

Physical Sciences

Sustainable Energy Sources

Year 6 Unit of Inquiry

Planeteers Game-based Learning Platform

Science and Technology, Arts, Math and Engineering

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Outcomes and Content

Science & Technology

Curriculum Content Code: ACSSU097

Learning Outcomes

Explains how electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources

Standards: Sustainable Energy Sources; Force and Motion

1. How can electrical energy be transferred and transformed in electrical circuits and be generated from a range of sources?
2. How can energy be sustainable?
3. How do solar panels help in sustainable transportation?
 - Consider whether an energy source is sustainable
 - Investigate the use of solar panels
 - Explain how electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources
 - Demonstrate understanding that force can change the size and movement of objects

Engineering

STEAM Curriculum Code: ED1.1 | ED1.2 | EN1.1 | EN1.2

Learning Outcomes

Selects appropriate materials to meet a design need; Identifies and creates simple or complex machines

Standards: Design Process for Innovation

1. How will you design or create an eco-friendly vehicle that could be an alternative mode of transportation?
 - Identify and use appropriate materials in creating an eco-friendly vehicle
 - Build products that use appropriate elements and parts

Arts & Mathematics

Learning Outcomes

Constructs 3-D simple and complex vehicles using geometric shapes/blocks, polygons, space, and repetition of colors to show the balance of the structure and shape.

Standards: Elements of Design and Geometry

1. What shapes and materials should be used to create an eco-friendly, simple or complex vehicle?
 - Describe the attributes/properties of triangles and quadrilaterals using concrete objects or models
 - Demonstrate understanding of the concepts of parallel and perpendicular lines, angles, triangles, and quadrilaterals
 - Identify and describe triangles according to sides and angles
 - Identify and describe the different kinds of quadrilaterals: square, rectangle, parallelogram, trapezoid, and rhombus
 - Demonstrate understanding of lines, colors, space and harmony through creation of simple and complex machines using 3D objects, and the right proportions of parts

Social Studies

Learning Outcomes

Examines projects and activities by the government for the common good in the community

Standards: Government and its services

1. How do innovative transportation projects benefit the community?
 - Describe and analyze the impact of eco-friendly transportation
 - Develop community awareness on sustainable modes of transportation

Unit Summary

Grade:

6

Subject:

Science, Technology,
English, Arts and Math

Duration:

1 week (50 minutes/day)

Syllabus Mapping:

- Sustainable Energy Sources
- Force and Motion
- Geometry
- Elements and Principles of Design
- Design Process for Innovation

Integration:

- Science
- Mathematics
- Arts
- Engineering
- Technology

Outcomes:

ACSSU097

Inquiry and Focus Questions:**Driving Question:**

With rapid urbanization comes the traffic crisis and increased air and sound pollution. How will you design an eco-friendly vehicle as an alternative mode of transportation that uses solar panels to maximize extreme heat?

Science & Technology:

- How can electrical energy be transferred and transformed in electrical circuits and be generated from a range of sources?
- How can energy be sustainable?
- How do solar panels help in sustainable transportation?

Mathematics, Arts and Engineering:

- What shapes and materials should be used to create an eco-friendly, simple or complex vehicle?
- How will you design or create an eco-friendly vehicle that could be an alternative mode of transportation?

Social Studies:

- How do innovative transportation projects benefit the community?

Learning across the Curriculum:**Cross-curriculum priority**

- Sustainability
- Environmental Awareness

General Capabilities

- Teamwork & Collaboration
- Critical & Creative Thinking
- ICT Capability
- Numeracy
- Literacy

Skills Focus:**Working Scientifically**

- Communicating
- Questioning and predicting

Design and Production

- Researching and planning
- Design and innovation
- Producing, implementing, testing, refining

Skills Focus:

This unit of investigation explores concepts from the core science standards for sustainable energy sources, with a focus on solar energy. Students use an individual inquiry-based approach to explore solutions to a multi-layered real-world question. They experiment with a number of in-game tasks to design and build an eco-friendly vehicle that could be an alternative mode of transportation. They test and refine the effectiveness of their design and construction, while minimizing the environmental and financial cost. Students learn about sustainable practices in dealing with traffic issues, air and sound pollution. They take action to improve their own and their community's social and environmental wellness.

Teaching, Learning & Assessment Activities

NOTE: 'Quest Game Activity' describes activities that happen in-game while 'Unplugged' occur outside the game

Lesson 1: Project Orientation and Research

Summary: Teacher discusses about how electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources, particularly solar energy. Teacher relates how solar energy can contribute to sustainable transportation. As part of the project-based lesson, the teacher poses a challenge on the threat of rapid urbanization that result in the worsening of traffic and transportation problems. Students are tasked with researching possible factors and consequences of this impending crisis in the long-run. As part of the research, students learn about ways to protect oneself from these detrimental effects, such as designing and creating an eco-friendly vehicle that could be an alternative mode of transportation.

Assessment: Pre-test about sustainable energy sources (10 minutes)

Unplugged Activity: *Driving Question (15 minutes) – Brainstorm (Guided)*

Begins with a discussion about how electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources, particularly solar energy. Relate how solar energy can contribute to sustainable transportation.

