

## Abstract

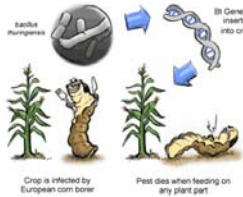
**Project STEP.** The objective of the National Science Foundation-funded Science and Technology Enhancement Program (STEP) is to provide training within the field of secondary education to engineering and science graduate students with the goal that the fellows will continue to bring their expertise to high school classrooms throughout their careers. This is facilitated through a year-long collaboration of the graduate fellow and a team of four teachers within a given high school.

**Fellow responsibilities.** As a fellow, I am to design lessons pertaining to a topic within the established curriculum, placing the content within the context of engineering, my personal research, and Cincinnati, demonstrating to the students that their current studies are applicable to their daily lives.

**The lesson.** Genetically engineered foods grow larger and repel insects better than non-engineered foods. These foods are sold unlabelled at local grocery stores such as Kroger and Biggs. In this lesson, students learn how and why corn has been genetically engineered, read the scientific studies regarding the effect of corn pollen on the monarch, and discuss the social implications of the studies. Groups of students then participate in a debate acting as farmers, scientists (monarchs are harmed), scientists (monarchs are unharmed) and social protestors.

**Assessment.** Analysis of the identical pre- and post- activity quiz given to two classes indicated that content knowledge increased by an average of 41% in class A and 48% in class B. Individual results categorized by class and student can be found in the results section.

## Introduction



**Problem:** The corn borer destroys the corn crop.

**Solution:** Scientists genetically engineered a pesticide into the corn that kills the corner borer but is safe for human consumption.

**Scientific studies:** A poorly designed experiment concluded that the pollen also kills monarchs, and people began to protest.

**The lesson:** Students discussed the genetic engineering process, read the scientific literature, and gave presentations from the viewpoints of the farmers, scientists (monarchs die), scientists (monarchs may live) and social protestors.

## Activity

**To gain their attention, students were shown these pictures:**

- A corn borer burrowing through a cornstalk



- A protest in which people were objecting the use of genetically engineered, corn borer killing, corn pollen based on a study that suggested the monarch were also killed.



**During the group activity, students:**

- Learned how and why corn pollen was genetically engineered



- Discussed the first scientific research paper that suggested that genetically modified corn pollen kills not only the corn borer, but monarchs as well



- Discussed the scientific research paper that listed the experimental flaws of the initial study.



- Gave presentations on genetic engineering representing farmers, scientists (monarchs die), scientists (monarchs may live), or social protestors.



## Student Feedback

### Class One

#### Liked best:

- Learning about the effects of Bt corn
- Getting to hear what everyone thought about the experiment
- Learning about the effects of genetically modified foods
- Group presentations

#### Liked least:

- Not enough time to do research
- Talking in front of the class

### Class Two

#### Liked best:

- Understanding what is happening in our world today
- Seeing the experiment and genetic engineering from four different points of view
- Group presentations

#### Liked least:

- Limited amount of time for research
- Having to present

#### Rate your level of learning:

	A lot	A little	None
Class One	69%	31%	0%
Class Two	48%	52%	0%
Combined	56%	44%	0%

#### Did this lesson increase your confidence about your ability to learn math science?

	Definitely	Sort of	Not sure	No
Class One	8%	62%	8%	23%
Class Two	17%	39%	26%	17%
Combined	14%	47%	19%	19%

#### Rate your interest in engineering:

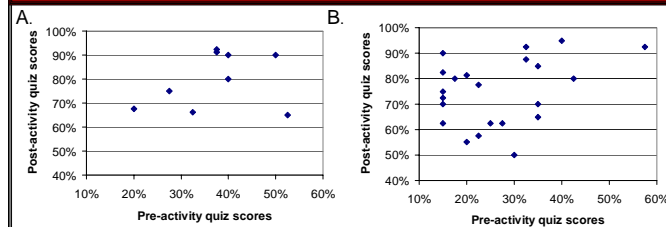
	Very	Somewhat	Unsure	None
Class One	31%	46%	8%	15%
Class Two	13%	48%	17%	22%
Combined	19%	47%	14%	19%

#### Did this lesson affect your interest in engineering?

	Increased	Decreased	No effect
Class One	38%	8%	54%
Class Two	48%	0%	52%
Combined	44%	3%	53%

**Figure 1. Student feedback.** Immediately following the activity, students completed anonymous feedback forms.

## Assessment Results



**Figure 2. Post-quiz results.** A) Class one and B) Class two completed a quiz both before and after the activity. The percentage correct on the pre-quiz (x-axis) is plotted versus the percentage correct on the post-quiz (y-axis). Each diamond represents the both pre- and post-scores of one student.

## Conclusions

- After participating in this lesson, 100% of students reported that they had learned during this lesson.

- This is supported by the fact that:

Class A quiz scores increased by an average of 41%.  
Class B quiz scores increased by an average of 47%.

## Acknowledgments

Project STEP is funded through NSF Grant # DGE058532.