Web Unit Plan

Title: Designer Genes: One Size Fits All?

Description: Student genetics experts help farmers in a blight-stricken region of Mexico decide whether to use genetically engineered corn.

At a Glance

Grade Level: 8–10

Subject sort (for Web site index): Life Science

Subject: Biology

Topics: Genetics, Economics, Social Issues

Higher-Order Thinking Skills: Investigation, Argumentation, Problem Solving

Key Learnings: Research and Analysis, Persuasion, Genetic Engineering

Time Needed: 2 to 3 weeks, 50-minute lessons, daily

Background: From the Classroom in Oregon, United States

Unit Summary

Student biologists research genetic engineering and issues related to risks and benefits of altering agricultural products. Students use their knowledge to create proposals for the town council of Ixtapa and create slideshows, newsletters, or Web sites to share their opinions and help the council decide whether they want local farmers to plant genetically engineered corn.

Curriculum-Framing Questions

- **Essential Question**

  Just because we can, should we?

- **Unit Questions**

  Should genetic engineering be permitted in our society?

  Do the benefits of genetically engineered foods outweigh the risks?

- **Content Questions**

  What is genetic engineering?

  How are the traits of an organism passed from generation to generation?

Assessment Processes

View how a variety of student-centered assessments are used in the Designer Genes: One Size Fits All? Unit Plan. These assessments help students and teachers set goals; monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

Instructional Procedures

Prior to the Unit

Previous to the start of this unit, complete basic lessons on genetics. The lessons should cover information about genetic science, such as understanding how the traits

of an organism are passed from generation to generation, how genetic mutation occurs in nature, and how DNA is structured and functions.

Introduce the Project

Create a poster to put up in your room that asks the Essential Question, *Just because we can, should we?* Hold a conversation about the question in regards to the students' recent studies on genetics. Have students write their thoughts about this question in personal journals.

Introduce the following scenario to the students (you may want to have a number of different scenarios for students to choose from):

> *You and your fellow biologists have been asked to serve as expert advisors to the district council of Ixtapa, Mexico. Corn weevils have infested the corn of Ixtapa, severely reducing the major food source in this agrarian district. Malnutrition is a real concern. Additionally, employment and the related economy are also suffering. A promising strain of weevil-resistant corn, called Wvbgone Corn, is in development in the United States. Should this research be pursued? Should Wvbgone Corn be planted in Ixtapa?*

Explain that in their role as student biologists and genetic experts, students will research and present proposals to the district council of Ixtapa on their findings to help the council decide whether the farmers should plant genetically engineered corn. Be clear that as scientists, they are to consult with other scientists, but they are responsible for their own research reports. They will then work with two or three other scientists to put together presentations. Go into an in-depth explanation of the project using the slideshow presentation.

Collect Information and Create Proposals

Hand out the student assessment and review expectations and requirements for the project. Students should use the scoring guide to guide them in the process and to ensure that they are completing all required components of the project.

Remind students to consider the following questions that were introduced in the slideshow presentation while doing their research:

- *What traits have been genetically engineered into corn and why?*
- *What are some of the benefits and risks to genetic engineering? (health, environmental, ecological, and social)*
- *Do the benefits of genetically engineered foods outweigh the risks?*
- *Should genetic engineering be permitted in our society?*

Several times during the research period, bring the class together. Pose questions such as, *Do you think you currently eat any genetically engineered foods?* and *Should regulations on genetically engineered foods be consistent worldwide?* Ask students to discuss and reflect individually in their journals.

Remind students to locate enough information to answer the preceding questions in an in-depth manner, because these questions will assist in coming up with a conclusion for their proposal to the district council. Remind students that they are required to hand in their proof of research (notes) prior to writing their papers to make sure they have all the information they need. Meet with students one-on-one to review notes, provide feedback, and answer any questions.

After research notes are finalized, have students complete the first drafts of their papers. Encourage students to have their papers peer edited and reviewed before they write their final reports.

Prepare to Share

Allow student scientists to choose groups and decide which presentation format will most effectively help convince their audience of their advice for dealing with the issue. They can create a slideshow, newsletter, or Web site.

Provide students with copies of the argumentation rubric. The rubric should help them to create strong proposals and arguments for their points of view. Review the rubric and consider providing mini-lessons throughout the process to help clarify and explain the elements of developing a strong argument.

Have each group hand in a proposal that identifies the presentation's format, storyboard, and ideas for an interesting introduction and conclusion. After the proposals are reviewed, meet with students to review feedback before students start their presentations.

Give students time to practice their presentations. Ask each student to offer thoughtful feedback to at least one group using the peer feedback form. Groups should revise their presentations based on feedback.

Present Findings

Student "expert" groups present their findings to the district council (the class). Remind students who are using a newsletter to make sure they have enough copies for each of the audience members. Have the district council (the class) give feedback on the presentation and product using the argumentation rubric. If time permits, hold a debate among student groups with opposing views on whether genetically engineered products should be allowed in our society.

At the end of the presentations, lead a whole-class discussion to revisit the Essential Question, *Just because we can, should we?* Have students refer to their initial answer to this question and discuss any differences they may have. Have students record their final thoughts in their journals. Collect journals at the end of the unit to assess students' individual thinking processes and learning.

