How Can the History and Philosophy of Science Contribute to Contemporary U.S. Science Teaching

Friday, 07 December 2012

Sponsored by the National Science Foundation's Division of Research on Learning in Formal and Informal Settings under REESE grant 1205273. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Organized by the School of Education and the Center for Philosophy and History of Science at Boston University.

Ethics in the Science Classroom: Outcomes with Students

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12/7/2012 How Can HPS Contribute to Contemporary U.S. Science Teaching?

NWABR

Promoting an understanding of biomedical research and its ethical conduct

NWABR Professional Development


Ethics in the Science Classroom
Tully's Green Cup is 100% Compostable

BIOETHICS

Students Learn How, Not What, To Think About Difficult Issues

A novel bioethics program trains teachers to help students confront challenges in the classroom—and in their lives

As a student, Rosetta Lee had mixed feelings about animal dissections. Now a science teacher, she gives her students the choice to opt out. That policy used to foster some unruly behavior in her classroom at Seattle Girls' School, a private middle school in downtown Seattle, Washington, where she's taught for 8 years. Those who chose not to dissect a chicken leg would often taunt their classmates with accusations of animal cruelty, whereas participants were "carelessly playful" and waved around pieces of chicken fat.

Not anymore. Thanks to a novel program that trains secondary school teachers in bioethics, Lee now prepares students with carefully guided classroom discussions exploring the potential benefits and harms of dissection. Lee can see the effect on her students: Those who choose to participate in the dissection are more studious and respectful, and those who abstain are less judgmental.

The program, sponsored by the Northwest Association for Biomedical Research (NWABR) and the University of Washington (UW), has taught Lee and other teachers how to help students think more critically about ethical issues inside and outside the classroom, such as the appropriate uses of genetic testing and the acceptability of stem cell research and genetically modified foods. That's an increasingly important skill, say science educators. "It would be a great thing for our society to have people who are more prepared to engage with these bioethical problems at that level," says Bruce Fuchs, director of the Office of Science Education at the U.S. National Institutes of Health (NIH) in Bethesda, Maryland. Teaching bioethics may even whet students' appetites for science itself, says Jeanne Ting Chowning, the director of the NWABR program and a former high school biology teacher. "Students often ask, 'Why do we have to learn this?' " Chowning says. "This is one way to show them … why it's important to understand science."

Serious play. Science teacher Jamie Cooke and Mercer Island (Washington) High School students use Play-Doh to model stem cells in a developing embryo as part of a class discussion.

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Beyond gut feelings

Science teachers typically get very little guidance on how to approach bioethics, says Chowning. "A lot of biology textbooks give you a really interesting scenario and maybe a few discussion questions and say, 'Discuss this with your class.' " That's a terrifying prospect for many teachers, Chowning says. "They're afraid it's just going to erupt into 'my opinion versus your opinion.' "

One of the first efforts to give teachers the tools they need was funded nearly 20 years ago by Roche Pharmaceuticals. Working with the Hastings Center, a bioethics research institute in Garrison, New York, the New Jersey Science Supervisors Association (NJSSA) developed a bioethics curriculum that includes case studies and classroom guides. Although the materials are still in use, much of it "was developed by ethicists who haven't been in a high school classroom since they themselves were in high school," says Lola Szobota, a district science supervisor in northern New Jersey who co-directs the NJSSA program and serves as an adviser to NWABR.

