GEORGIA MIDDLE SCHOOL Instructional Resources

CAREER, TECHNICAL, & AGRICULTURAL EDUCATION

ENGINEERING & TECHNOLOGY

COURSE: Invention and Innovation

UNIT 2: Candy Dispensers

INTRODUCTION

Annotation:

This unit includes lessons on the concepts of invention and innovation, attributes of inventors, assembly line procedures, and using basic math skills to evaluate the profitability of an invention. Students will analyze attributes of great inventors and the impacts of their inventions. They will utilize problem solving skills and the Engineering Design Process to design a candy dispenser. Students will then use mathematical skills to evaluate the mean, median, and mode of an invention operation and complete a cost analysis of an invention.

Grade(s):

	6th
X	7th
	8th

Time:

7.5 class hours total

Author:

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Students with Disabilities:

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided appropriately. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation. Many students (both with and without disabilities) who struggle with reading may benefit from the use of text reading software or other technological aids to provide access to printed materials. Many of these are available at little or no cost on the internet.

FOCUS STANDARDS

GPS Focus Standards:

ENGR-II-1- Students will learn the concept of invention and innovation.

a) Define related invention and innovation terms
b) Compare invention to innovation
c) Examine the role that Engineering & Technology and society play in the invention and innovation process

ENGR-II-4- Students will invent or innovate a technological product.

a) Apply a design process in the invention or innovation of a product or system
b) Design a simple invention or innovation
c) Construct a simple invention or innovation
d) Demonstrate appropriate safety in the invention or innovation of a product or system
f) Demonstrate the use and/or operation of the invention or innovation
g) Evaluate the invention or innovation

ENGR-II-5- Students will examine the impacts of inventions and innovations on society.

a) Discuss the societal impacts of a specific invention or innovation
b) Investigate important inventions or innovations related to Engineering and Technology and how they have impacted our lives
d) Analyze positive and negative effects of inventions and innovations

ENGR-II-6- Students will develop leadership skills and work ethics.

a) Demonstrate work ethics within the classroom and lab environment

GPS Academic Standards:

M7A3 Students will understand relationships between two variables.
c. Describe how change in one variable affects the other variable.

M7D1 Students will pose questions, collect data, represent and analyze the data, and interpret results.
c. Analyze data using measures of central tendency (mean, median, and mode), including recognition of outliers.

UNDERSTANDING & GOALS

Enduring Understandings:

Students will understand the concepts of invention and innovation, analyze attributes of inventors, test their inventive abilities by designing a candy dispenser using common household items, and utilize basic math skills to evaluate the profitability of an invention.

Essential Questions:

- What is invention and innovation?
- What makes an inventor special and what are their impacts on our society?
- What steps are necessary to invent and construct a simple technological system?
- How are mathematics used to evaluate an invention?

Knowledge from this Unit:

Students will:

- Define invention and innovation.
- List famous inventors and their inventions.
- List attributes of an inventor and their impacts on society.
- Explore careers associated with inventing and innovation skills.

Skills from this Unit:

Students will:

- Analyze attributes of an inventor.
- Utilize problem solving skills and the Engineering Design Process to design a product.
- Students will use mathematical skills to evaluate the mean, median, and mode of an invention operation.
- Use mathematical skills to complete a cost analysis of an invention.
- Evaluate an invention's effectiveness using basic mathematical skills.

ASSESSMENTS

Assessment Method Type:

____ Pre-test
X Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
X_ Unit test
X Group project
____ Individual project
X Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
__ Self-check rubrics
__ Self-check during writing/planning process
__ Journal reflections on concepts, personal experiences and impact on one's life
__ Reflect on evaluations of work from teachers, business partners, and competition judges
__ Academic prompts
X_ Practice quizzes/tests
X Subjective assessment/Informal observations
__ Essay tests
X_ Observe students working with partners
__ Observe students role playing
____ Peer-assessment
__ Peer editing and commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
X Dialogue and Discussion
__ Student/teacher conferences
X_ Partner and small group discussions

_____ X_ Whole group discussions
__ Interaction with/feedback from community members/speakers and business partners
_____ Constructed Responses
__ Chart good reading/writing/listening/speaking habits
__ Application of skills to real-life situations/scenarios
_X___ Post-test

Assessment(s) Title:

ENGR 7-2 Candy Dispenser Challenge Rubric
ENGR 7-2 Test

Assessment(s) Description/Directions:

Use the attached PowerPoints to lead class discussions. Unit is broken down into three areas; Introduction to Invention and Innovation, Inventor's Attributes, Candy Dispenser Challenge, and Mathematically Evaluating an Inventions Success.