Prerequisite Skills

- Completion of a 2-week course of study in genetic science
- Basic research skills
- Basic computer skills, including knowledge of slide show presentation and desktop publishing software

Differentiated Instruction

Resource Student

- Consult with the student frequently to check understanding and progress
- Assign a more basic research report about genetic disorders if the student has limited reading, writing, or research skills

Gifted Student

- Encourage the student to study fiscal and ethical issues in-depth and be responsible for those parts of the report and presentation

English Language Learner

- Pair the student with a more proficient bilingual student or a community volunteer

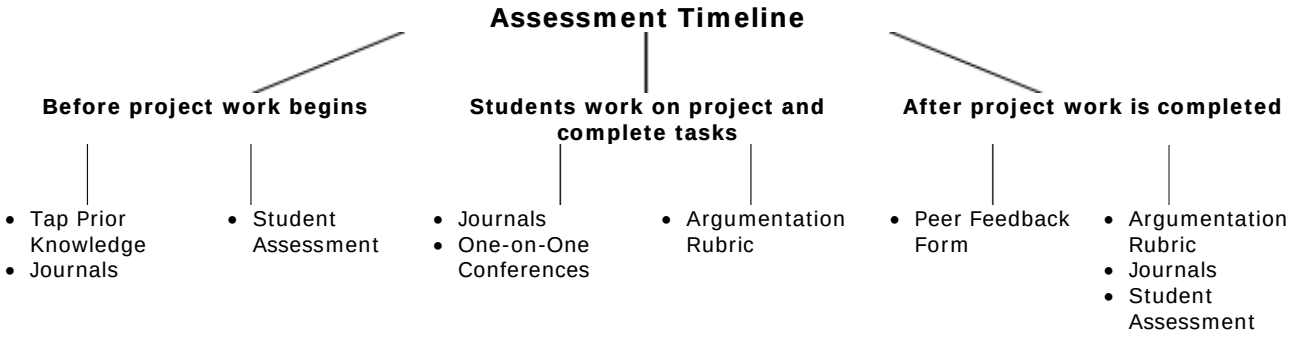
- Provide templates in the student's first language
- Ensure that texts and Web research materials are available in the student's fist language

Credits

Nancy Floerke participated in the Intel® Teach Program, which resulted in this idea for a classroom project. A team of teachers expanded the plan into the example you see here.

THINGS YOU NEED (highlight box)

Assessment Plan



The unit begins with the introduction of the Essential Question, *Just because we can, should we?* It is posed to prompt discussion and engage students' prior knowledge of genetics. Journals are then introduced and used by the students throughout the unit to record individual thoughts, questions, and responses to discussions and questions. This journal is a valuable assessment tool, collected at the end of the unit to assess each student's individual learning process and higher-order thinking.

The student assessment is introduced and discussed at the beginning of the project to set clear expectations. This scoring guide is used during project work by the students to guide their progress and by the teacher at the end of the unit to assess final products. One-on-one conferences with the students help both the teacher and students to monitor progress and stay on track. The argumentation rubric is used by students as a self-check to ensure that they are creating strong arguments for their opinions in their proposals and communicating those to the audience. Have the council fill out the rubrics as a form of peer feedback after presentations are given. Peer feedback is given while students are creating and practicing their presentations using the peer feedback form. Students should use feedback to modify and improve their presentations.

Targeted Content Standards and Benchmarks

National Science Standards

Science: Grade 8–10

- Understand the history and the basic principles of heredity and human genetics
- Explain genetic mutation as it occurs in nature

- Explain how genetic engineering could be helpful/harmful

Student Objectives:

Students will be able to:

- Describe how the traits of an organism are passed from generation to generation
- Explain the structure and function of DNA
- Explain how genotypic variation occurs and results in phenotypic diversity
- Describe the information that might be carried on a gene
- Describe genetic mutations and hybrids

Materials and Resources

Printed Materials

- Library books on genetics

Internet Resources

Lesson Plan Ideas

- The Educator's Reference Desk
  www.eduref.org/cgi-bin/lessons.cgi/Science/Genetics*
  A number of lesson plans to choose from on the study of genetics
- Teachnology
  www.teach-nology.com/teachers/lesson_plans/science/biology/genetics*
  Site with genetics lessons to choose from
- Genetics Education Center, University of Kansas Medical Center
  www.kumc.edu/gec/lpneurga.html*
  Hands-on lesson on inheritance
- Genetics Education Center, University of Kansas Medical Center
  www.kumc.edu/gec/lpcolber.html*
  Hands-on exercise to teach cloning

General Information

- Genetics, Genomics, and Genethics
  www-ed.fnal.gov/lincon/w01/projects/genethics/resources.html*
  Collection of various genetic links
- Indigenous Peoples Council on Biocolonialism
  www.ipcb.org*
  Resource to assist indigenous peoples in the protection of their genetic resources
- Nova Online: Cracking the Code of Life
  www.pbs.org/wgbh/nova/genome*
  Classroom resources to study the issues behind the Human Genome Project
- Genetically Engineered Organisms
  www.geo-pie.cornell.edu/crops/corn.html*
  Public Issues Information Project

Technology—Hardware

- Computer(s) for research and presentations

- Internet connection for genetics research
- Projection system for proposal presentations

Technology—Software

- Desktop publishing to create a newsletter
- Encyclopedia on CD-ROM for research
- Internet web browser for research
- Multimedia software for slideshow presentations
- Web development software for Web site design
- Word processing for storyboarding and final research paper