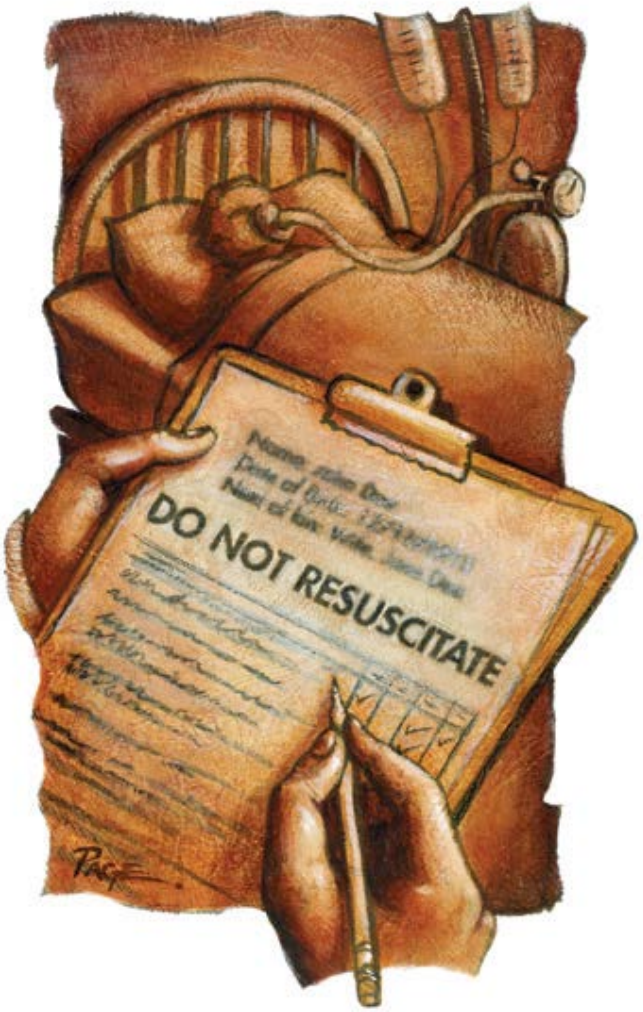
Chowning and colleagues wanted to build on that effort, which was restricted to New Jersey teachers. In 2003, they received a 5-year, $1.5 million Science Education Partnership Award from the National Center for Research Resources, a component of NIH, to develop a primer and other materials for teachers and run summer training workshops. Last month, they received notice of a new grant for $1.3 million, with the aim of developing additional materials and training for teachers and expanding the program's reach.

The primer (downloadable at www.nwabr.org/education/index.html) provides a step-by-step process for ethical decision-making. In Lee's class, that means helping her students identify the ethical question (to dissect or not to dissect); examine relevant facts about the planned lab, including what they might expect to learn from a dissection that they couldn't learn from a book; consider different perspectives; and weigh the possible courses of action.

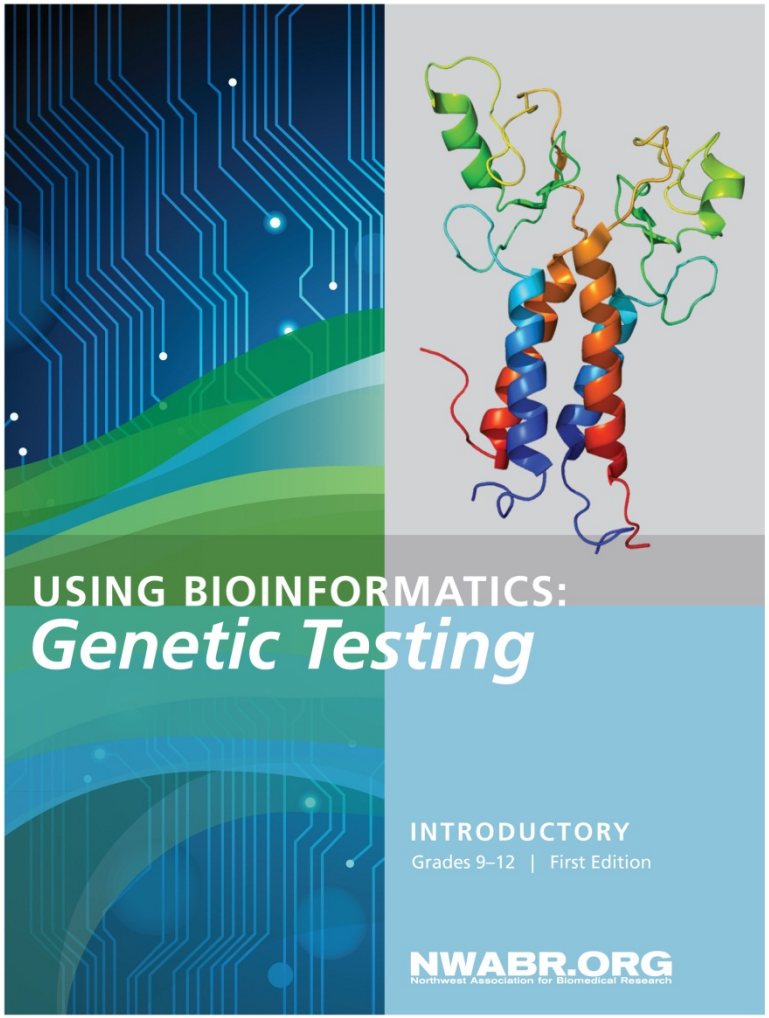
Chowning and colleagues have also published curricula on stem cells and on HIV vaccine research, and there's one in the works on genetic testing for nicotine addiction risk in collaboration with UW's Department of Genome Sciences. The stem cell curriculum, for example, begins with a lesson on the biology of stem cells and a lab exercise in which students experiment with *Planaria* flatworms, whose stem cells enable them to regenerate when cut into pieces. In later lessons, students delve into how scientists obtain embryonic and adult stem cells and discuss a case study in which a couple who conceived two

