

Science and Society:  
**G.M.O.**  
genetically modified organism  
**FOODS**



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# MLL

middle level learning

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**ABOVE:** A TV correspondent interviews "anti-Bt brinjal activists" (dressed as eggplants) standing outside a public hearing in Bangalore, India, in 2009. The Indian government's decision to allow commercial release of a genetically modified vegetable—after pronouncing it safe for human consumption—stirred up such controversy that the government was compelled to back down and seek wider public comment.

Citizens must learn some science before they can intelligently engage in such a policy debate. The vegetable "brinjal" is also called eggplant. The soil bacterium *bacillus thuringiensis* (Bt) produces a toxin repellent to insects. Genetic engineers at Monsanto/Mahyco have placed Bt genes within the cells of the eggplant so that it too can produce this toxin, which reduces insect damage to the crop. (Infoeco at [commons.wikimedia.org](http://commons.wikimedia.org))

**ON THE COVER:** Plant physiologist Grace Chen removes castor bean pods to test for genetic transformation. Photo by Brian Prechtel, Agricultural Research Service, USDA.

### Middle Level Learning

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# Evaluating the Social Aspects of Scientific Innovation: An Interdisciplinary Inquiry

Courtney Ferrari

Students often view science and social studies as separate and unrelated courses. After all, that’s usually how they are taught. However, integrating these subjects offers opportunities for critical thinking about complex, real-world issues. It can help students understand how both scientific innovations and social concerns inform public decision-making.

After attending a teacher training workshop with the Classroom Law Project in 2007, I saw the opportunity to merge civics lessons with controversial topics in biological sciences at Valley Catholic Middle School in Beaverton, Oregon.<sup>1</sup> Eighth grade students could consider ethical questions arising from scientific innovation and debate some of these questions in a “public hearing” before a panel of invited guests.

For four years, I have teamed up with a science teacher to make this unit of study happen. Ethical issues our students have grappled with include the use of stem cells in medical research and therapy; the creation of genetically modified organisms in agriculture; and the use of performance-enhancing drugs in sports. When my science-teaching partner and I first presented this unit of study to our peers, we were met with silence, followed by gently worded doubts about the scope and difficulty of such a project for eighth graders. Since then, 240 of our students have participated in the project, and many say it was the best thing they did in middle school. I encourage teachers to choose a current controversy related to the curriculum . . . and let your students surprise you.

The idea to cross the traditional curricular boundaries has wide support among educational organizations. NCSS states that teachers can “prompt learners to evaluate various policies proposed to deal with social changes resulting from new technologies . . . and to formulate strategies and develop policy proposals” pertaining to science, technology, and society.<sup>2</sup> The National Science Education Standards also recognize the importance of public decisions on new research and technologies. “Decisions involve assessment of alternatives, risks, costs, and benefits and

consideration of who benefits and who suffers, who pays and gains, and what the risks are and who bears them.”<sup>3</sup>

## Putting Knowledge to Use

In the following five- or six-day collaborative unit of study, our eighth grade students:

- Research a current controversy arising from scientific innovation
- Analyze and adopt the views of various stakeholders
- Research the role of government in regulating the technology
- Hold a mock public hearing
- Present some of their learning to an adult audience

This unit of study is intended as a joint project between teachers in the sciences and the humanities, although a motivated teacher in either field could carry out the activity in a single classroom. The subject of language arts is also involved, as students communicate their ideas in a public hearing and write individual views in a persuasive essay. With two or three collaborating teachers (social studies, science, and language arts), the project has the potential to maximize student learning in a week-long unit of study. By studying an issue’s scientific background and how it affects society, students gain a broader understanding of the topic and the realization that all academic subjects link with and build upon each other.

This year-end activity calls upon students’ prior knowledge from the eighth grade curricula in both social studies and science.<sup>4</sup> The civics curriculum at this level includes the interaction of the three branches of government, for which our project gives real-life examples. Students should understand that legislative committees depend on information from executive departments

## Sidebar 1: Selecting a Topic (Science & Society)

Use students' science curriculum and interests to choose a topic and a main question. The phrasing of the question should be broad enough to allow for student exploration and narrow enough to offer direction. Change topics and questions annually as new information or technologies become available.

Certain topics may strike a nerve in your community. Consider discussing your choices with your supervisor first and approach any topic with sensitivity. Stem cell research has been the most challenging of our topics, but the one most students select because they *want* controversy. However, as scientists find viable alternatives to embryonic stem cells, much of the discussion has shifted from the rights of the unborn to the effectiveness of those treatments.

### Biomedical Science

- As genetic technology improves, should the government screen newborn children for genetic diseases or defects?
- Should the National Institute of Health loosen its regulations on research involving cloning to produce stem cells?
- In light of the recent developments in stem cell research, should the government modify the current regulations on stem cell research?
- Should the government change regulations on animals being used for various forms of research (e.g. biomedical, cosmetic)?
- Should government impose stricter regulations on performance-enhancing drugs?