Attachments for Assessment(s):

ENGR 7-2 Candy Dispenser Challenge Rubric
ENGR 7-2 Stus Jeopardy Review
ENGR 7-2 PowerPoint Jeopardy
ENGR 7-2 Test

LESSON PLANS

• LESSON 1: INTRODUCTION TO INVENTION AND INNOVATION

1. **Identify the Standards. Standards should be posted in the classroom for each lesson.**

ENGR-II-1: Students will learn the concept of invention and innovation.
a) Define related invention and innovation terms
b) Compare invention to innovation
c) Examine the role that Engineering & Technology and society play in the invention and innovation process

2. **Review Essential Question. Essential Questions should be posted in the classroom for each lesson.**
   - What are Invention and innovation?

3. **Identify and review the unit vocabulary. Word Wall should be posted in the classroom for unit.**

Invention	Engineering Design Process
Innovation	Science
Attributes	Technology
Societal Impacts	Artifact
Specialization of function	Prototype

Words introduced in lesson: **Invention, Innovation, Science, Technology** (Definitions in text below and in PowerPoint)

4. Utilizing PowerPoint, give students 1 minute to list 3 of the most famous inventors they can think of, and then briefly review their answers. Do not discuss what they invented.

   Examples of inventors might be: Alexander Graham Bell, George Washington Carver, Leonardo Da Vinci, Walt Disney, Thomas Edison, Albert Einstein, Henry Ford, Benjamin Franklin, Johannes Gutenberg, Lewis Latimer, Sir Isaac Newton, Levi Strauss, Eli Whitney, and Wilbur & Orville Wright.

5. Utilizing PowerPoint, give students 1 minute to list what these famous inventors invented, and then review their answers.

   Examples of inventors might be: Alexander Graham Bell -telephone, George Washington Carver –peanut butter, Leonardo da Vinci - weapons, Walt Disney –multiplane camera, Mickey Mouse, Thomas Edison –phonograph, light bulb, Albert Einstein –atomic bomb, Henry Ford –assembly line, Benjamin Franklin –bifocals, lighting rod, odometer, Johannes Gutenberg –printing press, Lewis Latimer –disinfectant , Sir Isaac Newton – reflecting telescope, Levi Strauss –blue jeans, Eli Whitney –cotton gin, and Wilbur & Orville Wright –powered flight.

6. Utilizing PowerPoint, give students 1 minute to list how one of their inventions listed impacted society, and then review their answers.

   Examples of impacts might be: improved transportation, winning wars, faster production, faster communications, entertainment, better food and clothing.

7. Discuss the similarities in the terms invention and innovation. Have students copy the following definition on their note taking guide:

   Invention -- A new and unique product created by an inventor.
   Innovation--The process of altering an existing product or system to improve it.

8. Discuss the terms science and technology and how they relate to invention and innovation. Have students copy the following definition on their note taking guide:

   Science -- Science is the study of the natural world.
   Technology -- Technology is the use of knowledge to turn resources into goods and services that extend our capability.

9. Review Essential Question and summarize.
   - What are invention and Innovation?

• LESSON 2: ATTRIBUTES OF INVENTORS

1. **Identify the Standards. Standards should be posted in the classroom for each lesson.**
   ENGR-II-5: Students will examine the impacts of inventions and innovations on society.

2. **Discuss the societal impacts of a specific invention or innovation.**
   Analyze positive and negative effects of inventions and innovations

3. **Review Essential Question. Essential Questions should be posted in the classroom for each lesson.**

What makes an inventor special and what are their impacts on our society?

4. **Identify and review the unit vocabulary.** Word Wall should be posted in the classroom for unit.

Invention	Engineering Design Process
Innovation	Science
Attributes	Technology
Societal Impacts	Artifact
Specialization of function	Prototype

Words introduced in lesson: **Artifacts, Attributes, Societal Impacts** (Definitions in text below and in PowerPoint)

5. Introduce students to the term artifacts and how we learn about cultures from their artifacts. Have them record the definition on their notetaking guide.

Artifact--A human made object.

6. Introduce students to the term attributes and why inventors are special. Have them record the definition on their notetaking guide.

Attributes-- The characteristics of a person.

7. Introduce students to the term societal impacts and review some of the impacts discussed in the last lesson. Have them record the definition on their notetaking guide.

Societal Impacts-- How people and products affect the way we live.