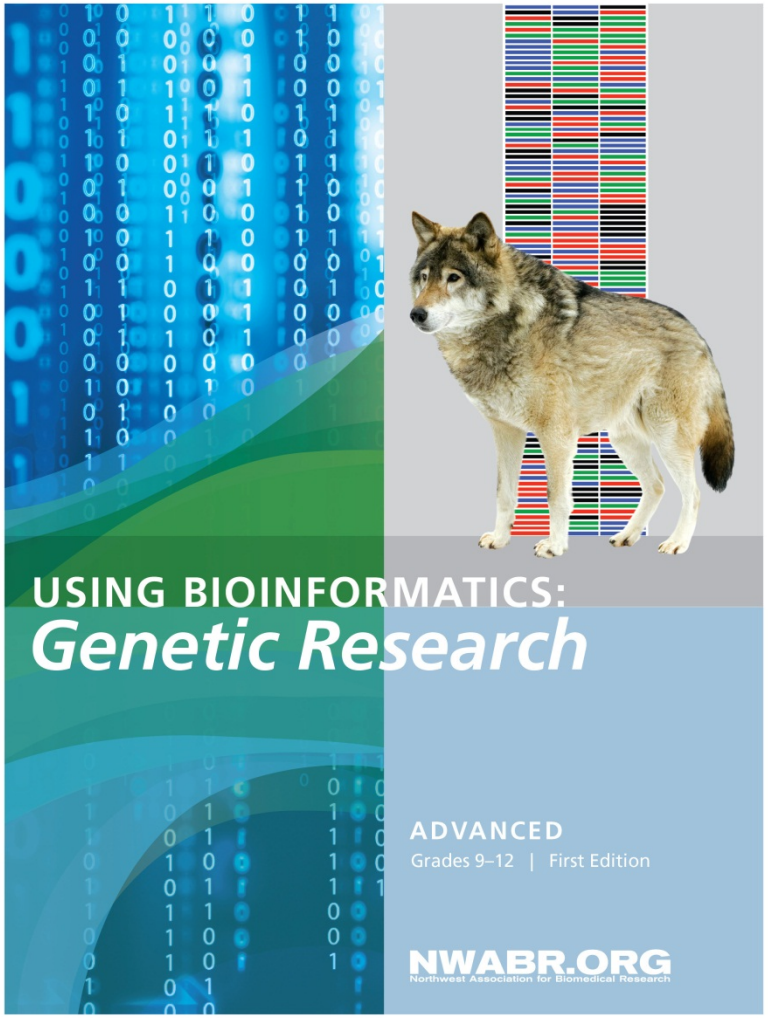
- Over **4000 teachers have received Ethics in Science professional development** from NWABR since 2003
- Over **200** of these have participated in **2-week intensive workshops**
- We foster **teacher leaders** and a **professional community** through ongoing contact