### Agricultural Science

- Should government forbid or restrict certain persistent and toxic pesticides for agricultural use?
- Should the government restrict the use of fertilizers to reduce nitrogen and phosphorus pollution of waterways?
- Should the government require dairy products to be labeled if the cattle were treated with artificial bovine growth hormone?
- Should the federal government ban the use of non-therapeutic antibiotics in pigs?
- Should the government tighten regulations on CAFOs (confined animal feeding operations) due to their impact on water, labor, property values and animal treatment?

### Environmental and Physical Science

- Should endangered species status be extended to polar bears, elevating their protections from the current status of threatened?
- Should the Environmental Protection Agency (EPA) declare carbon dioxide a pollutant, and therefore be empowered to regulate carbon emissions?
- Given the earthquake damage to Japan's northern nuclear reactors, should the government change regulations for reactors in the United States?
- Should the government continue to fund space exploration through NASA or divert funds to other programs?
- Should the government regulate the use of plastic bags?
- Should the government invest in alternative forms of energy?

when considering bills, and that those bills may become laws that dictate the actions of those same departments. New bills are often inspired by conflicts that the courts attempt to resolve. After new laws are enacted, the courts may rule on aspects of their enforcement, and even on their constitutionality.

The life science curriculum prepares students for this project with a background in cell structures and biological processes. In preparation for a science fair held at the school, our students learned how to research a scientific topic. If students at your middle school learn physics or earth science in eighth grade, there are other current event topics that will suit your subject matter and build upon the knowledge that students bring to the classroom.

### Selecting a Topic

Teachers should choose a topic that is currently in the news, controversial and unresolved, of interest to the age group, and calls upon knowledge that students have learned this year. (SIDEBAR 1). One of the reasons that I haven't had trouble finding adult guests to serve as guest panelists is that I have chosen topics that are relevant to my school community. Valley Catholic lies on the border between an affluent suburb and a rural area. My students are children of doctors and engineers on the one hand and of farmers on the other. By selecting biotech and agricultural topics, I give my students a chance to learn about interesting topics that may be part of their parents' life experiences.

I begin by writing a provocative question about a controversial issue, which helps generate interest. Such a question might create the false impression that it is an either/or proposition--but that impression is usually debunked later by the students' own research. The teacher can choose a single topic and divide students into 4–6 stakeholder groups, or work with multiple topics to reduce the number and size of stakeholder groups.

Food is a topic that interests students, so the genetic modification of food crops is likely to grab their attention. I pose this question to students at the beginning of the unit of study:

*Should the federal government ban the use of genetically modified organisms (GMOs) in agriculture? Explain your reasons.*

### **Day 1: Background in Science and History (2 class periods)**

At least one class period each in science and social studies is devoted to introducing the topic and building upon students' prior knowledge.

In science class, students review cell structure and function and methods of gene transmission. They will need an introduction to recent advances using genetic modification if that information was not part of the curriculum. Sample questions that the science class might address in this background lecture and discussion include

- How is new genetic information added to a plant or animal cell?
- How is genetic modification different from selective breeding?
- What do researchers think is the potential of genetically modified cells for agriculture?
- In what plants and animals has genetic modification already been tested (or used commercially)?

In social studies, review some historical background in technological developments that have affected agriculture, such as traditional breeding of plants and animals over thousands of years; the invention of the gasoline engine; and the use of chemical fertilizers and pesticides. (SIDEBAR 2, page 6). Sample questions that the social studies class may address include

- What advances and technologies made modern agriculture so productive in the 20th century?
- How was productivity affected after each development?
- Did any problems arise as a result of these new advances and technologies?

### **Day 2: Social Impact**

Introduce the controversy surrounding genetic modification and the current status of regulation. Some sample questions can get the discussion going.

- What are the potential (or observed) benefits of these modifications?
- What are the potential (or observed) drawbacks or dangers of these modifications?
- How has genetic modification changed agriculture recently?



John Javellana / Greenpeace

**A Greenpeace volunteer serves organic dishes during an organic cook-out in Manila, Philippines, in 2011. The event called for a ban on GMO food crops and the promotion of sustainable agriculture.**

- What is the current regulation on genetic modification of food crops in the United States? And in other countries?
- What controversies about genetic modification of crops have arisen recently in the courts, or in the halls of state and national legislatures, as reflected in stories in the news media?

During this class period, students research the benefits, costs, and potential risks of genetic modification and compare those to more traditional methods of plant breeding. Students compare alternatives and offer their opinions. I ask students to list not just economic “costs and benefits,” but also potential positive and negative effects on human health, the environment, and various actors in society (such as producers, corporations, and consumers).

Divide students into small groups that they will be in for the remainder of the project. Students research different sources and complete the first of three worksheets (HANDOUT A, page 10, “Costs and Benefits.”) that will help them evaluate the social aspects of a scientific innovation.” A list of resources for the topic of genetic modification of food crops is in SIDEBAR 2. Using a single source, students will be able to complete only a part of the worksheet, but when students share what they’ve found, they’ll get a more complete picture, and can also identify gaps in their knowledge.