8. Form groups of 3 to 4 students, pass out the **Great Thinkers and Their Inventions**, and them complete the **Attributes Worksheet**. Explain to the students they must make general assumptions to the best of their ability to determine the attributes and impacts.

9. Reform the class and discuss their answers to the worksheets.

10. Review Essential Question and summarize.

• LESSON 3: ASSEMBLY LINE PROCEDURES

1. **Identify the Standards. Standards should be posted in the classroom for each lesson.**

ENGR-II-4: Students will invent or innovate a technological product.
B) Construct a simple technological system
C) Explain how your technological system operates
C) Describe the steps of the Engineering Design Process

2. **Review Essential Question. Essential Questions should be posted in the classroom for each lesson.**

What steps are necessary to invent and construct a simple technological system?

3. **Identify and review the unit vocabulary.** Word Wall should be posted in the classroom for unit.

Invention	**Engineering Design Process**
Innovation	**Science**
Attributes	**Technology**
Societal Impacts	**Artifact**
Specialization of function	**Prototype**

Words introduced in lesson: **Specification of Function, Engineering Design Process, Protype** (Definitions in text below and in PowerPoint)

4. Review attributes of inventors from the previous lesson. Explain why understanding invention and innovation is important. Introduce the term specification of function and have students record the definition in their notetaking guide.

   Specification of Function—Involves decreasing the overall capabilities of a product or system in order to increase its ability to perform a more narrow or specific task very efficiently.

5. Discuss possible careers associated with invention and innovation.

   Examples include the areas of Construction, Engineering, Marketing, Science, Technology, and Manufacturing.

6. Briefly review the steps in the Engineering Design Process. Have student write the step on their notetaking guide.

   Engineering Design Process--
   Defining the challenge
   Explore ideas
   Plan & Develop
   Test idea
   Present the solution

7. Discuss the definition of a prototype and explain their uses. Have students write the definition on their notetaking guide.

   Prototype-- A full-size working model used to test a design.

8. Introduce the Candy Dispenser Challenge and split the class into groups of 3 to 4 students. Pass out the **Candy Dispenser Design Brief** and the **Candy Dispenser Engineering Design Process Worksheet**. Give the class approximately 2 hours to construct their candy dispenser. (**Note:** Recommend using Skittles and giving groups a small amount to testing to prevent them from eating the samples. Prior to demonstrating their dispenser, have the student throw away samples used in the invention process due to being unsanitary, then give the students a larger sampling for their demonstration allowing them to eat them afterwards.)

   Situation:
   Your aunt Laura, the "candy connoisseur" and "part-time scientist" has innovated a new way to make Skittles that have different flavors. For example, she has discovered a way to make Skittles that taste like chocolate ice cream, hot dogs with ketchup, and peanut butter and jelly. She would like to share her new type of Skittles with the public by offering them free samples in stores. She hopes that by offering them free samples, they will like them so much that they will go out and buy them by the jars and make her rich and famous. However, she needs someone to "invent" for her a Skittles dispenser.
   Challenge:
   In this small group activity, your team is to design and develop (invent) a prototype (working model) of a small Skittles dispenser.
   Criteria and Constraints:
   Your Skittles dispenser must be made with at least 7 different items.
   - You must decide on a name for your Skittles dispenser.
   - The Skittles dispenser must be able to hold at least 4 ounces of Skittles and be able to dispense a small "free sample" of approximately 4-8 pieces of Skittles.

Tools, Materials and Equipment Needed:
3 Straws, 1 Bowl, 1 CD, Tape, 2 Paper Clips, 1 Cup, 2 Pipe cleaners, 2 Rubber Bands, 1 File Folder

Procedure:

A. Students, working in groups of 4 or 5, will use the engineering design process to invent a new Skittles Dispenser.
B. Student groups will:
   a. Assign a group leader.
   b. Discuss the problem (complete EDP Worksheet).
   c. Discuss ideas for solving the problem (make sketches).
   d. Choose the "best idea" (make final sketch).
   e. Obtain materials and build a prototype (working model).
   f. Evaluate and test your prototype, refine as needed.
   g. After the prototype is finished, name it - be creative.
   h. Make an oral presentation to the class describing the completed "Skittles Dispenser." (**Note: You may vary materials used based on what you have available in the classroom.**)

9. Prior to releasing the groups to their working areas, discuss the merits of good group work.

10. Have students complete their candy dispensers.

11. Have each group demonstrate their Candy Dispenser.

12. Discuss how the invention process went.

13. Assess student performance/participation using Rubric.

14. Review Essential Question and summarize.
15.

• LESSON 4: USING MATHEMATICS TO ANALYZE AN INVENTION

(This lesson is optional and you may wish to include worksheet as part of Lesson 3)

1. Identify the Standards. Standards should be posted in the classroom for each lesson.
ENGR-II-4: Students will invent or innovate a technological product.
G) Evaluate the invention or innovation

M6A2 Students will consider relationships between varying quantities.
M6D1 Students will pose questions, collect data, represent and analyze the data, and interpret results.