NWABR Curriculum Resources



NWABR Curriculum Resources





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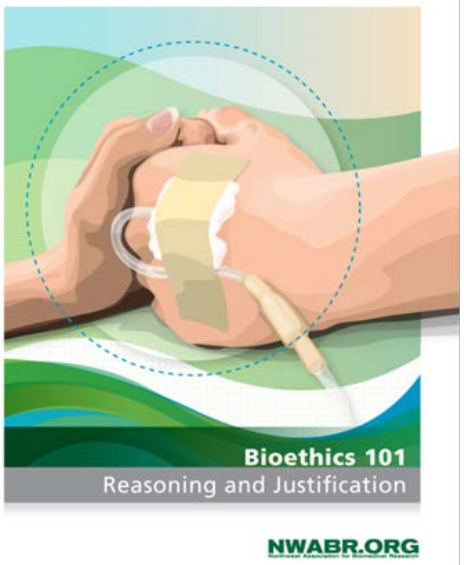

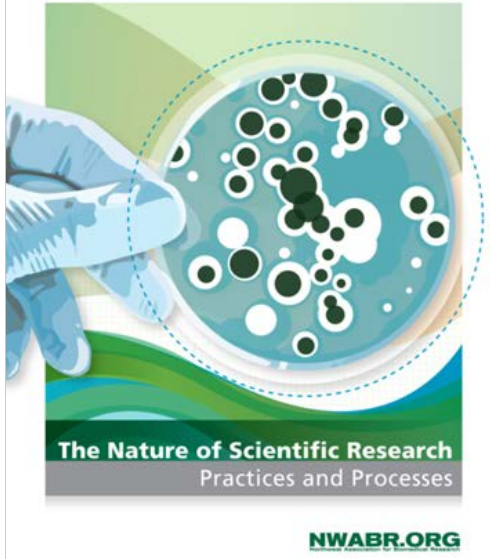

RESEARCH ARTICLE OPEN ACCESS

Fostering Critical Thinking, Reasoning, and Argumentation Skills through Bioethics Education

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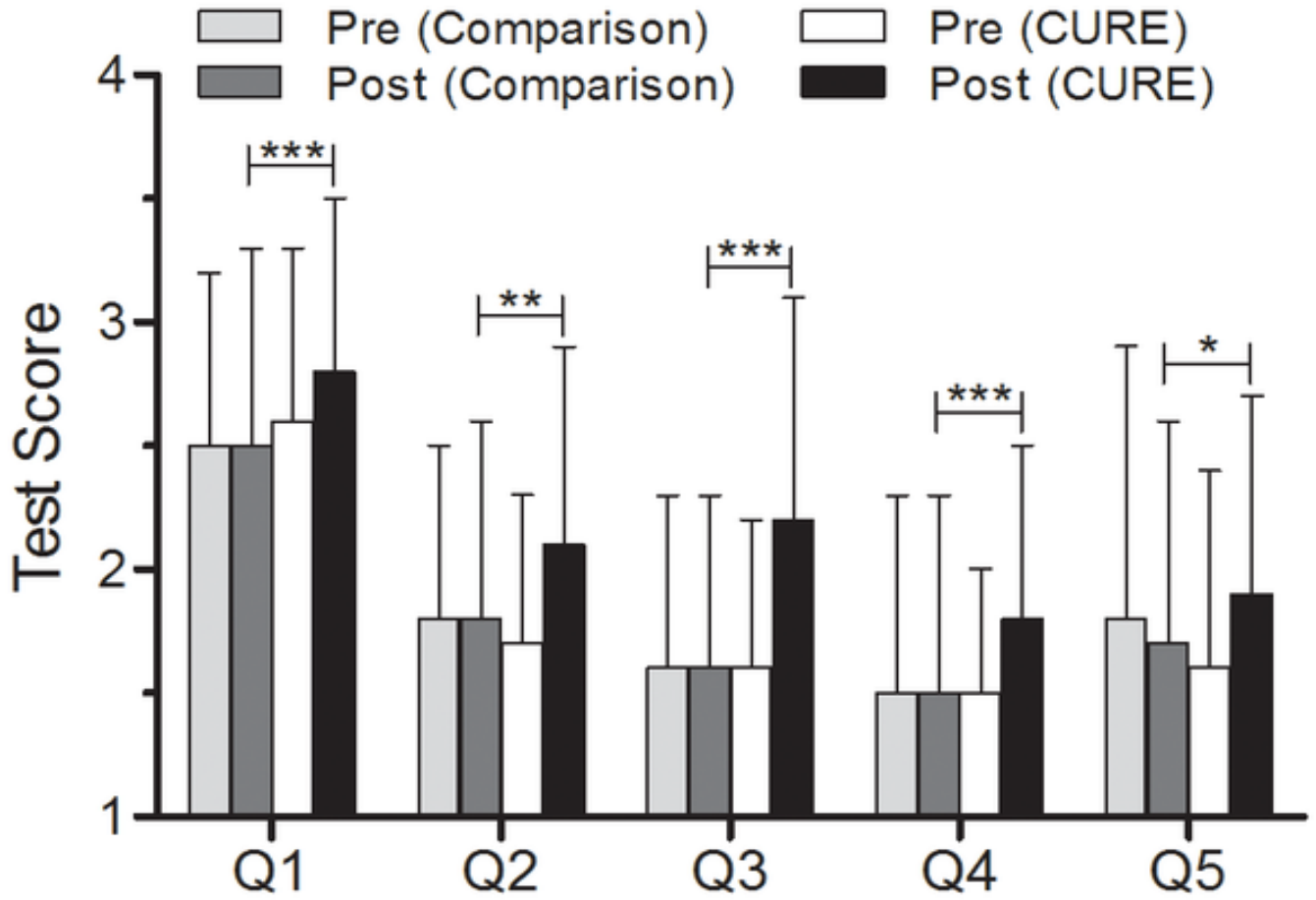
Abstract Top

