Internet of Things (IoT) at UCF

UNIVERSITY OF CENTRAL FLORIDA

UCF RET Site: Collaborative Multidisciplinary Engineering Design Experiences for Teachers

1205040: M/J Grade 7 Mathematics

Sara Jacks

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READ THIS FIRST

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- Remember to do your 3R reflection include an updated copy of your lesson plan, developed assessment tools, presentation materials, to the evaluator. See implementation plan instructions developed by the evaluator. Send within a week after completing the lesson to bonnie.swan@ucf.edu

RET Site: CoMET Lesson/Unit Plan

Course(s): M/J Grade 7 Mathematics
Grade Level: 7th
Suggested Length of Lesson: 180 min

Materials/Technology Needed
- Computer with internet access
- Free account with tinkercad.com
- Ruler
- Scrap Paper (optional)
- Grid paper mm^2 and cm^2 (optional)

Where this Fits
- Students will have previously worked with the tinkercad program and developed their own 3D designs within this program.
- This lesson will be used at the end of the ratio and proportional reasoning unit.
- This activity will assist students in building connections between proportional reasoning and scale drawings/ scale factor.

Lesson Objective(s)/Learning Goal(s)
- Students will recognize the purpose of a scale factor and explain how the zoom function in technology a function of a scale factor is.
- Students will be able to apply proportional reasoning to compute scale conversions.
- Students will utilize unit conversions to visualize the actual size of a 3D printed item resulting item generated from a CAD program.

Standard(s)/Benchmark(s) Addressed
- *Standards:*
  - **(MAFS.7.RP. 1.1)** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units.
  - **(MaAFS.7.RP.1.20)** Recognize and represent proportional relationships between quantities.
  - **(MAFS.7.G.1.1)** Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas form a scale drawing and reproducing a scale drawing at a different scale.

Standards for Mathematical Practice
- **(MAFS.K12.MP.4)** Many everyday problems can be solved by modeling the situation with mathematics.
- **(MAFS.K12.MP.1)** Solving a mathematical problem involves making sense of what is known and applying a thoughtful and logical process which sometimes requires perseverance, flexibility, and a bit of ingenuity.
- **(MAFS.K12.MP.7)** Recognizing a structure or pattern can be the key to solving a problem or making sense of a mathematical idea.

Instructional Strategies
- Guided Inquiry
- Cooperative Learning
- Mathematical Reasoning
- Mathematical Modeling
- Error Analysis

Evidence of Learning (Assessment Plan)
- Final Product- 3d model to size in tinkercad
- Completed hand out with computations and sketches of scale and actual size illustrations

Description of Lesson Activity/Experiences

Day 1

1. Students will be provided a handout in which they will be asked to sketch their CAD modeled item in "actual size". I will model this process and walk them through what this should look like.
2. After about 10-15 mins, I will model appropriate measuring and labeling techniques. I will circulate the room and provide additional guidance where needed.
3. As students complete their measurement portion of this activity I will instruct them to transfer what they see in the tinkercad program onto the $1mm^2$ grid paper, they will do this from each view of their item top, bottom, left, right, front, back.

Day 2/3

4. I will then explain to students that this illustration is the actual size their item will print, I will then facilitate a discussion targeting the questions:

   Is this the size you wanted your item to print?
   -What do you think happened?
   Does this match the size you see on the computer?
   -Why do you think this is?
   What happens when you zoom in and out?
   How can we get our code blocks items to print the size we want?
5. I will provide guidance and leading questions to assist students in their process of solving their scale issue through unit conversion.
6. Students will complete their conversions, input these new values into their tinkercad code blocks program.
   - Note: This is where students may begin noticing mistakes in their conversions. If a section or item in their design is no longer proportional to the rest, could be a sign of an incorrect conversion or a student not computing a conversion on a specific section of their item. (Students will be guided to address these concerns at this stage and reminded that this is part of the engineering process.)

Day 4

7. Students will then be asked to once again transfer what they see in the tinker cad program onto the $1mm^2$ grid paper, they will do this from each view of their item top, bottom, left, right, front, back.
8. Students will be asked to compare this with their ideal size. If this does not suite their ideal size, I will prompt students to troubleshoot and provide necessary supports as they make adjustments.

Recommended Assessment(s) and Steps

- Students will turn in completed steps on their handouts, as well as an appropriately size tinkercad code blocks file.

List of Materials/Resources Used

- All materials and resources listed above.

Important Vocabulary

Term	Definition
STEM	Science Technology Engineering Mathematics
Engineering	A person who designs, builds, or maintains engines, machines, or public works.
Code	How computers communicate. The language computer programmers use to communicate what they want the computer to do.
3d Printer	A machine that can print 3 dimensional objects, typically by laying down several thin layers of polymer and curing each layer individually.
CAD	Computer Aided Design (typically a software)
Dimension	A measurable extent of some kind. Ex: length, width, height.
Scale Drawing	Illustrates an object with accurate sizes reduced or enlarged by some amount.
Scale Factor	Ratio of corresponding sides of similar figures.
Ratio	A numerical relationship between two amounts.
Proportion	A part or number considered in comparative relation to a whole. Ratio=Ratio
Unit Conversion	Process of converting on unit to another.

Troubleshooting Tips

- *Students may need assistance in adding "work plane" in various views so they can see the grid from each view in tinkercad.*
- *Be sure students are using the mm^2 blocks when transposing onto the secondary document.*
- *Students with limited experience in tinkercad code blocks may need assistance in inputting their new values for length, width, and height. To prevent this, the teacher may provide a specific item to students generated in code blocks and provide an outline for this.*

Other Helpful Information

- Encourage students to develop an ideal size for their printed item that will be a different size than the item they generated in tinkercad.

- Keep in mind the capabilities of the 3D printer, students items size should not be larger than the printing volume of the printer.

Attachments

- PowerPoint
- Handouts

References

References

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Authors

Sara B. Jacks

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- Advising Faculty: Dr. Gou, Dr. Cho, Jim Ebbert, (ect….)

Contact information

Sara B. Jacks
E-mail: Sbjacks@volusia.k12.fl.us