Lesson: **Genetically Modified Organisms: Chemical Engineering**

Grade Level: 8-9 – Time Required: 40 minutes – Lesson Dependency: None – Subject Areas:

* History
* Design
* Science and Technology

Summary

This lesson plan and schedule is specifically structured to accommodate a solely online environment. The three most fundamental parts of this lesson include first the lecture, then activity, and finally, an assessment based on both retention of the given information and the intuitive expansion of the knowledge already given. The lecture segment of this lesson is structured to grab attention and maximize attention span by utilizing commonly used online academic retention tactics. The next part of the lesson utilizes activities to both help the reader understand the information just dealt to them and have a way to thoroughly understand it without the pressure of assessment just yet, and also allows the teachers to elaborate on the problems that the class might have in their learning. Finally, to end the lesson, a fair, two-part assessment is given that focuses on one, what was said explicitly, and two, how they could use it in the real-world application of a Biochemical Engineer.

Engineering Connection

The lesson reflects upon the definitive placement of GMO Engineering in the world of engineering. Specifically, how it is under the group of Chemical Engineering and then a big part of both subgroups of it, those being; Chemistry and Biology. It also explains in detail how the engineering process is used in relation to this research that differs it from just being an area of science rather than an established field of engineering.

Learning Objectives

* Know the Engineering process
* Understand GMOs
* Understand the good and bad effects of them
* Understand a very simplistic history
* Differ between a science and a field of engineering
* Have an opinion on whether GMOs should be used in modern-day product production

### Educational Standards

SC.912.L.15

CTE-AFNR.68.ANIMAL.02

CTE-AFNR.68.FOOD.02

CTE-AFNR.68.FOOD.03

CTE-TECED.68.AGBIO.02

CTE-HLTH.68.BIOTEC.01

Worksheets and Attachments

* Genetically Modified Organisms Presentation
* Pros and Cons of GMOs Video
* Genetically Modified Babies Video
* GMO Scavenger Hunt Worksheet Fill-out Activity

Introduction/Motivation

Remember that the first part of the presentation is lesson-based, so in order to keep the student’s attention bring attention to the photographs. Furthermore, most of the script is on a separate teachers document and not on the page to reduce the strain on the students’ mind, so be sure to accent several key terms as you elaborate on the slide that is in front of them because they will need to remember those later for the after lesson quiz.

The next part of the lesson is activity-based but do not let that stop you from informing them, it is important to keep a stream of steady communication to these kids whilst they are doing the activity. For example: give them pointers, ask them if they find anything interesting, if they like the game or if they are beginning to have a better, more thorough understanding of the intrinsic fundamentals of each field.

It is also important to remember these key points:

1. GMOs are not all bad

2. GMOs exist naturally

3. GMOs can have a very bad effect on the environment uncontrolled

4. Definition of a superweed

5. GMOs that we eat on a daily basis

6. GMO Engineering is different from GMO science because one deals with the application of it to a problem whilst the other is just research

7. GMOs can apply to any form of a living organism but not abiotic ones

When the Debate occurs, the breakout rooms students should be divided by the last name in chronological order with a reasonable number of students per each room. Each room should be moderated by either a teacher or a co-teacher to reduce aloofness and promote healthy flowing debate.

Lesson Background and Concepts for Teachers

(The script is meant to be an aid to the presenter rather than what they should say verbatim. The goal is for the presenter to put the information in their own words as best they can while still making it easy to understand. Presenters are not recommended to read off the slides.)

**Slide 1 -** Introductory slide to GMOs, Pose Questions

**Slide 2 -** What are they? Rudimentary explanation of GMOs

**Slide 3 -** Naturally occurring GMOs

**Slide 4 -** The history of it**,** Famous GMO Researchers

**Slide 5 -** The benefits

**Slide 6 -** Popularly modified foods and organisms

**Slide 7 -** Activity Slide

**Slide 8 -** Environmental Impacts

**Slide 9 -** Video Slide

**Slide 10 -** Controversies

**Slide 11 -** Video Slide

**Slide 12 -** Debate Information and pointers slide to help students in break out room sessions

**Slide 13 -** Tie in this sect of engineering with the rest of the fields by explaining the reason it is a field of engineering in addition to being a science

Associated Activities

**GMO Scavenger Hunt Worksheet Fill-Out Activity** - Based off the knowledge presented on the different widely available used products that have been genetically modified, find any GMO around your house, take a picture, and provide a paragraph explanation about why this particular photograph depicts a GMO