Teacher says, *"The traffic and transportation crises continue to grip urban areas, especially Metro Manila. There are many factors that contribute to this, such as rapid urbanization, low development of public transportation, roads-to-vehicle ratio, and institutional weakness. If not addressed, the implications, such as increased air and sound pollution, might be detrimental in the long-term."*

Teacher poses driving questions for the students to investigate and discover possible solutions:

Q. With rapid urbanization comes the traffic crisis and increased air and sound pollution, how will you design an eco-friendly vehicle as an alternative mode of transportation that uses solar panels to capitalize the extreme heat?

Science & Technology Inquiries:

- How can electrical energy be transferred and transformed in electrical circuits and be generated from a range of sources?
- How can energy be sustainable?
- How do solar panels help in sustainable transportation?

Social Studies Inquiries:

- How do innovative transportation projects benefit the community?

Mathematics, Arts and Engineering Inquiries:

- What shapes and materials should be used to create an eco-friendly, simple or complex vehicle?
- How will you design or create an eco-friendly vehicle that could be an alternative mode of transportation?

Lesson 1: Project Orientation and Research (Continued)

Project Orientation (5 minutes)

- Teacher introduces the project and relates it to the discussion outcomes
- Teacher divides the class in research groups (recommend 4-6)
- Provides project guide and overview of the timeline of activities and assessments to students (organized by lesson)

Research and Design Journal (20 minutes)

- Students research, watch documentary videos, and read infographics about sustainable energy, and technologies that can be used in creating an environmental-friendly and sustainable transportation.

Science & Technology Inquiries:

- How can electrical energy be transferred and transformed in electrical circuits and be generated from a range of sources?
- How can energy be sustainable?
- How do solar panels help in sustainable transportation?

Mathematics, Arts and Engineering Inquiries:

- What shapes and materials should be used to create an eco-friendly, simple or complex vehicle?
- How will you design or create an eco-friendly vehicle that could be an alternative mode of transportation?

Social Studies Inquiries:

- How do innovative transportation projects benefit the community?

- Students brainstorm, draft their design and plans on a sheet of paper or project journal**

** If teachers run out of time in the lesson to meaningfully allocate time for this exercise, students can be given the design plan during extra time.

Lesson 1 Assessment Ideas

Teachers should consider different assessment options throughout the project phases, including for example:

1. Quiz about sustainable energy sources
2. Quality of student research and project journal
3. Design assessment and reasoning, problem solving
4. Group skills, time management, collaboration
5. Project works (later lessons)
6. Photo Essay (later lessons)

Lesson 2: Prototyping an Eco-friendly Vehicle

Introduction to the Lesson

Teacher guides the students in identifying basic parts of an innovative and eco-friendly vehicle. Based on their design plan from lesson 1, students can start prototyping within the game. They should be able to explain the parts and how they promote sustainable energy, such as using solar panels to capitalize the extreme heat from the sun. They should also describe the usefulness of the materials based on functions, properties and the viability of their vehicle as a good alternative mode of transportation in an urban area.

Teacher-Led Unplugged Activity (10 minutes)

- Teacher gives an overview of lesson goals, and reiterates the driving question.
- Teacher gives students the opportunity to ask questions before beginning their prototype.

Guided Game Quest Activity (30 minutes)

In-Game Prototype:

1. Use the Builder Tool to make an inventory of blocks and basic parts in building a vehicle -- either a car or a bike.
2. Use the Builder tool to create an innovative and eco-friendly vehicle that could be an alternative mode of transportation.
 - Ideally, the vehicle should include essential parts: blocks, wheels, engine, and battery, cockpit and steering wheel of a car, or bike seat and handle.
 - Students should consider changing the properties of the blocks (i.e. metal, carbon fiber, etc.) in order to strengthen the foundation or add weight to their vehicle
 - Ideally, the vehicle should include solar panels for sustainable energy

Documentation using Game Camera:

- Using the Camera, students should take pictures of their prototype at different stages of construction.
- Later, in lesson 5, the photos will be used in their reflection and presentation i.e. they will create a photo essay and present their project in class.

Lesson 2 Assessment Ideas

Teachers should consider different assessment options throughout the project phases, including for example:

1. Quality of student research and project journal
2. Design assessment and reasoning, including material uses and reasoning in relation to sustainable energy
3. Engineering approach, including aspect, size, parts that are environmentally-friendly, and other considerations that students should explain
4. Time management, collaboration, problem-solving skills

Lesson 3: Testing and Refining

Introduction to the Lesson

Students test and refine their vehicle by discovering different textures in the Builder tool, trying out vehicle parts to affect motion, adjusting the size and length of their vehicle. With consideration of the traffic and transportation crises, plus the impending threats in air and sound pollution, students should strategize ways to aid traffic while reducing carbon footprints. Ideally, their vehicle should emit less or no air and sound pollution.

Teacher-Led Unplugged Activity (10 minutes)

- Teacher gives an overview of lesson goals, and reiterates the driving question.
- Teacher gives students the opportunity to ask questions before they begin testing and refining their prototype.

