Biological Sciences

Living things and their environment

Year 4 Unit of Inquiry

Planeteers Game-based Learning Platform

Science and Technology, Arts, Math and Engineering

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Outcomes and Content

Science and Technology

Curriculum Content Code: ACSSU072

Learning Outcomes

Investigates the roles of living things in a habitat

Standards: Living things and their environment

1. What happens to living things when the environment changes?
2. What measures must be taken to protect living things and the ecosystem?
3. How can we use science and technology to protect the environment most especially the animals that live in it?

- Investigate how plants provide shelter for animals
- Recognise how interactions between living things can be competitive or mutually beneficial
- Recognize that environments can change and that this can sometimes pose dangers to living things
- Explain the need to protect the Earth's resources and environment
- Design tools that can help in protecting the environment

Engineering

STEAM Curriculum Code: ED 1.1 | ED 1.2

Learning Outcomes

Uses different materials to make a robot, and selects appropriate materials to meet the robot's design need

Standards: Optimizing the Design Solution

1. How can robots help with important tasks?

- Build, modify and upgrade a robot for a specific function or purpose
- Discuss functions of the robot on how it can help in conservation and protection of the environment
- Apply design assessment to build and create real world projects

Arts and Mathematics

Learning Outcomes

Constructs 3-D projects using primary and secondary colors, geometric shapes, space, and repetition of colors to show balance of the structure and shape

Standards: Elements of design and Geometry

What shapes and textures should be used in designing and creating a survey drone?

- Select and manipulate combinations of materials and techniques
- Recognize volume as an attribute of solid figures and understand concepts of volume measurement
- Classify two-dimensional figures into categories based on their properties
- Construct polygons, circles, and solid figures

Coding and Robotics

STEAM Curriculum Code: TC1.1 | TC1.3 TC1.4 |TC1.6

Learning Outcomes

Creates an algorithm for a complex machine (i.e. robot with specific functions and purpose) to follow; program a robot to respond to external and internal changes (Triggers)

Standards: Basics of Coding and Block Code, Simple Events & Triggers

1. How do you design a robot to survey and monitor the environment?

- Discuss the importance and the elements necessary to design a technology that can be used for protecting the Earth's resources and environment

Unit Summary

Grade:
4

Subject:
Science & Technology

Duration:
1 week (50 minutes/day)

Syllabus Mapping:
- Living things and their environment
- Elements of Design
- Geometry
- Design Process for Innovation
- Making

Integration:
- Science
- Mathematics
- Arts
- Engineering
- Technology

Outcomes:
ACSSU072

Inquiry and Focus Questions:

Driving Question:
With the impending dangers of habitat loss through deforestation and global warming, how do you design and create a robot to help protect and conserve the environment and Earth's resources?

Science and Technology Inquiries:
- What happens to living things when the environment changes?
- What measures must be taken to protect living things and the ecosystem?
- How can we use science and technology to protect the environment most especially the animals that live in it?

Engineering Inquiries:
- How can robots help with important tasks?

Arts and Mathematics Inquiries:
- What shapes and textures should be used in designing and creating a survey drone?

Coding and Robotics Inquiries:
- How do you design a robot to survey and monitor the environment?

Learning across the Curriculum:

Cross-curriculum priority
- Sustainability
- Environmental Awareness
- Technology

General Capabilities
- Teamwork & Collaboration
- Critical & Creative Thinking
- ICT Capability
- Numeracy
- Literacy
- Community Awareness

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 living things and their environment, with a focus on habitats. Students use an individual inquiry-based approach to explore solutions to a multi-layered real-world question, while utilizing the use of technology. They are introduced to the basic concepts of robotics and coding such as robot design and construction, and to basic programming. They experiment with a number of in-game tasks to design a survey drone that can help in surveying and protecting the environment. They strategize and learn about sustainable practices in protecting, managing and conserving the environment specifically living things and their habitat. They take action in improving their own and others' 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 describes how living things depend on each other and the environment to survive. Teacher illustrates the rich biodiversity of the world and its ecosystems—from verdant forests, to colorful corals, and strong mangroves that serve as habitats to most animals. As part of the project based lesson, the teacher poses a challenge on how to protect and preserve the environment, esp. their habitat, for the future generations. Students are then tasked with researching on the importance of protecting their habitat and the environment. As part of the research, students also learn about different technologies that help in surveying, monitoring, protecting, managing, and conserving animal habitats. They strategize and conceptualize of campaigns on how they can influence their community to take action.