## Sidebar 2: Resources about Genetically Modified Food

### Science Background

Bill Nye has a video that addresses the topic well for this grade level: “The Eyes of Nye: Genetically Modified Foods,” and Disney offers an online teacher’s guide for the video with additional information and extension activities. Your science-teacher colleague may wish to add other resources for students to investigate.

### Social Studies Background

“A History of American Agriculture.” Growing a Nation, The Story of American Agriculture. [www.agclassroom.org/gan/timeline/index.htm](http://www.agclassroom.org/gan/timeline/index.htm). Includes a searchable timeline—by decade or by category. The time period covers the 17th century to the present. By the 20th century, information is sorted by decade. Pertinent categories include “Farm Machinery and Technology” and “Government Programs and Policy.”

### Opinions on Biotechnology—science class

Chang, Maria. “Genetically Modified Fungus Could Fight Malaria.” Associated Press. April 7, 2011. Accessed April 23, 2011. [abcnews.go.com/Technology/wireStory?id=13316241](http://abcnews.go.com/Technology/wireStory?id=13316241)

“Genetically Modified Foods and Organisms.” U.S. Department of Energy Genome Programs. November 5, 2008, [www.ornl.gov/sci/techresources/Human\\_Genome/elsi/gmfood.shtml](http://www.ornl.gov/sci/techresources/Human_Genome/elsi/gmfood.shtml)

Schulman, Miriam. “Attack of the Killer Tomatoes?” Santa Clara University. [www.scu.edu/ethics/publications/submitted/schulman/tomatoes.html](http://www.scu.edu/ethics/publications/submitted/schulman/tomatoes.html)

“Weighing the GMO Arguments: For and Against,” Food and Agriculture Organization of the U.N. March, 2003.  
For—[www.fao.org/english/newsroom/focus/2003/gmo7.htm](http://www.fao.org/english/newsroom/focus/2003/gmo7.htm)  
Against —[www.fao.org/english/newsroom/focus/2003/gmo8.htm](http://www.fao.org/english/newsroom/focus/2003/gmo8.htm)

### Opinions on Government—social studies class

The Agricultural Research Service (ARS) website lists all government-funded research programs. National Program 301 includes Plant Genetic Resources, Genomics and Genetic Improvement. Under “National Programs” ([www.ars.usda.gov/research/programs/programs.htm?projectlist=true&NP\\_CODE=301](http://www.ars.usda.gov/research/programs/programs.htm?projectlist=true&NP_CODE=301)). You can search for research being done in or near your state. Each summary is only a few paragraphs long, and thus understandable to most middle school students.

Animal and Plant Health Inspection Service (APHIS) overview of its Biotechnology Regulatory Services, [www.aphis.usda.gov/biotechnology/brs\\_main.shtml](http://www.aphis.usda.gov/biotechnology/brs_main.shtml)

News report of a district court ruling on the use of GMO sugar beets, [news.opb.org/article/judge-orders-removal-gmo-sugar-beet-plants](http://news.opb.org/article/judge-orders-removal-gmo-sugar-beet-plants)

This is when students learn to research a controversial issue—to identify reliable, authoritative, online sources, and to recognize bias in opinion pieces. If class time or Internet access is limited, you can simplify the activity by providing readings to students. But if you have time, allow students to seek out information from Internet sources while you travel from group to group, monitoring their efforts, steering them toward reliable sources, and explaining your criteria for recommending one source over another.

### Day 3: Role of Government

During this class period, the student groups navigate the layers of our government’s bureaucracy to understand which executive branch agencies carry out the work mandated by Congress to regulate genetic research on plants and animals. This otherwise dry information is made more interesting if constructed as a scavenger hunt. Challenge students to start with a complete list of executive departments and narrow logically to the U.S. Department of Agriculture (USDA) as the department of interest. Students should then follow clues on the department’s homepage to figure out the agencies that research and regulate biotechnology: the Agricultural Research Service (ARS) and the Animal and Plant Health Inspection Service (APHIS). Students may also come across the work of the Food and Drug Administration (FDA), which is part of the Department of Health and Human Services.

Next, focus on the legislative branch. Follow the same approach, allowing students to discover that the House Committee on Agriculture is a key body that is interested in the regulation of GMOs. While referring to the committee’s website, ask students to identify key issues of concern for the committee. Which subcommittee would hear their arguments on proposed changes to GMO regulation? (Answer: the Subcommittee on Rural Development, Research, Biotechnology, and Foreign Agriculture). To learn about recent judicial and citizen action on these topics, a web search will reveal numerous actions that can be sorted by region and date, as needed. Key search words might be “GMO Hearing,” “GMO Protest,” “GMO ruling,” or “GMO Court Cases.”

Use the information sources above and **HANDOUT B**, page 11, “Government Involvement,” to explore how different branches of government and citizen advocates work on this social issue. Invite the student groups to share information with each other to get a more complete picture of how citizens and government agencies work with this issue.

