize and respect the diversity of opinion revolving around socio-scientific issues. In order to achieve this goal, the teacher must, through example, show students the importance of investigating and considering the various sides of the issue at hand, and to, following opinion formulation, continue to respect others. Irrespective of the teacher’s own opinion, he or she must still ensure that students are familiarized with and fully understand the scientifically acceptable stance on the issues being addressed. For “[b]y using acceptance of a theory as the best scientific explanation currently available, [the teacher] is emphasizing that the recognition of the validity of a scientific theory is not simply a matter of personal opinion, thus providing a strong contrast with belief” (Southerland et al., 2001).

Upholding Ethics, Values and Beliefs in the Science Classroom

By providing their students with an unanimously accepted stance amongst members of the scientific community, teachers risk sending belittling and undermining messages about strongly held ethical, moral and religious values. Students may, in addition, accuse the teacher of “attempting to indoctrinate their students”. Equally worrisome, teachers risk discouraging students from thinking for themselves about moral issues. In any case, whether or not they agree with their teacher’s pronouncements, students may soon become more interested in their teacher’s answers than in the reflective process itself; after all, they may think, to get a good grade one must satisfy the
teacher’s expectations—which, in this case, is to come up with what the teacher thinks are the “right answers” (2004).

In order to avoid such situations, teachers can indicate that students will not be assessed on the ‘correctness’ or ‘incorrectness’ of their conclusions about the moral issues the class is considering. While the scientific community may in fact possess the right or wrong answers, the point of including such issues in classroom discussion is to encourage students to think about the issues carefully, to assemble and organize (difficulty defined) ‘relevant’ facts as best they can, to support whatever conclusions they draw with the best reasons they can come up with, and to carefully consider and respect alternative viewpoints suggested fellow classmates.

The On-Line Ethics Center asserts that teachers need to keep in mind, particularly in addressing socio-scientific issues, that “there are many terms of evaluation other than ‘right/wrong’. Our views can be carefully formulated/carelessly formulated, articulate/inarticulate, well informed/poorly informed, consistent/inconsistent, coherent/incoherent, and so on” (2004).

The Academic Controversy Model

The ‘academic controversy model’ was put to test by Monhardt et al. and proved to be a successful activity to execute in dealing with scientific controversy in the classroom. This model employs, and in fact necessitates, a working knowledge of science in order for students to logically present an argument for a specified stance on an issue. Monhardt et al. assert that using this model can sway students “from an egocentric view to accommodations of the perspectives of others. By acquiring content knowledge necessary to understand the issue and understand the opposing viewpoint” the
author insists that can not only “learn about science but also can learn a constructive way to resolve conflict” (Monhardt et al., 2000).

This model is a form of intellectual debate similar to deliberation, for it too is based on a difference of ideas and opinions. There is however one distinctive characteristic of this model which conflicts entirely with debate, and that is, there is no winner or loser. The academic controversy model instead requires in-depth reasoning and a conclusive ‘joint proposition’ on all sides of a particular issue, following the formulation of well developed best evidence lists. This model was proposed by Johnson and Johnson (1995) and is comprised of the following five step process:

1. Researching and preparing positions.
2. Presenting and advocating this position.
3. Open discussion and challenging of the opposing side’s argument.
4. Reversing perspectives and presenting a “best case” for the opposing position, while trying to see the issue from both perspectives simultaneously.
5. Synthesizing best evidence and reasoning from both sides into a joint position statement.

The detailed study, as mentioned earlier, yielded successful results and highlighted the models ability to “engage students in a science topic by generating interest and ownership, to help students learn science concepts because they need to know them, and also to help students learn to work with others in a situation where all parties may share differing opinions on issues” (Monhardt et al., 2000). These outcomes are evidently important for both the teaching and learning of science, but also offer
students the life skills necessary to develop “scientifically literate citizens who are able to resolve conflicts in a productive and intelligent manner” (Monhardt et al., 2000)

**Concluding Remarks**

Contemporary society is marked by controversial scientific and technological developments and is characterized by social tensions. These tensions often arise at levels of personal and ethical standing, occurring, for example, between individual rights and social aims, political priorities and environmental values and economic interests versus health concerns. The inevitable union, or lack thereof, between science and society accordingly affords itself a front seat in science classrooms. For science education’s overarching goal of providing students with ‘acceptable’ literacy can only be achieved by enriching student knowledge with a two-sided coin. On one side, the theoretical and factual aspects of science prevail, while on the other, equally relevant socio-scientific issues reside. Members of the science education team need to realize, and act upon, the necessity of integrating both sides of this one coin into the science classroom as they guide the progression of a successful group of citizens.
Appendix A
### Table 1
Common myths about the nature of science (after McComas, 1998)