Developing a position on a socio-scientific issue and defending it using a well-reasoned justification involves complex cognitive skills that are challenging to both teach and assess. Our work centers on instructional strategies for fostering critical thinking skills in high school students using bioethical case studies, decision-making frameworks, and structured analysis tools to scaffold student argumentation. In this study, we examined the effects of our teacher professional development and curricular materials on the ability of high school students to analyze a bioethical case study and develop a strong position. We focused on student ability to identify an ethical question, consider stakeholders and their values, incorporate relevant scientific facts and content, address ethical principles, and consider the strengths and weaknesses of alternate solutions. 431 students and 12 teachers participated in a

Growth in Student Justification and Analytical Reasoning Ability

(N=431)



Q1 - What is your decision?
Q2 - What facts support your decision?
Q3 - Who will be impacted by the decision and how?
Q4 - What are the main ethical considerations?
Q5 - What are some strengths and weaknesses of alternate solutions?

Interest and engagement with science content

"Students were engaged and interested - great way to talk both about science content and about issues that affect all of us in our daily lives..."

Analysis and critical thinking skills

"Students learned and went through the process of thinking through and making valid arguments...The critical thinking skills they gained were invaluable."

Awareness of ethics and ethical issues

"They are able to understand the complexity of ethical issues in our global society."

"Students are aware of ethical dilemmas and actually start discussions on their own."