#### Day 4: Stakeholder Groups and Perspectives

With their background work complete, students have begun to think about pros and cons, as well as individuals or groups who might be interested in the topic and affected by a technology and its regulation. Now introduce the idea of stakeholders—a person or group of people who have something to gain or lose from the situation. Their interest may be economic, personal, intellectual, or professional. Building on the information already on their worksheets, students generate a list of stakeholders (or “interest groups”) for the topic. In the case of genetic modification, some potential stakeholders are

- Farmers of all types of crops
- Monsanto (the world’s largest producer of GM crops)
- World Health Organization (WHO)
- Countries that import modified crops or animals from the United States
- Countries that import food to the United States
- Scientists who work in various settings (companies; government; academia)
- Consumers of GM foods (the public)

Designate each student group to represent one of the stakeholders. Ask student groups to put themselves in the shoes of the stakeholder, to figure out what is important to that person, and to build an argument for regulation that would best serve his or her needs. (A stakeholder may desire stronger government regulation, weaker regulation, or none at all.) Beware of stereotypes at this point. For example, a company may actually want the government to get involved in setting standards or establishing clear and enforceable rules so that they and their competitors are “playing on a level field.” (The stereotype is that private companies are always opposed to government regulation.)

Some students will object to defending a position with which they personally disagree. Reassure all students that they will have a chance at the end of the project to convey their personal opinions, but that in a representative democracy, citizens must learn to see all sides of an issue. So they should see this as an exercise in taking on a different perspective, like being on a debate team.

Students now build a persuasive argument (**HANDOUT C**, page 12). Using the information gathered in class and through individual research, each stakeholder group should organize evidence that supports the assigned stakeholder opinion on GMOs. The groups should consider the scientific evidence as well as economic and social issues. For example,

- How might the cost of food be affected if GM foods are, or are not, allowed on the market?
- Is it ethical to change the DNA of an organism?



- Should GM foods be labeled so consumers can make a choice in what they eat?
- How might GM crops affect the environment around the farm?

A number of excellent resources are available to help teachers guide students through an examination of controversial social issues. For example, the Northwest Association of Biomedical Research (NWABR) offers lesson plans that are specifically focused on bioethics.<sup>5</sup> A new “Environmental Public Health” online collection of educational resources has been created by WGBH Public Television with the support of the National Institute of Environmental Health Sciences (NIEHS).<sup>6</sup>

Particularly useful for this part of the project is providing students with a list of essential components of a persuasive argument:

- Be clear and relate directly to the question posed
- Offer scientific evidence, historical evidence, and other facts in support
- Consider how various stakeholders could be affected
- Address the strength and weakness of alternative options

Students can use **HANDOUT C**, “Building a Persuasive Argument,” to organize their ideas.

#### Day 5: Practice in Listening (optional)

If possible, hold a practice hearing in social studies class in which each stakeholder group presents the draft version of its argument. The other groups should record the strengths and weaknesses of each argument they hear and plan a counter argument to ideas with which they disagree. It’s important for

students to be open-minded and see the viewpoint of other stakeholders.

This practice exercise in listening can be omitted if time is limited, but such a rehearsal is helpful and reassuring to students if, on the following day, there will be a final mock hearing with visiting panelists who are adults from your community.

### Day 6: A Public Hearing of Opposing Viewpoints

The final step of the activity is for students to present their conclusions and make a persuasive argument to a panel of mock legislators. Teachers from each subject area, or volunteers from the community, listen as each stakeholder group makes its argument, ask follow-up questions, and give feedback on the merits of various positions. (SIDEBAR 3, page 9: Guest Panelists) The adult audience and the immediate feedback increase students' sense that they are being heard and taken seriously.

In allotting time for a "public hearing," ensure that each group has equal time to present, and that a question and answer period is designated for each group to defend its argument. The panel can give immediate feedback to stakeholder groups. If time is limited, you can request that panelists write comments for you to share with students at a later date.

### Outcomes and Assessment

Over the course of this unit, students apply skills in research, group process, critical thinking, rational argument, public speaking, civic discourse, and independent writing. I assess students in each of these areas:

1. Effective and varied information gathering
2. Respectful and productive collaboration with peers
3. Ability to prepare a logical argument in support of a proposed solution with thorough coverage of scientific, social, and economic issues
4. Oral arguments display diction, fluency, and body language
5. Accurate scientific knowledge of the assigned topic
6. A final, well-reasoned written reflection

The final writing assignment gives students a chance to express and defend their personal views on the topic, which may differ from their assigned stakeholder position.

### Freedom to Experiment

A project like this requires teachers to go out on a limb. The authors of *Handbook on Teaching Social Issues* assert that teachers need to provide resources beyond a standard text,

to help kids find value in asking questions that may have no definitive answer, and to teach them to construct reasoned and detailed arguments.<sup>7</sup> Students will make this effort if they feel they have a stake in the outcome. It's important to choose topics that are interesting, but also truly challenging, even for the teacher. If the students feel that the teacher already has the "answer," they will try to find your answer to get a good grade. Letting students become experts is empowering for all involved.

