

Unit Name: Design Principles
Author: Egg Harbor Township Middle Schools

Time Frame: 22 days

UNIT

Subject: STEM

Country: **USA**

Course/Grade: STEM/6th

State/Group: **NJ**

School: **Egg Harbor Township Middle Schools**

UNIT SUMMARY

Students will follow the design process to take an idea from research to design to building to testing to redesigning. Students will see how creative designs, unique logos, and vivid color schemes can affect the appeal and function of products. Students will explore two-dimensional (2-D) and three-dimensional (3-D) visualization processes and mediums by designing, developing, and building.

UNIT RESOURCES

- *Rulers*
- *Pencils*
- *Cardboard*
- *3-d printer*
- *Recyclable materials*
- *Markers*
- *Styrofoam*
- *Iteea Curriculum*

Internet Resource Links:

www.iteea.org

www.edheads.org

www.howstuffworks.com

STAGE ONE

GOALS AND STANDARDS

TEC.5-8.8.1.8.A.5 - [*Cumulative Progress Indicator*] - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.

TEC.5-8. - [*Content Statement*] - The use of digital tools and media-rich resources enhances creativity and the construction of knowledge.

TEC.5-8.8.1.8.E.1 - [*Cumulative Progress Indicator*] - Gather and analyze findings to produce a possible solution for a content-related or real world problem using data collection technology.

TEC.5-8. - [*Content Statement*] - Information accessed through the use of digital tools assists in generating solutions and making decisions.

TEC.5-8. - [*Content Statement*] - Technology systems impact every aspect of the world in which we live.

TEC.5-8. - [*Content Statement*] - The design process is a systematic approach to solving problems.

TEC.5-8.8.2.8.B.1 - [Cumulative Progress Indicator] - Design and create a product using the design process that addresses a real world problem with specific criteria and constraints.

TEC.5-8.8.2.8.B.2 - [Cumulative Progress Indicator] - Identify the design constraints and trade offs involved in designing a prototype, (how the prototype might fail, and how it might be improved) by completing a design problem and reporting results in a multimedia presentation.

TEC.5-8.8.2.8.B.3 - [Cumulative Progress Indicator] - Solve a science-based design challenge and build a prototype using science and math principles throughout the design process.

TEC.5-8.8.2.8.E.1 - [Cumulative Progress Indicator] - Work in collaboration with peers and experts in the field to develop a product using the design process, data analysis, and trends, and maintain a digital log with annotated sketches to record the development cycle.

ENDURING UNDERSTANDING

- Students will understand that the design process is a framework engineers and designers use to create products that can be utilized in any order.
- Students will understand that many factors are taken into consideration when creating a logo.

ESSENTIAL QUESTIONS

1. How does the design process help engineers create and improve products?
2. Why is the redesign step very important to completing projects?
3. How does color, logo, and overall design alter the way a product is viewed?
4. How can 3-dimensional objects be represented by 2-dimensional sketches?

KNOWLEDGE AND SKILLS

- Students will understand that the design process is composed of researching, designing, building, testing, and redesigning.
- Students will understand that 3-dimensional objects can be represented by different 2-dimensional views.
- Students will understand that creative designs, bright colors, and logos are appealing to consumers.
- A misunderstanding is that students will think the design loop must be followed in a strict order.
- Students will be able to communicate their ideas to their groups and present their ideas to their classmates.
- Students will be able to create isometric and orthographic drawings using measurement.
- Students will be able to use design software to create 3-dimensional viewings.

STAGE TWO

PERFORMANCE TASKS

- Design: Toying with Technology
 - Happyland Toy Company wants to create a new board game with a unique logo that will appeal to younger children. You will design and create a game for the Happyland Toy Company that will sell the most board games to children. The logo and color scheme should relate to the game idea and look inviting for children to want to play. You must also create 3-dimensional game pieces that include the color scheme and logo of the company.
- Manufacturing: The Fudgeville Crisis
 - Fudgeville makes the most delicious fudge, but they have a problem- the fudge only tastes good in the store! They are unable to ship their product because they do not

have containers that will preserve the freshness of their product. Your job is to create a cost-effective container in a shape that is easy to ship and preserves the great taste of the fudge.

- Technological Systems: Creating Mechanical Motion
 - You will be given a request from a younger student at a neighboring school. This request will include the age of the student and what types of toys the student likes to play with. Your job is to create a toy with simple machines and linkage mechanisms that is fun to play with and really works.
- Kite Project
- A number of different items have been used at sporting events to support and promote team and school spirit. For this project you are to develop a kite which could be flown during the event outdoors or held by a fan.
- Trash Transformation

Here's the challenge: Young inventor Thaddeus found his uncle, world renowned inventor Phineas T. Quirkbotham, contemplating a box of assorted materials on his big reference table. "You know, Thadd," Phineas said, "Thomas Edison said something very important many years ago. He said the first step toward inventing something is to start with a big pile of junk!"

With that, Thadd joined his uncle in examining the box, which contained a variety of things like old CDs/DVDs, discarded toothbrushes, popsicle sticks, and a variety of empty sewing thread spools. Phineas decided to challenge Thaddeus—and your students—to apply their creativity to invent something useful that incorporates one or more of these materials. Given a good supply of discarded CDs/DVDs, old toothbrushes, popsicle sticks, and empty sewing thread spools, what might your students create?

OTHER EVIDENCE

Safety Quiz

Design Process Quiz

Measurement Quiz

STAGE THREE

LEARNING PLAN

- Introduction of Safety/Safety Quiz
- Introduction of Measurement/Ruler Quiz
- Introduction of Design Process
- Research: Prior knowledge, Human interaction, Research on laptops
- Design: Brainstorm, sketches, isometric and orthographic designs
- Building: Creating the product
- Testing: Test and written results
- Redesign: Written description of how to better project, actual design of item
- Presentation of product to classmates

Students must get 100% on safety quiz in order to build project.

Students must check-in with teacher after each step in design process in order to get next part of the design portfolio.

Classroom observations will be made and documented as students work in their cooperative learning groups.