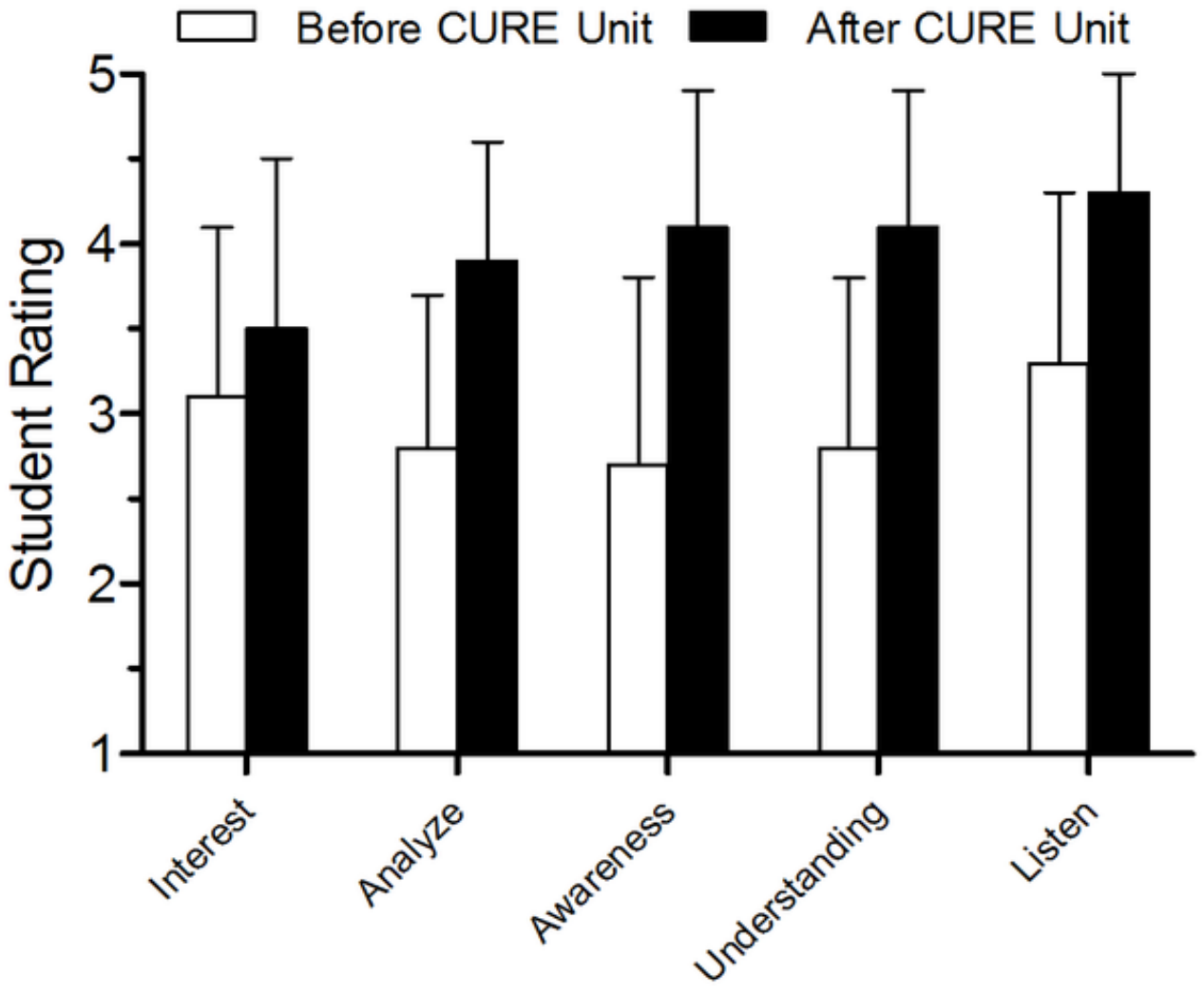
Understanding connections between science and society

"The greatest successes have been seeing awareness dawn on students about the impact science has on everyday life."

Discussion Skills - Ability to Listen to Different Viewpoints

"Students became more open minded about other opinions, and felt secure being able to openly discuss their opinions."

Student Perceptions about Participation in the NWABR Ethics Unit (N=308)



Chowning JT, Griswold JC, Kovarik DN, Collins LJ (2012) Fostering Critical Thinking, Reasoning, and Argumentation Skills through Bioethics Education. PLoS ONE 7(5): e36791. doi:10.1371/journal.pone.0036791
http://www.plosone.org/article/info:doi/10.1371/journal.pone.0036791

PLoS one

Thank You!

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD

Supported by the National Institutes of Health

Funding provided by Collaborations to Understand Research and Ethics, Science Education Partnership Award, National Center for Research Resources, National Institutes of Health and Bio-ITEST, Innovative Technology Experiences for Teachers and Students