Assessment: *Pre-test about living things and their environment (10 minutes)*

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

Begins with a discussion about living things and their environment.Teacher presents the challenge the world currently faces with global warming, shows pictures of 'before and after' conditions of different ecosystems from different parts of the world. Teacher says, *"Humans can cause extinction of a species through overharvesting, pollution, habitat destruction, introduction of invasive species (such as new predators and food competitors), overhunting, and other influences. Understanding how animals interact with the environment can help lessen and protect animals from these impacts."*

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

Q.With the impending dangers of habitat loss through deforestation and global warming, how do you design and create a robot to help protect and conserve the environment and Earth's resources?

Science and Technology Inquires:

- What happens to living things when the environment changes?
- What measures must be taken to protect living things and the ecosystem?
- How can we use science and technology to protect the environment most especially the animals that live in it?

Engineering Inquiries:

- How can robots help with important tasks?

Arts and Mathematics Inquiries:

- What shapes and textures should be used in designing and creating a survey drone?

Coding and Robotics Inquiries:

- How do you design a robot to survey and monitor the environment?

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 and watch documentary videos about living things, particularly animals, and their habitat. They also watch videos and analyze infographics about technologies, such as drones, and how they can be useful in closely monitoring and protecting the environment.

Science and Technology Inquires:

- What happens to living things when the environment changes?
- What measures must be taken to protect living things and the ecosystem?
- How can we use science and technology to protect the environment most especially the animals that live in it?

Engineering Inquiries:

- How can robots help with important tasks?

Arts and Mathematics Inquiries:

- What shapes and textures should be used in designing and creating a survey drone?

Coding and Robotics Inquiries:

- How do you design a robot to survey and monitor the environment?

- Students brainstorm, plan and draft their design 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 as homework.

Lesson 1 Assessment Ideas

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

1. Quiz on living things and their environment
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: Basics of Coding and Robotics

Introduction to the Lesson

Teacher explains basic to advanced concepts of robotics and its relevance in real life scenarios. Teacher explains that robotics is the science behind our favourite machines and includes designing, coding, manufacturing, and operating the robots. The students are re-introduced to the essential parts of a robot, concept of artificial intelligence (AI), automation and how they can reduce workloads. Particularly for the lesson, the teacher facilitates discussion of how technology (i.e. drones) are able to automate and replace the work of a pilot, helicopter and a photographer. Teacher guides the students in making connections between robots and the computer programs that give them instructions.

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 guided game quests.

Game Sandbox Activity (30 minutes)

Robotics Blockly Coding Quests:

1. Students complete the guided robotics and coding quests inside the game.
2. Scaffolded game quests teach students the following skills as they debug and repair a broken robot
   - Basics of coding & Block Code
   - Reinforce the definition of coding
   - Explain commands, sequencing, and basic coding terms like program, run and debug
   - Identify parts of the coding user interface (UI): commands, scripts area, stage
   - Connect/fix Block Codes in a robot
   - Explain and validate the importance of sequencing codes and pattern recognition to create algorithms
   - Introduce and emphasize the concept of debugging
   - Using simple events and triggers

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
3. Time management, collaboration, problem-solving skills
4. Logical and computational thinking
5. Badges earned completing the guided quests

Lesson 3: Prototyping, Testing and Refining their Survey Drone

Introduction to the Lesson

Teacher guides the students in identifying ways to use technology in surveying, protecting, and conserving living things and their environment (i.e. air, land, water). Based on their design plan from lesson 1, students can now start prototyping within the game. They should be able to explain the functionality of each part of their drone design. Students should explain how their design can be sustainable and scalable, especially for the future generations.

Students test and refine their drone by discovering different machine blocks and action blocks that can be used to upgrade their robot features.

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.

Game Sandbox Activity (30 minutes)

In-Game Prototype:

1. Students are tasked with using the games' *Builder Tool* to construct a survey drone which has features that help in monitoring, protecting, managing and conserving the environment.
   - Ideally, their drone should be able to work on air or underwater.
   - The blocks that they'll be using should be appropriate for its intended purpose.
2. The robot design should include important components e.g. Camera, remote control, drone propeller, and other parts necessary.
3. The robot should also be constructed with appropriate parts and materials to make it useful and adaptable to its environment.
5. Students can also use the Painter Tool to add a color scheme to their robot.