**Pros and Cons of GMOs Video** (<https://www.youtube.com/watch?v=7TmcXYp8xu4&index=0&list=PLL6vLbdwhYvrDpCWw2pEe-7O_ZDdXNEPh>) - To be added into the presentation to give the students a platform of facts that they can base their debates on

**Genetically Modified People Video** (<https://www.youtube.com/watch?v=jAhjPd4uNFY>)

**GMO Risks Vs Benefits Debate** - Allow the students to view a list of opposing view to one another by having a breakout room mediator screen share a table of said items

Vocabulary/Definitions

**Chemistry -** Chemistry is the study of matter, its properties, how and why substances combine or separate to form other substances, and how substances interact with energy

**Chemical Engineering -** Chemical engineering is a branch of engineering that uses principles of chemistry, physics, mathematics, biology, and economics to efficiently use, produce, design, transport and transform energy and materials

**Engineering -** Engineering is the application of science and math to solve problems

**Engineering Process -** The engineering process is a series of steps engineers use to help them solve problems

**Modern Science -** the systematic study of the nature and behavior of the material and physical universe, based on observation, experiment, and measurement, and the formulation of laws to describe these facts in general terms

**Biology -** The study of living organisms, divided into many specialized fields that cover their morphology, physiology, anatomy, behavior, origin, and distribution

**Genetically Modified Organisms –** A genetically modified organism is any organism whose genetic material has been altered using genetic engineering techniques

**Superweed -** a weed which is extremely resistant to herbicides, especially one created by the transfer of genes from genetically modified crops into wild plants

**Super pest -** a strain of bacteria or insect that has become resistant to antibiotic drugs

**Biotic –** Any form of living organisms

**Abiotic –** Any form of non-living organisms

Assessment

**Pre-Lesson Assessment**

The pre-lesson assessment is a verbal assessment in which the presenter asks students if they have any prior knowledge about automotive engineering and to explain what it is to the best of their ability.

**Post-Intro Assessment**

Have students ask any questions about the lesson after each slide (if needed) to ensure they are paying attention and retaining the information that is told to them.

**Lesson Summary Assessment**

Following the completion of the Genetically Modified Organisms Presentation, students will be given an interactive quiz that will feature five questions about automotive engineering with multiple answer choices and one correct answer:

* What field of engineering do GMOs fall under? - Chemical Engineering
* GMOs are 100% man-made - False
* Which one of the following Engineers helped in the creation of the first GMO?- Stanley Cohen
* All GMOs are harmless - False
* Which of the following is NOT an effect of bad GMO practices? - Superdroughts
* The first GMO was made in - 1971
* Designer babies have NOT been perfected yet - True
* Which of the following fruits is NOT a GMO? - Blueberries

The “lesson summary assessment” will be this final quiz, which has 20 questions. The reasoning behind this was to avoid giving the students an exam after each lesson under the unit this lesson is a part of. The quiz itself is kept short so that students are not discouraged or intimidated by it. Additionally, students will be explained why the correct answer is correct and why the other answer choices are wrong after each question. This will allow the students to learn more and retain the information better. The quiz itself is also very interactive and visually appealing, which will keep the students engaged. Finally, each question is worth a certain amount of points, with students gaining points every time they get a question right. In the end, the top three students will receive a prize. The prize will provide the student with the incentive they need to do well on the quiz, but the quiz itself will be revealed at the end.

References

Dictionary.com. Lexico Publishing Group, LLC. Accessed July 28, 2020. (Source of most vocabulary definitions, most of which were done in my own words) <http://www.dictionary.com>

CPALMS Standards Accessed July 28, 2020 (Source of educational standards) <https://www.cpalms.org/Public/search/Standard>

Encyclopedia Britannica Accessed July 28, 2020 (Source for most information on Chemical Engineering and GMO Research) <https://www.britannica.com/>

Contributors

Reuben Latorre, Alex Garrido, Victoria Velazquez, Justin Barroso, Jorge Diaz, Abiel Vasallo, and Kyle Kamiya.

Supporting Program

SYIP 2020 Summer Internship Program partnered with Hialeah Gardens Senior High School.

Acknowledgments

I would also like to acknowledge Hialeah Gardens Senior High School for allowing me to write this lesson and conduct the research on it.