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Using STEM Resource Package: Sample Lesson Plans

This document provides a sampling of lesson plans utilizing STEM strategies in a variety of ways. Additional STEM activity ideas and lesson plans related to specific curriculum areas are available with each of our Curriculum Topic Resource Packages. STEM lesson plans are also available as a Teacher Tool with many individual videos on our website.

Sample Lesson 1: Good Bye Plastic Bags

Type of Teacher Tool: Small Group
Targeted Grade Level(s): 3-8
Targeted Curriculum Areas: Environment

Learning Objectives:
The learner will:
1. discover the problems with plastic bags for the environment.
2. design an idea to help the school/community reduce the use of plastic bags and plastic.

Featured National Standards:
1. CCSS.ELA-LITERACY.RST.6-8.8
Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

2. 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

3. RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS3-1)

4. MP.2 Reason abstractly and quantitatively. (5-ESS3-1)

5. 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Additional State and National Standards related to the content of our videos listed below for this lesson are also provided on the Educate.Today page where you find the video.

Resources/Materials Needed:
1. Environment 51: What can we do to reduce stores using plastic bags.

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2. Environment 68: Repurpose Your Waste and Help the Environment
3. **One Plastic Bag: Isatou Ceesay the Recycling Women of the Gambia** by Miranda

Teacher Instructions:

1. List in your group how many times in a day all the times you use plastic. Multiply that by how many people are in the group. Discuss the problem for the environment this might cause.
2. Read **One Plastic Bag** and watch Environment 51.
3. Research what the plastic does to the land and oceans and how long it takes to decompose. Research how many are recycled and how they are recycled.
4. Brainstorm different ideas to reduce the use of plastic bags or other plastics.
5. Choose one idea to encourage the students in your school or your community to do. Design posters with information to hang in the school.

Assessment/Evaluation Options:

1. Students should develop a reasonable idea for reducing the amount of plastic or plastic bags.
2. They should show an opinion that is supported by facts. Examples:

- Pack lunches in bags or containers that can be used over and over.
- Hold on to, instead of tossing, a recyclable item to take to a place to recycle.
- Bring own bags to go shopping
- Choose to buy things that are in recyclable packaging or no packaging at all.
- Use used plastic items to make something new.
- Petition the school to add a recyclable can in the cafeteria.

Sample Lesson 2: Make a Space Capsule Console

Type of Teacher Tool: Small Group
Targeted Grade Level(s): 4 – 6
Targeted Curriculum Area: STEM
Learning Objectives:

1. Students will learn about the design of the Mercury and Gemini capsules
2. Students will understand and demonstrate the planning and designing of a spaceship.

Featured National Standards:

1. CCSS.ELA-LITERACY.RST.6-8.3

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

2. ISTE Standard #4—Innovative Designer

4a—Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.

3. Next Generation Science Standards

3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time or cost.

3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Resource Materials:

Videos:

1. Space 11: History in the First Person—Building the Mercury Capsule
2. Space 4: How were the materials necessary for the construction of the spacecraft determined?
3. Space 6: Were any unusual materials chosen to help build the Gemini capsule and adapter?
4. Space 7: What were the challenges in design of the capsule to allow for space walks?

Other Materials:

1. Cardboard box and / or foldable poster
2. Color Markers and Foam
3. Scissors, Glue, Glitter, Cardboard
4. Table and Chair

Teacher Instructions:

1. Divide students into groups of 4 to 5.
2. Have students view the videos above to learn how NASA engineers designed space capsules and control consoles for the Mercury and Gemini missions.
3. As students view the videos, have them write down any areas of confusion they have so they can ask you clarifying questions before beginning the next step of the activity.
4. Have each group choose the destination of their space mission: to the moon, Mars, or the International Space Station.
5. Have students determine how many astronauts they plan to fit inside their capsule and design a control console for their mission including anything the console would need to complete the mission.

6. Use the materials listed to make buttons, handles, alarms, and anything else in the design. The materials above are just suggestions. Feel free to use other materials.
7. Have students look for pictures on the Internet for real spaceship consoles and/or take screen captures from images in the videos, and compare those consoles with the one they created.
8. After completing their comparison, each group should make a list of the things they would change on their console.
9. Have each group prepare a short presentation they will give to the class that shows and explains their console design. Tell them to be prepared to answer questions from their classmates.
10. Have the class compare the different consoles made, then vote for the one they believe best fits its mission.