While our year-end projects have focused on biomedical and agricultural research, the possibilities are endless. For example, a class studying Native American history and current issues could look at NAGPRA (Native American Graves Protection and Repatriation Act) or the proposals to remove dams and restore salmon runs. Students who are learning about 20th-century America could look at the history of vaccine development and consider the extent to which vaccines should be required, or whether the few remaining samples of smallpox virus should be destroyed. The topic choices are endless, but the skill set is the same. Researching a topic that is both technical and controversial; formulating a well-grounded argument; and sincerely seeking to understand different perspectives—these skills form an important foundation for the critical analysis that our students will need in high school, college, and the complex world beyond. 📖

### Notes

1. Classroom Law Project brings civics and law-related education programs into Oregon schools, teaching students at all grade levels the values and skills essential to being a participating citizen in our democracy. More than 400 teachers and 24,000 students from 250 schools in 75 Oregon communities participated last year. Visit [www.classroomlaw.org](http://www.classroomlaw.org)
2. National Council for the Social Studies. "National Standards for Social Studies Teachers." (Silver Spring, MD: NCSS, 2002), [downloads.ncss.org/NCSSTeacherStandardsVol1-rev2004.pdf](http://downloads.ncss.org/NCSSTeacherStandardsVol1-rev2004.pdf). See also the expectations for middle school learning about **SCIENCE, TECHNOLOGY, AND SOCIETY** in National Council for the Social Studies, *National Curriculum Standards for Social Studies: A Framework for Teaching, Learning, and Assessment* (Silver Spring, MD: NCSS, 2010).
3. National Research Council. *National Science Education Standards* (Washington, DC: National Academies Press, 1996), 199.
4. At Valley Catholic Middle School, the eighth grade class is small (60 students), so all of the students have the same teacher for each core subject (for social studies, for science, etc.), which enables collaboration on projects.
5. Northwest Association of Biomedical Research, "Bioethics 101, Lesson 4" (Seattle, WA: NWABR, 2010), [www.nwabr.org/education/esc\\_bioethics\\_101.html#BIO101](http://www.nwabr.org/education/esc_bioethics_101.html#BIO101).
6. The EPH collection ([www.teachersdomain.org/special/enh](http://www.teachersdomain.org/special/enh)) offers free classroom-ready resources for middle and high school students that look at how researchers, communities, and policy makers are working to address health issues resulting from toxins and other factors in our environment.
7. Ronald W. Evans, Fred M. Newmann, and David Warren Saxe, "Defining Issues-Centered Education," in *Handbook on Teaching Social Issues* (Washington DC: NCSS, 1996), 2. Available at [www.infoagepub.com](http://www.infoagepub.com).

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# How to Hold a Civic Debate: A Social Studies Opportunity

R. O. Hughes

A dumb democracy is the teacher's opportunity, it has been said. But how? Shall we tell our pupils what they must think and how they must act? No. It is far better that we content ourselves with helping them get the information they need to make their own choices and with giving them practice in discussing all sides of disputed questions.

What if the entire membership of a class does not reach just the same conclusion? Their elders have not always done so. Perhaps we can, by patient example and careful instruction, induce young people to differ courteously and to use arguments that bear upon the question, instead of indulging in the calling of names and the setting-up of straw men to knock down.

May I stress right here our opportunity in the field of social studies to emphasize the importance of tolerance?

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Excerpted from an article by R. O. Hughes in issue 1, number 1 of *Social Education*, January 1937, which was based on his presidential address to the NCSS Annual Conference in Detroit the previous November.



## Sidebar 3: Guest Panelists for a Mock Hearing

In our experience, students have most appreciated the chance to share their views with experienced professionals. Up to this point in students' careers, their only academic feedback has come from teachers. If it is possible in your community to invite professionals from outside your school to hear student arguments, you can create a respectful and realistic committee hearing. We have found that students adopt a level of seriousness and commitment when presenting to outsiders that is not typical in a classroom environment.

We have called upon parent and grandparent volunteers, local doctors and farmers, extension service staffers, local reporters, and retired teachers. While it is interesting to recruit professionals with relevant backgrounds, even adults without specialty knowledge in the topic area bring a valuable voice to the table. Consider the real-life experience of legislators on a House or Senate committee: many have an interest or background in the general area being addressed, but they must be able to offer a wider citizen perspective on very narrow topics.

"I liked this project because we got to express our feelings on an important topic to other people, and we normally wouldn't do that," said one student. The involvement of professionals gives the hearings a level of reality and importance that is hard to duplicate in the classroom. Students feel their arguments are being taken seriously and they are empowered by the format of the hearing.

Pictured above is Dr. Jim Barnhart, the father of a teacher, who volunteered to be a "legislator" at the "public hearing" in 2009. Dr. Barnhart, then CEO at Peace Harbor Medical Center in Florence, Oregon, is currently an administrator at Peace Island Medical Center in San Juan County, Washington.

## Handout A

### Evaluating the Social Aspects of a Scientific Innovation

# Costs and Benefits

	Current Technology	Innovation	Alternative(s)
<b>Benefits</b>			
<b>Who Benefits</b>			
<b>Costs</b>			
<b>Who Pays</b>			
<b>Risks</b>			
<b>Who Could Get Harmed</b>			
<b>One Citizen's Opinion (Yours):</b>  <b>Which is the best technology to use?</b>			

SOURCE: "Decisions involve assessment of alternatives, risks, costs, and benefits and consideration of who benefits, who suffers, who pays, and [who] gains." —NRC, *National Science Education Standards* (Washington, DC: National Academy Press, 1996), 199.