Lesson 3: Prototyping, Testing and Refining their Survey Drone (continued)

Refining the Prototype:

1. Students add Block Code to the robot to improve its functionality.
2. Students use the following to evolve the Robot's AI: Loop condition, If conditions, If Press conditions, Motion codes, and Action codes.
3. The code design for the robot AI should enable the following:
    a. Activate the remote control
    b. Make the robot play a "beep" sound while it is moving
    c. Activate the in-game camera for taking photos
4. The code can be tested using the 'Play' icon in the Blockly coding environment.
5. Students can also use the Painter Tool refine/finalize the color scheme to their robot.

Documentation using Mission Journal

1. Using the game's *Mission Journal,* students should explain each feature of their robot and how they function to survey the environment.
2. Students should add notes on their journal describing how their machine design benefits the ecosystem and the community (i.e. using a drone will leave no footprints, thus making the ecosystem undisturbed).

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 functionality and its benefit to the community
3. Creativity, time management, collaboration, problem-solving skills
4. Logical and computational thinking
5. Engineering approach, including aspect, construction, and other considerations that the student should describe/explain

Lesson 4: Project Finalization

Introduction to the Lesson

Teacher explains the social and environmental impact of protecting and conserving living things, particularly animals, their habitat s and the environment. Teacher highlights the importance of innovating new technologies that would help in sustainable conservation in the community. The students make connections between robotics and coding and how these make machines or robots useful for the environment and the community.

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 designs/project.

Game Sandbox Activity (30 minutes)

Final Project

1. Use the Builder tool and the Block Code to make any final improvements to their robot/s.
2. Students should finalize any additional design and codes in making their robot function efficiently and effectively.

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.
- With their project complete, students should write captions for each photo taken using the mission journal.
- They should explain the functionality of their robot, especially in surveying, protecting, managing, and conserving the ecosystem.

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 functionality and its benefit to the community
3. Creativity, time management, collaboration, problem-solving skills
4. Logical and computational thinking
5. Engineering approach, including aspect, construction, and other considerations that the student should describe/explain
6. And specifically for Lesson 4
   - Final project design, including all components based on their own merit
   - Explaining changes and modifications to their prototype and why they made them
   - Explaining how their AI works to control the robot, and describing the different parts of their program and what each does

Lesson 5: Presentation and Reflection

Introduction to the Lesson

Teacher asks the students to write about their project, their robot design, 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 project, and insert them into their essay.
3. For example, some questions students might be asked to answer in their photo essay, may include:

   - What happens to living things when the environment changes?
   - What measures must be taken to protect living things and the ecosystem?
   - How can we use science and technology to protect the environment most especially the animals that live in it?
   - How can robots help with important tasks?
   - What shapes and textures should be used in designing and creating a survey drone?
   - What environmental conditions did you design your robot for?
   - What we the major design considerations and why? What materials did you use and why?
   - What form of locomotion did you use and why did you choose it?
   - What kind of power source did you use and how long would it last?
   - What sensors did you include on your robot and why?
   - How did you paint your robot and why did you choose the color scheme?
   - What kind of AI did you create in block code, what did it do to enhance the robot's usefulness?
   - What else would you have done, or do differently if you had more time?

Assessment: Post-test about living things and their environment (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!

- Ecosystems are an important part of the living world. See the National Geographic resource library on ecosystems. READ
- Check out this infographic on the ecosysstems of our world. READ
- Have kids create an ecosystem to make them understand how components of their built-upon world depend on each other to survive. READ
- Robots and AI are now joining the fight in protecting the environment! READ

Other Multimedia Resources

- CrashCourse explains the importance of each parts of an ecosystem and how they connect to one another. WATCH
- France24 News details how innovative technology is being implemented for environmental conservation. WATCH
- Check out these different types of drones for forestry and conservation. WATCH

Other Reference Material

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

Planeteers Robotics Fun Facts

- Arms, sensors, and wheels, oh my! Robots can have them all. A robot has four essential characteristics: sensing, movement, energy, and intelligence. Artificial Intelligence (AI)" comes from instructions sorted in the robot's central processing unit or CPU.
- Robots that can function on their own are called 'autonomous' and are very useful in remote exploring, space flight, and even dangerous missions! Advanced autonomous robots have lots of sensors and an AI system can learn from the environment, experience, and build on what it can do.
- So basically, "Us robots ask a lot of questions! The CONDITION is the response to those questions. If the response is YES, the condition is TRUE. If the response is not a yes, the condition is FALSE and the program will not do anything. IF statements like this are a called CONTROL STRUCTURES because they control the flow of a program. Cool Huh!"

Support & Help

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

Email: education@steamcraftedu.com