Assessment/Evaluation Options:

1. Have students engage in self-reflection on how well their console designs met the space mission they chose.
2. Evaluate the consoles for appropriateness regarding needs associated with the chosen mission.
3. Have students reflect on the process of design for a specific purpose.

Sample Lesson 3: Angular to Linear Velocity

Type of Teacher Tool: Individual/Differentiation
Targeted Grade Level(s): 9-12
Targeted Curriculum Areas: STEM/mathematics/physics

Learning Objectives:
The learner will:

1. Find the angular velocity created by the spin of the earth for a specific place/city on earth
2. Learn to find the corresponding linear velocity to the angular velocity

Featured National Standards:
CCSS.ELA-LITERACY.RST.11-12.7
Integrate and evaluate multiple sources of information presented in diverse formats and media (eq., quantitative data, video, multimedia) in order to address a question or solve a problem.

CCSS.ELA-LITERACY.RST.11-12.8
Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

Resources/Materials
Educate.Today Videos:

1. Space 11: History in the First Person: Building the Mercury Capsule
2. Space 9: History in the First Person: The Gemini Project
3. Space 10: Orion: The First Step to Deep Space
4. Space 11: History in the First Person: Building the Mercury Capsule

Other:

1. Internet
2. Graphing Calculator or at last Scientific Calculator

Teacher Instructions:

1. Use any of the Educate.Today videos listed to provide the students background information on space exploration and examples of how scientists and engineers apply their scientific and mathematic knowledge to solving problems integral to space flight.
2. Let students know that rockets leaving Earth's surface and traveling eastward get a boost from the Earth's spin. In fact, someone standing on equator is actually traveling at just over 1000 mph.
3. Have each student pick a city anywhere in the world or have them draw the name of a city from a hat of choices you have provided.
4. Students should then look up the latitude for that city.

5. Have students calculate the angular velocity of the earth in mph using $\omega = \frac{\theta}{t} = \frac{2\pi radians}{24hours}$
6. Next have students find the radius of the earth for their chosen city using the formula $R_{\alpha} = R_{e}\,\mathrm{Cos}\left(\alpha\right)5$ where α = latitude and R_{e}=3958.8 miles (the radius of earth at the equator)
7. Once students have the radius, have them calculate the additional thrust the rocket would receive in the town they chose using $v = \omega \cdot r$

Extension Activity Options:

1. Take all of the data and do a scatterplot either on the board or with a graphing calculator using latitude for x and velocity for y3. See what shape the graph takes. Draw conclusions based on the shape of graph.

Assessment/Evaluation Options:

1. Have students turn in their work to assess the accuracy of their calculations.

Sample Lesson 4: Design A Subway System

Type of Teacher Tool: Small Group
Targeted Grade Level(s): 7 - 9
Targeted Curriculum Areas: Geography, STEM, STEAM, Transportation

Learning Objectives:
The learner will:

1. increase his/her understanding of logistics and city transportation designs.
2. demonstrate ability to problem solve, using mathematics and systems of measurement.
3. gain understanding of civil engineering and city Infrastructure.

Featured National Standards:

1. CCSS.ELA-LITERACY.RST.6-8.7

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

2. CCSS.ELA-LITERACY.RST.6-8.4

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.

Resources/Materials Needed:
Consider using the Educate.Today videos listed below.

1. Transportation 10: Railroad Speed Activity
2. Transportation 15: Explore! Trains

Teacher Instructions:

1. Have students either pick a small city /town, or make one up.
2. Next have students draw a basic roadmap for a downtown area (this can be a basic pencil sketch). For simplicity, you will want to keep the service area to less than 25 square miles (5 miles x 5 miles).
3. Decide the population size. Assume 25% of population will use the subway.
4. Assume that each car can hold up to 100 people. Then decide how many cars on your train you will need (5 – 10).
5. Have students look up speed information for a subway.
6. To help students in their understanding of subway speed and operation, have them view either of the videos above that talk about the operation of trains. A subway, of course, is a train that runs underground, so let them see if any information provided in those videos helps them with background/context for their work in the next step.
7. Using the roadmap in step 2, the information from steps 4 and 5, have students draw up a basic plan for a subway system. The goal will be for no one to have to walk more than a mile, and to move the population during a 2-hr. window.