Evaluating the Social Aspects of a Scientific Innovation

# Government Involvement

	<b>Current Technology</b>	<b>Innovation</b>	<b>Alternative(s)</b>
<b>Executive Branch:</b> Current Agencies, Regulations, and Enforcement			
<b>Judicial Branch:</b> Recent rulings and court cases			
<b>Legislative Branch:</b> Current oversight, bills, and proposals			
<b>Citizen Action:</b> Current petitions, organizations, conflicts, or broad movements			
<b>Company Action:</b> Current media campaigns, investment, and lobbying			
<b>One Citizen's Opinion (Yours):</b> How should the government regulate this technology, if at all?			

SOURCE: Knowledge for middle school students includes “the need for laws and policies to govern scientific and technological applications.” —NCSS, *National Curriculum Standards for Social Studies* (Washington, DC: NCSS, 2010), 115.

## Handout C

### Evaluating the Social Aspects of a Scientific Innovation

# Building a Persuasive Argument

Stakeholder: \_\_\_\_\_

Stakeholder's recommendation:

Evidence supporting your recommendation	Identify the source of your evidence
Scientific Facts	
Economic Issues	
Social Issues	

How will the recommendation affect you—and other—stakeholders?

Stakeholders	Positive impact	Negative impact

# Analyzing Historical Political Cartoons: Helping Students With Diverse Learning Needs Analyze Primary Sources

Grant R. Miller

The best online activities for students challenge them to go beyond the mere memorization of names and dates. They also support students' diverse learning needs with scaffolds that balance academic rigor with support. In this article, I describe three free websites that use historical sources to support students' acquisition of the skills needed for historical thinking.

It seems worthwhile to revisit the method of using primary sources, including political cartoons, in the social studies classroom in the pages of *Middle Level Learning* for a couple of reasons. These three websites were not listed in an earlier 2007 article on this topic.<sup>1</sup> Also, I would like to point out how using the lens of Universal Design for Learning (UDL) reveals how these websites model teaching methods that are flexible enough to meet students' diverse learning needs. The creators of the Common Core Standards identify UDL as way for teachers to help students with learning disabilities "participate with success in the general curriculum." The UDL approach "foster[s] student engagement by presenting information in multiple ways and allowing for diverse avenues of action and expression."<sup>2</sup> The websites discussed here give students opportunities to successfully evaluate, corroborate, and synthesize primary sources.

## Universal Design for Learning

UDL offers guidelines—based on a theory of how human beings learn—that help teachers select, adapt, and create lessons and teaching activities. UDL guidelines for educators are divided into three main categories. In order to learn, a student must

1. Recognize patterns—and the teacher can provide multiple representations of the new content to be learned, as well as link new content to what students already know.
2. Engage with new information in various forms—and the teacher can vary the level of challenge as well as the ways that students might manipulate and organize the new material.

3. Demonstrate new knowledge through various strategies—and the teacher (and administrators) can allow students multiple means of displaying and reporting their new knowledge and skills.

Under each category are three guidelines, each of which has three-to-five indicators. For example, under "Recognize Patterns," three guidelines provide options for assisting students with A) Perception, B) Language and Symbols, and C) Comprehension. Under this last guideline, Comprehension, there are four indicators, which are options for teaching that

- Provide or activate background knowledge (3.1)
- Highlight critical features, big ideas, and relationships (3.2)
- Guide information processing (3.3)
- Support memory and transfer of knowledge (3.4)

When beginning a lesson, a teacher might review the previous lesson's content, ask students what they already know about a topic, or introduce a social studies concept such as "compromise" by discussing an event that happened on the playground or reported recently in the news. This teacher would be activating students' background knowledge (indicator 3.1), giving students an opportunity to connect new knowledge with what they have already experienced and increasing their abilities to recall and apply knowledge in a new context.

Highlighting critical features (3.2) helps students identify what is relevant to their inquiry, and what is distracting or superfluous information.

Finally, information processing (3.3) and memory and transfer (3.4) occur when students engage in activities like sorting, categorizing, prioritizing, corroborating, and summarizing aspects of the material to be learned.<sup>3</sup> Aids to memory and transfer often come in the form of graphic organizers or other tools that help students organize what they are learning.

For the purposes of this article, I will focus on how these four

indicators can be applied while teaching students to contemplate and interpret political cartoons.

### It's No Laughing Matter

American Memory at the U.S. Library of Congress ([memory.loc.gov](http://memory.loc.gov)) has developed several learning environments for students to access and analyze primary sources. For example, No Laughing Matter - Analyzing Political Cartoons helps students interpret political cartoons from an era of desegregating American public education ([memory.loc.gov:8081/ammem/ndlpedu/features/political\\_cartoon](http://memory.loc.gov:8081/ammem/ndlpedu/features/political_cartoon)).<sup>4</sup> Students are guided to use five concepts—symbolism, exaggeration, labeling, analogy, and irony—to help them identify the ways cartoonists use humor to address serious issues.



