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E in STEM

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Midterm: Phase I – Research and Planning

1. Identify the “Big” concept to be covered by the engineering design challenge.

This design challenge has several tiers of “Big” concepts. The overarching theme is an introduction to the concepts of technology and engineering. More specifically, the students are introduced to the field of package engineering and how the needs of both the products and the consumers impact package design. Incorporated into the challenge is a review and reinforcement of the science concept of the needs of plants.

2. Research appropriate learning standards associated with the topic.

NJSLS (New Jersey Student Learning Standards for Science):

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

ISTE (International Society for Technology in Education):

1. Creativity and innovation Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

Technology

a. Apply existing knowledge to generate new ideas, products, or processes

b. Create original works as a means of personal or group expression

4 Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.

Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.

CCSS.MATH.CONTENT.6.SP.B.5.B

Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

3. Identify and discuss the different types of problem solving and declarative/procedure knowledge needed.

This design challenge is a moderately structured problem. There are varying strategies that can be utilized to solve the problem, but students are constrained by the “base” package they are given to modify.

Some of the declarative knowledge includes what a plant needs to survive (light, water, air, space).

The procedural knowledge come in within the constraints of materials and cost. The students soon learn that the best way to keep cost low is to utilize pieces of the base package in new ways. For instance, they may turn the label over and use it to label and communicate how to care for the plant.

4. Explore objectives and ancillary concepts/content covered by the project.

- Explore the role of a packaging engineer
- Implement the steps of the engineering design process
- Identify and explain the needs of the product (the plant) and of the consumer
- Identify the properties of the materials that can be used in a package design and evaluate how well they meet the needs of the product and the consumer.
- Evaluate a plant package design using established criteria.
- Improve on a design, taking into account the evaluation of the prior design.

5. Identify possible activities and 6. Select the best activity for your classroom.

All Engineering is Elementary units start with a challenge that focuses on the meaning of “technology”. As I am limited by time, and my students have had lessons previously on this topic, I will not use this part of the lesson.

The unit from Engineering is Elementary introduces the challenge using a story book. I found this book to be a little young for my class so I will use a different “hook”. I will frame the challenge around the trend to order *everything* from Amazon.com. I researched customer reviews for actual plants delivered with packaging issues (boy were these fun!) and will share them with the class as our real-world connection.

I plan to run the rest of the challenge as presented in the EiE curriculum.

Students will learn what package engineering is and analyze a package and will be asked to identify the *product*, *target consumer*, and *functions* of the package.

After we review the needs of our product (the plant) students will be given the choice of either a cardboard juice carton or a 2L plastic bottle as a base package to modify and design to meet the needs of the product and consumer.