Assessment/Evaluation Option:

1. Have students turn in their plan for grading on completion, accuracy and presentation.

Sample Lesson 5: Overlapping Engineering Fields

Type of Teacher Tool: Whole Class or Small Group
Targeted Grade Level(s): 9-12
Targeted Curriculum Areas: STEM, Science, Engineering

Learning Objectives:
The learner will:

1. learn about the different engineering fields and the type of work each field does.
2. increase their understanding of the different subjects encompassed by the multiple engineering fields.
3. demonstrate knowledge to be able to distinguish one type of engineering from another.

Featured National Standards:

1. CCSS.ELA-LITERACY.RST.6-8.1

Cite specific textual evidence to support analysis of science and technical texts.

Resources/Materials Needed:
Consider using any combination of the following Educate.Today videos:

1. Engineering 7: What skills are important to being a successful engineer?
2. Sample Video 88: Robots 7: The Science Behind Robots
3. Engineering 9: The Science Behind the New Mississippi River Bridge, Part 1
4. Sample Video 81: Engineering 10: The Science Behind the New Mississippi River Bridge, Part 2
5. Sample Video 80: Engineering 30: What are some different ways that engineers dissipate energy to slow the coaster down as it enters the station?
6. Sample Video 51: Space 11: History in the First Person: Building the Mercury Capsule
7. Sample Video 34: Physics 9: The Science Behind Roller Coasters
8. Sample Video 26: Aviation 13: Four Forces That Affect Flight
9. Sample Video 25: Aviation 16: Flying a Jet Fighter
10. Resource Package 10: Engineering
11. Aviation 2: The Science Behind Aviation
12. Aviation 9: Propulsion
13. Environment 8: The Science Behind Dams
14. Space 10: Orion: The First Step to Deep Space
15. Space 9: History in the First Person: The Gemini Project
16. Space 11: History in the First Person: Building the Mercury Capsule
17. Engineering 9: The Science Behind the New Mississippi River Bridge, Part 1
18. Transportation 15: Explore! Trains
19. Environment 14: Earth Day: Building Green Program 1
20. Transportation 20: HEC-TV Live! Passage to Progress Program 2
21. Engineering 11: You Are Here: Gateway Arch

Teacher Instructions:

1. Have student(s) research and list the different types of Engineering and the subjects each of those types cover
2. Discuss the way the different fields of engineering have over lapping subjects. (i.e. electrical and biomedical).
3. Next have students make a list of each subject required for each type of engineering.
4. Determine which of the videos listed above that you want students to watch to see those elements of engineering come to life.

Assessment/Evaluation Option:

1. After discussion and viewing videos, have students pick 2 types of engineering and write an essay to compare and contrast those 2 types.

Sample Lesson 6: Weather Measurements

Type of Teacher Tool: Whole Class
Targeted Grade Level(s): 5-8
Targeted Curriculum Areas: Science, STEM, STEAM, Meteorology

Learning Objectives:
The learner will:

1. increase his/her understanding of weather and the topics it incorporates.
2. demonstrate ability to document and record weather related topics.
3. gain understanding of scientific recording methods.

Featured National Standards:

1. CCSS.ELA-LITERACY.RST.6-8.7

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

2. CCSS.ELA-LITERACY.RST.6-8.9

Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Resources/Materials Needed:

1. Weather 30: Explore! Weather
2. Weather 1: What Tools are used to forecast the weather
3. Weather 2: Why is the weather so difficult to forecast
4. Weather 3: How do computers create model that forecasters use?
5. Weather 31: The Science Behind Weather Forecasting
6. Paper, color pencils, Internet, and photo printer
7. Binder

Teacher Instructions:

1. Either as a whole class or in small groups, have students watch the videos from the list above that you find most helpful for their understanding of meteorology and learning through this activity.
2. Decide or have individual student(s) decide on 5 – 10 weather measurements/events/facts they believe should be recorded daily. (i.e.: if rainfall is one, have them put a container out and measure the rainfall in inches).
3. Have students monitor and record the weather for 10 days in a journal. Journal should include pictures they have drawn or printed.
4. Optional: Have students photograph and identify different clouds they see and determine any relationships they see between how the amount of clouds might have affected other measurements.

5. Have students calculate average measurements over the 10 days in each of their measurement areas. (i.e.: If they recorded high and low temperatures, what is their average? What was average rainfall over the 10 days? Etc.)
6. Next have students compare their results with other students.

Assessment/Evaluation Option:

1. Have students turn in Journal for grading on completion, accuracy and presentation.