2. Review Essential Question. Essential Questions should be posted in the classroom for each lesson.
How are mathematics used to determine the success of an invention?

3. Identify and review the unit vocabulary. You may wish to add these two words to your Word Wall. Word Wall should be posted in the classroom for unit.

Mean	**Mode**
Median	**Break-Even Point**

Words introduced in lesson: **Mean, Median, Mode, Break-Even Point** (Definitions in text below and in PowerPoint)

4. Explain that students will now use their mathematical skills to analyze an invention. Introduce mean, median, and mode, and work examples.
   Mean -Add all the numbers together then divide the answer by the amount of numbers.
   Median-List all the numbers in correct order, being sure to include an doubles and find the middle number. If you have an even amount of numbers, the median is found by adding the middle two numbers together and dividing by 2.
   Mode-List all numbers in order, the mode is that number which appears the most times. There can be more than one mode.

5. Introduce break-even point and work example.
   Break-Even Point-The point at which cost or expenses of your device and revenue or profit made from the sale of candies are equal.
6. Give students a copy of the ENGR7-2 Candy Dispenser Analysis worksheet.

7. Allow student sufficient time to complete worksheet and review answers.

8. Review Essential Question and summarize.

9. Review & Vocabulary Test
   1. Use attached PowerPoint Jeopardy file or optional Stu's Jeopardy File. To utilize optional Stu's Jeopardy file, first go to http://stujeopardy.com for free download of Stu's Double Jeopardy Game engine. If you wish to change questions or convert information in this file to a PowerPoint, use notepad to open file and edit.
   2. After review, ensure students have completed their note taking guides.
   3. Give vocabulary test.

• ATTACHMENTS FOR LESSON PLANS

Power point:

ENGR 7-2 Lesson 1
ENGR 7-2 Lesson 2
ENGR 7-2 Lesson 3
ENGR 7-2 Lesson 4

Word Documents:

ENGR 7-2 Note Taking Guide
ENGR 7-2 Word Wall
ENGR 7-2 Lesson 1 ESSENTIAL QUESTION
ENGR 7-2 Lesson 1 GPS
ENGR 7-2 Lesson 2 Attributes Worksheet
ENGR 7-2 Lesson 2 ESSENTIAL QUESTION
ENGR 7-2 Lesson 2 GPS
ENGR 7-2 Lesson 2 Great Thinkers and Their Inventions Vignettes
ENGR 7-2 Lesson 3 ESSENTIAL QUESTION
ENGR 7-2 Lesson 3 GPS
ENGR 7-2 Lesson 3 Skittles Dispenser
ENGR 7-2 Candy Dispenser Challenge Rubric

ENGR 7-2 Lesson 4 ESSENTIAL QUESTION
ENGR 7-2 Candy Dispenser Analysis
ENGR 7-2 Test

Games:

ENGR 7-2 PowerPoint Jeopardy
ENGR 7-2 Download Stus Double Jeopardy Link
ENGR 7-2 Stus Jeopardy Review

- **NOTES & REFLECTION:**

To utilize optional Stus Jeopardy Review file, first go to http://stujeopardy.com for free download of Stu's Double Jeopardy Game engine. To modify Stus Jeopardy Review use Windows Notepad.

UNIT RESOURCES

Web Resources:

http://www.iteaconnect.org/EbD/CATTSresources/StateSiteAgreements/GeorgiaSiteAgreement.htm

Attachment(s):

Materials & Equipment:

- Handouts
- PowerPoint projector/screen
- Miscellaneous materials to make candy dispenser
- Internet

What 21st Century Technology was used in this unit?

X	Slide Show Software		Graphing Software		Audio File(s)
	Interactive Whiteboard		Calculator		Graphic Organizer
	Student Response System		Desktop Publishing		Image File(s)
	Web Design Software		Blog		Video
	Animation Software		Wiki	X	Electronic Game or Puzzle Maker
	Email		Website		