<table>
<thead>
<tr>
<th>Myth</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypotheses become theories which in turn become laws.</td>
<td>Laws are generalisations or patterns. Theories are explanations of those generalisations.</td>
</tr>
<tr>
<td>Scientific laws and other such ideas are absolute.</td>
<td>Scientific laws have limitations and can be subject to revision.</td>
</tr>
<tr>
<td>A hypothesis is an educated guess.</td>
<td>Hypothesis could mean a ‘generalising’ hypothesis (which might become a law); an ‘explanatory’ hypothesis (which might become a theory); a prediction.</td>
</tr>
<tr>
<td>A general and universal scientific method exists.</td>
<td>No research method is applied universally. Scientists approach and solve problems with imagination, creativity, prior knowledge and perseverance.</td>
</tr>
<tr>
<td>Evidence accumulated carefully will result in sure knowledge.</td>
<td>It is impossible to make all possible observations and to secure facts for all time.</td>
</tr>
<tr>
<td>Science and its methods provide absolute proof.</td>
<td>Accumulated evidence can provide support for a law or theory but never prove them to be true.</td>
</tr>
<tr>
<td>Science is procedural more than creative.</td>
<td>It is the creativity of individual scientists which allows them to go beyond the evidence and develop laws and theories.</td>
</tr>
<tr>
<td>Science and its methods can answer all questions.</td>
<td>Science cannot answer moral, ethical, social, aesthetic questions.</td>
</tr>
<tr>
<td>Scientists are particularly objective.</td>
<td>Scientists are no different in their objectivity than other professionals. They do try to be careful in analysis of evidence.</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Experiments are the principal route to scientific knowledge.</td>
<td>Scientific knowledge is gained in many ways including observation, analysis, speculation, library investigation and experimentation.</td>
</tr>
<tr>
<td>Scientific conclusions are reviewed for accuracy.</td>
<td>The number of findings from one laboratory checked by others is small.</td>
</tr>
<tr>
<td>Acceptance of new scientific knowledge is straightforward.</td>
<td>If an idea is a significant breakthrough or change, its acceptance is by no means quick or easy.</td>
</tr>
<tr>
<td>Scientific models represent reality.</td>
<td>Scientific models are created to describe aspects of the natural world and are useful in giving predictions and explanations.</td>
</tr>
<tr>
<td>Science and technology are identical.</td>
<td>Pure science is the pursuit of knowledge for its own sake. Technology, or applied science, is exploitation of science.</td>
</tr>
<tr>
<td>Science is a solitary pursuit.</td>
<td>Scientists work in teams.</td>
</tr>
</tbody>
</table>
Figure 1. Curriculum and Textbooks
Note: SAgree=strongly agree, DAgree=disagree, SDA= strongly disagree, and No Op.=no opinion. Statements are as follows:

1. I believe that social issues should be integrated into the current science curriculum.
11. The majority of my curriculum is derived from a textbook.
14. The current science curriculum being taught in my school provides students with valuable information on social issues.
20. My current curriculum includes social issues.
25. I must follow a very strict curriculum set up by the district.
27. Science/technology/society/environment (STSE) has been implemented in my personal curriculum.
28. I feel that textbooks adequately cover social issues.
34. My lesson plans incorporate social issues that my students are interested in.
36. I consider the backgrounds and cultures of all my students when preparing lessons concerning social issues.
37. My curriculum integrates current world affairs.

(Pedersen and Totten, 2001)
Bibliography


Integrating skills can help students transfer skills, e.g., if students have to read a blog post before writing their own they’ll become familiar with the structure and content which will help them write it. It also allows you to vary your activities in class, creating a more engaging and motivating experience for students. How to Integrate the four skills. Perhaps the easiest way to start integrating skills in your class is by combining the receptive and productive skills which are used across the same medium. Oral medium: Listening and Speaking. Try a simple yet fun activity like Telephone. Please contact the form owner to correct this issue. Please check the field: Let us know which updates you’d like to receive Social Science. Top subcategories. Advanced Math. Consumer Anxiety Translates into Focus on Sensitive Groups Thus, changing values are shaping new consumption patterns and purchasing motives throughout America. Consumers have responded to “green marketers” at varying rates. Yet, in a recent survey, over 93 percent of those surveyed consider protecting the environment a very important factor in their decision to purchase a product (Manly, 1992). The second view is that some sensitive groups and social issues experience a life cycle. This results from the media collectively popularizing a particular group and social issue. Keywords: Evolution education; controversial issues; sensitive issues; creationism; intelligent design Word count: 7227 (including Abstract and References) Evolution education: treating evolution as a sensitive rather than a controversial issue The importance of evolution education for schools Evolution education raises issues for education that are of conceptual interest and have practical significance. These issues include the aims of schooling, how we arrive at knowledge that is reliable, and how schools should deal with issues that raise difficulties on the grounds of their controversy or sensitivity. Controversial issue assignments increase critical thinking skills and appreciation of cultural diversity. A 2003 evaluation of students given a controversial issue assignment found that: 98.25% “agreed, strongly agreed, or very strongly agreed” that “they were more sensitive to the concerns of people from diverse populations” after completion of a controversial issue assignment. 9.6% “agreed, strongly agreed, or very strongly agreed” that “their knowledge about a population other than their own had increased.” Discussing current events and debating controversial issues are associated with higher scores on the National Assessment of Educational Progress (NAEP), the largest national standardized test in the United States. An Apr. Incorporate different perspectives into lessons. It doesn’t take much time to mention facts that would interest all of your students. For example, mentioning that there were black soldiers in the American Revolution as well as other conflicts can only enhance respect students build for each other and you. However, teachers who viewed intelligence as malleable demonstrated less bias and treated students more equally. In conclusion, to engage in best practices, teachers should encourage administrators to make cultural responsive training a part of ongoing professional growth and be willing to implement techniques which are evidence-based in the classroom. Ironically, culturally responsive teaching as a norm must be integrated into the culture of the school. References.