For the first activity, students click on different portions of a political cartoon depicting how state governments continued to exclude African Americans from public education eight years after the *Brown v. Topeka Board of Education* decision. In this cartoon, a black schoolgirl holds a birthday cake and tells an onlooker, “I’m eight. I was born on the day of the Supreme Court decision.” Behind her is a massive iron gate that separates her from a school building that stands in the background. When the user clicks on the list of concepts (e.g., irony, exaggeration), portions of the cartoon are highlighted to illustrate how the cartoonist used these creative techniques to persuade an audience. Users can test their knowledge of these concepts with four additional cartoons. This activity offers a great opportunity to ask students, “What creative techniques are used to capture our attention?”<sup>5</sup>

The No Laughing Matter website also defines key concepts such as “irony” and includes links to background information about the civil rights movement. To help students work through the activity and organize their thoughts, teachers could provide explicit directions for the task and a simple graphic organizer on a sheet of paper. Students can record the creative techniques these cartoonists have used to persuade their audiences to support desegregation or to feel empathy for the segregated African Americans that are the subject of the drawings.

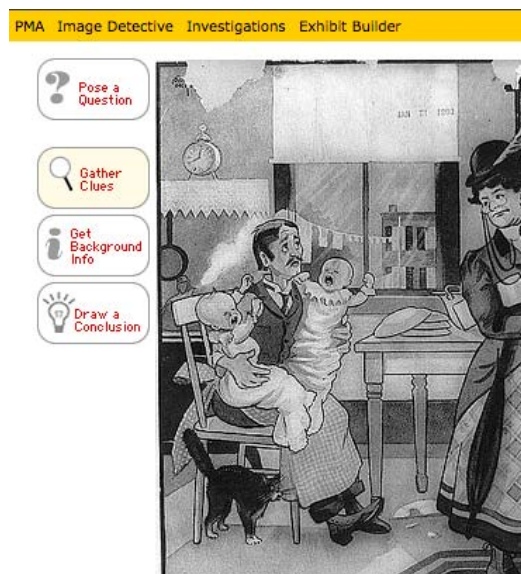
This website clearly defines key concepts such as “irony” and

includes links to background information (See UDL indicator 3.1) about the civil rights movement. It also highlights relevant portions of an image that illustrate key concepts (3.2) in the warm-up activity introducing the concepts.

Missing from the activities on this website are scaffolds that would clearly guide information processing (3.3) and memory and transfer (3.4). To provide these scaffolds, teachers could provide a simple graphic organizer for students to record the creative techniques cartoonists used (to persuade their audiences to support desegregation or have empathy for segregated African Americans).

### Picturing Modern America

Picturing Modern America is a suite of activities that help students analyze, corroborate, and synthesize primary sources from the Gilded Age ([cc2.edc.org/PMA](http://cc2.edc.org/PMA)).<sup>6</sup> One activity, “Image Detective,” guides the students’ analysis of images such as a propaganda poster that opposes women’s suffrage.



First, students pose a question—either their own or one they have selected from three choices (e.g., “Is this poster in favor of women’s right to vote, or against it?”). Then, students collect clues by moving the cursor over the image to reveal clickable yellow boxes. These highlight significant portions of the image, including an exasperated father with two crying babies in his arms, an emotionless mother giving the father one last look before she leaves the house, and a sign reading “Votes for Women” hanging on the wall. When the user clicks on the highlight, a textbox appears with the prompts, “What do you see?” and “What might this mean?” Students write notes in these boxes, which can be retrieved as students compose answers to their original question.

At this point, the student can also access additional background knowledge on the topic. Finally, when the student is ready to make a conclusion about the image, three textboxes appear with prompts:

I am fairly confident that:  
My best reasons for thinking this are:  
A question this raised for me is:

Once students submit their completed sentences, they can access and read various responses that students, teachers, and even scholars made about the same image. The result is a form of public review and conversation in a digital environment that helps learners identify details that support their interpretations of an image, and compare their analysis with those of other viewers.

In sum, this activity leads students through a cycle of critical thinking: examining evidence, making inferences, testing those thoughts against additional information, reading what others say, and raising questions for further inquiry.

All four UDL indicators are addressed in this activity. Internet links to additional relevant information are available, albeit after the student has collected clues about the image (3.1). Highlighted portions of the political cartoon, which students then determine to be significant or not, are limited in number (3.2). Students' conclusions are chunked by three prompts—e.g., “I am fairly confident that . . .” (3.3). And students' notes for each clue from the image they collect are displayed when they write their final answer (3.4). In short, students can transfer and synthesize the clues they collected as they draw conclusions about the image and compose complete sentences.

## Historical Thinking Matters

Recently, readers of *Social Education* were introduced to the website Historical Thinking Matters. ([www.historicalthinkingmatters.org](http://www.historicalthinkingmatters.org)).<sup>7</sup> This is one of my favorite free historical thinking resources because it models the process necessary to scaffold students' evaluation, corroboration, and synthesis of multiple conflicting sources. Currently, the four units include: Spanish American War, Scopes (Monkey) Trial, Social Security, and Rosa Parks/Montgomery Bus Boycott.



