Unit 1: Introduction to STEM

Content Area: **Engineering**
Course(s): **STEM**
Time Period: **Week 1**
Length: **15 Days**
Status: **Published**

Unit Overview

In this unit, students will learn exactly what STEM is. Students will begin this unit by working as a team to develop the tallest standing paper tower possible using the given materials. This will be the first time that students will need to come up with a problem solving plan and work together towards achieving that goal. Next, students will learn the importance of using illustrations to assist with solving problems. Students will then use those illustrations that were created to come up with a device that will successfully transport an egg from a given height. After learning how to use pictures to help solve a problem, students will learn about scale drawings by creating a floor plan of their house. Finally, students will use that floor plan to come up with an estimate as to how much it would cost in materials to re-create that room. The concepts learned within this unit will serve as the foundation for the remaining units of this course.

Standards

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

CCSS.ELA-Literacy.WHST.6-8.2.c	Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
CCSS.ELA-Literacy.WHST.6-8.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.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.

Essential Questions

1) Why is having a problem solving strategy an important factor in coming to a solution to a problem?

2) How can having illustrations help with the design process?

3) Why are scale drawings useful when helping to budget for a particular job?

4) How can science, math, engineering, and technology be used when solving real world problems?

Application of Knowledge: Students will know that...

- A scale drawing can be used to help estimate the cost of a given project.
- Gravity is the outward force acting on a body pulling it towards the center of the earth.
- Illustrations can be created to assist with a problem
- It is important to have a plan in place when trying to solve a given problem.
- Scale drawings show a real object with accurate sizes reduced or enlarged by a certain amount.
- STEM is an acronym representing: Science, Technology, Engineering, and Math.

Application of Skills: Students will be able to...

- Construct a contraption that will prevent an egg breaking when dropped from a given height.
- Create a problem solving plan to come up with a solution to a given problem.
- Create a scale drawing of the classroom with a set of given criteria that needs to be met.
- Draw pictures to represent the hopeful outcome of their model.
- Utilize a scale drawing to assist with estimating the cost associated with constructing the room

Assessments

- Journal logs: Will be used for students to share anything that worked out well during the design process or anything unexpected they encountered.
- Egg Drop Scoring rubric: students will be self graded in addition to being graded as to how well they

used the resources available to them and if in fact their contraption actually worked.
- Floor Plan scale drawing: Students will be required to construct an accurate scale drawing of the classroom. Students will be required to measure all aspects of the room and apply an appropriate scale when drawing the result.
- Estimating (for budgeting): Students will be required to come up with an estimate to calculate how much it would actually cost to construct the floor plan that they created on their own.
- Information from this unit will be included on a locally developed, end of course benchmark assessment that may take the form of a test, performance based project, or other summative assessment.

Suggested Activities

- Paper tower project: Students will work cooperatively with a given partner to construct the tallest standing paper tower using very minimal resources.
- Egg drop project: Students will design and construct a contraption that will protect an egg from a drop of a given height. Students will be asked to draw a design of their model, explain the reasoning as to why they chose the materials that they did, and actually construct the contraption.
- Classroom scale drawing: Students will measure and construct a scale drawing of our classroom.
- Fictional floor plan: Students will be asked to construct a fictional floor plan of a home that meets a given set of criteria including the furniture.
- Estimating exercise: Students will be asked to take their fictional floor plan and estimate the cost of actually constructing it.

Activities to Differentiate Instruction

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time
    - Prioritize tasks
    - Think in concrete terms and provide hands-on-tasks
    - Position student near helping peer or have quick access to teacher
    - Anticipate where needs will be

- Content specific modifications may include:
    - Break a project up into attainable goals that can be met each period.
    - Provide the given measurements in the classroom when completing the floor plan project.

Differentiation for ELL's:

- General modifications may include:
  - Strategy groups
  - Teacher conferences
  - Modification plan
  - Collaboration with ELL Teacher

- Content specific vocabulary important for ELL students to understand include: gravity, STEM, scale, estimate, budget

Differentiation to extend learning for gifted students may include:

- Having students draw a model of the outside of their fictional house as well (including any landscaping).
- Give students a more challenging scale to use (decimal) when creating the scale drawing of the classroom.
- Have students design a contraption that will allow the egg to float to the ground rather than something that cushions its fall.

Integrated/Cross-Disciplinary Instruction

ELA: Practice formulating complete and grammatically correct responses for the given journal entries.

Mathematics: Correctly use scale and proportions to create your own fictional floor plan.

Science: Use the scientific method to experiment with different designs when trying to create the egg drop contraption.

Engineering: Successfully create a free standing tower with the supplies provided.

Resources

www.learn2.stem101.org

STEM Labs for Middle Grades

Youtube videos: self directed videos that can help students along in the design process

https://stem.neu.edu/resources/activities/eggdrop/

21st Century Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.