Guided Game Quest Activity (30 minutes)

Refining and Testing the Prototype:

1. Using the game's Builder Tool, the students spend time in finishing their vehicles.
2. When their basic prototype is completed, students should test different strategies to help decongest traffic and lessen sound and air pollution.
3. After their initial testing, they can refine their design based on initial observations and opportunities for improvement.
4. Students should explain their reasoning behind refining the design in their project journal.

Documentation using Game Camera

- Students should take pictures of their prototype at different stages of construction.
- They should take photos to illustrate how they refined their designs.
- Later, in lesson 5, the photos will be used in their reflection and assessment i.e. they will create a photo essay about their project.

Lesson 3 Assessment Ideas

Teachers should consider different assessment options throughout the project phases, including for example:

1. Quality of student research and project journal
2. Design assessment and reasoning, including material uses and reasoning in relation to sustainable energy
3. Engineering approach, including aspect, size, parts that are environmentally-friendly, and other considerations that students should explain
4. Time management, collaboration, problem-solving skills
5. And specifically for Lesson 3:
 - Design changes to improve functionality based on students' observation
 - Their reasoning and explanation for making these changes

Lesson 4: Project Finalization

Introduction to the Lesson

Teacher explains the social and environmental impact of innovating eco-friendly vehicles. Teacher highlights the importance of proposing alternatives to solve the increasing crises on traffic, transportation, air and sound pollution, esp. in urban areas.

Teacher-Led Unplugged Activity (10 minutes)

- Teacher gives an overview of lesson goals, and reiterates the driving question.
- Teacher gives students the opportunity to ask questions before using game to finalize their design/project.

Game Sandbox Activity (30 minutes)

Final Project

1. Use the Builder tool to make any final improvements to the vehicle: properties of blocks, size, length, basic and additional parts
2. Students should finalize any and all additional design strategies for their innovative and eco-friendly vehicle as an alternative mode of transportation.

Documentation using Game Camera

- Students should take photos to illustrate and record their final designs.
- Later, in lesson 5, the photos will be used in their reflection and assessment i.e. they will create a photo essay about their project.

Lesson 4 Assessment Ideas

Teachers should consider different assessment options throughout the project phases, including for example:

1. Quality of student research and project journal
2. Design assessment and reasoning, including material uses and reasoning in relation to sustainable energy
3. Engineering approach, including aspect, size, parts that are environmentally-friendly, and other considerations students should explain
4. Time management, collaboration, problem-solving skills
5. And specifically for Lesson 4:
 - Final project design, including all components based on their own merit (solar panels, boosters, etc.)
 - Their reasoning and explanation for final design
 - Extra credit is students used the *Painter Tool* to color their vehicle, or even coded it

Lesson 5: Presentation and Reflection

Introduction to the Lesson

Teacher asks the students to write about their project and design assessment using the game's photo essay tools.

Game Sandbox Activity (30 minutes)

Photo Essay

1. Using the game's Mission Log, students finalize their photo essay about the project.
2. In the photo essay, students should organize and name photos by activity and stage of the project, and insert them into their essay.
3. For example, some questions students might be asked to answer in their photo essay, may include:
 - How can electrical energy be transferred and transformed in electrical circuits and be generated from a range of sources?
 - How can energy be sustainable?
 - How do solar panels help in sustainable transportation?
 - What is the idea behind your eco-friendly vehicle?
 - What important things were you trying to achieve with your design?
 - Energy-sufficient
 - Reduces carbon footprints
 - Emits less/no sound and air pollution
 - Capitalizes on extreme sunlight
 - Fast/speedy
 - What are the effects of force on the shape of an object?
 - How does force affect the size and movement of an object?
 - Why do you think force applied to an object causes a change in its size, shape, and movement?
 - How do innovative transportation projects benefit the community?
 - How will you encourage the government to adapt an eco-friendly vehicle as an alternative mode of transportation?
 - What shapes and materials should be used to create an eco-friendly, simple or complex vehicle?
 - How many blocks and what kinds of blocks were used?
 - What were the differences in design considerations and materials for each? And why?
 - What changes did you make after the initial prototype and why?
 - What else would you have done, or do differently if you had more time?

Assessment: Post-test about sustainable energy sources (10 minutes)

Final Assessment

1. Photo essay
2. Post-test
3. Previous assessments made during the other lessons

Teacher Handy Links and Resources

From Us to You!

- As forms of energy, students must better understand how light, sound and heat work. [READ HERE.](#)
- How do solar-powered vehicles work? How would they affect the future of transportation? [READ HERE.](#)
- Check this infographic on how urbanization can be made eco-friendly and future-ready on 'smart' cities. [SEE HERE.](#)

Other Multimedia Resources

- Check out this video on how extreme heat can harm the human body to a fatal degree. [WATCH HERE.](#)
- Check out these solar cars that will be available for use in the future! [WATCH HERE.](#)

Other Reference Material

- Australian Curriculum (ACARA) Science Sequence of Content F-6: Strand [READ](#)

Support & Help

Please feel free to contact the STEAM Craft Edu team for any inquiries or support needs

Email: education@steamcraftedu.com