Each topic begins with a multimedia introduction (sound and images), followed by several sources and analysis questions that focus on details of the cartoon's text or image. Each unit

has explicit step-like procedures for analyzing sets of sources, and printable graphic organizers help students corroborate sources. Similar to the Picturing Modern American site, the clues students gather from each source are retrievable when students write their final essay. Historical Thinking Matters also provides printable resources such as primary texts written in modern English and Spanish versions.

As an experiential endeavor, this website illustrates the components of a well-designed online activity—essential (or critical) questions, graphic organizers, strategies of how to question with historical thinking heuristics (e.g., sourcing), models for think-aloud models, highlighted critical features, and multiple representations. These components help learners engage in the rigorous task of historical thinking.

In addition to exemplifying historical thinking, this site does a great job addressing the four UDL indicators I highlight in this article. Each topic begins with a multimedia introduction to topic (3.1). Several source analysis questions include “Show Me” hints, which highlight portions of text or image (3.2). Each unit has explicit step-like procedures for analyzing sets of sources (3.3). And finally, printable graphic organizers help students corroborate sources. Similar to the Picturing Modern American site, the clues students gather from each source are retrievable when they write their final essay (3.4).

As evidenced by these three examples, there are a lot of amazing resources on the web that engage students in the challenging but important task of analyzing primary sources. With the UDL guidelines in hand, teachers can make informed decisions about which materials they use in their classrooms, and how they use them, to make historical thinking more accessible for students with diverse learning needs. 🌐

## Notes

1. James M. Duran, “‘Toonin’ Into History: Online Collections of Political Cartoons,” *Middle Level Learning* no. 29 (May/June 2007): 8–11.
2. National Governors Council and Council of Chief State School Officers, “Application to Students with Disabilities,” [www.corestandards.org/the-standards](http://www.corestandards.org/the-standards).
3. National Center on Universal Design for Learning, [www.udlcenter.org/aboutudl/udlguidelines/principle1](http://www.udlcenter.org/aboutudl/udlguidelines/principle1).
4. Library of Congress, “It’s No Laughing Matter: Analyzing Political Cartoons” (Washington, DC), [memory.loc.gov:8081/ammem/ndlpedu/features/political\\_cartoon](http://memory.loc.gov:8081/ammem/ndlpedu/features/political_cartoon).
5. This is a question from Jeff Share, Tessa Jolls and Elizabeth Thoman, *Five Key Questions That Can Change the World: Classroom Activities for Media Literacy* (Malibu, CA: Center for Media Literacy, 2005) 7, [www.medialit.org](http://www.medialit.org).
6. Educational Development Center, “Picturing Modern America” (Newton, MA: EDC, 2002), [www.edc.org/CCT/PMA](http://www.edc.org/CCT/PMA). This website uses primary source material provided by the Library of Congress. EDC is not continuing this particular effort, but the website still serves as a useful classroom activity and a model for designers of future web activities for students.
7. Daisy Martin, Sam Wineburg, Roy Rosenzweig, and Sharon Leon, “Historicalthinkingmatters.org: Using the Web to Teach Historical Thinking,” *Social Education* 72, no. 3 (November/December 2008): 140–143. Historical Thinking Matters is a project of the Roy Rosenzweig Center for History and New Media at George Mason University, and the School of Education at Stanford University.

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## GMO T-Shirts: Pro and Con Cartoons

What people wear has often been used to signal their sentiments or political position. Just think of the red bandana of revolution; the yellow ribbon of those waiting for a soldier to return from overseas; and the wool and linen of Abolitionists who refused to wear slave-produced cotton.

Today, we print text messages and cartoons on T-shirts. Here are two shirts, sold by the same company ([cafepress.com](http://cafepress.com)), that illustrate opposing views on genetically modified organisms (GMOs), especially those used as food crops. After your students have learned about the pros and cons of the debate over GM foods (see this issue of *MLL*, pages 2–12), invite them to apply some media literacy skills (see *MLL*, pages 13–15) to the messages printed on these contrasting T-Shirts.

### *Topics for Discussion*

- Would it be easier to design a pro- or an anti-GM food T-shirt?
- How does the anti-GM shirt convey its message? (A strong statement of condemnation; Helvetica font that is bold, black, and capitalized; and a repeating biohazard symbol within some of the letters. Is that warning symbol “gestating” within those round egg shapes? If so, that might be rather ominous!)
- How does the pro-GM shirt convey its message? (An upbeat and humorous statement; iron-red Helvetica letters; and a colorful DNA design in the center of a circle. Take a second look at that larger “circle,” with a shape rather like a jolly penguin. Is it a variation on the biohazard symbol? If so, that might be kind of funny!)
- Would you wear a T-shirt that announces your strong opinion about a controversial issue?
- Can T-shirt messages deepen our knowledge of the issue?
- Is it useful to know, at a glance, another person’s opinion about a controversial issue?
- When might you avoid wearing a T-shirt that conveys a strong message?
- Can you create a design for a T-shirt on a cause that you feel strongly about?

