

Biological Sciences

The Growth and Survival of Living Things

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

Curriculum Content Code: ACSSU094

Learning Outcomes

Explain how the growth and survival of living things are affected by physical conditions of their environment

Standards: The Growth and Survival of Living Things

1. What matter do living things need in order to grow?
2. How does matter move within an ecosystem?
3. How does energy move within an ecosystem?
 - Investigate how changing the physical conditions for plants impacts on their growth and survival
 - Construct an argument that plants get the materials they need to grow primarily from air and water
 - Examine dependencies of organisms and their environment, in terms of flow of energy and matter
 - Explain that organisms interact and exchange matter and energy with each other and their environment

Engineering and Technology

Curriculum Content Code: 5-ETS1-2 | 5-ETS1-3

STEAM Curriculum Code: EF 1.2 | EF1.3 | EN1.2

Learning Outcomes

Explore local environment to meet immediate needs; select appropriate materials to meet robot's design need

Standards: Natural and Built Environments

1. How do plants and animals get the nutrients they need to grow?
2. What types of materials are used for making a robot?
 - Explore local environment to meet immediate needs
 - Design and build real world projects/products
 - Identify and use different elements to construct different products

Standards: Design process for innovation

1. How can robots help with important tasks?
 - Builds, modifies and upgrades a robot for specific function or purpose

Arts and Mathematics

Curriculum Content Code: 5 MD 3a, b | 5 MD 4 | 5.G.3–4

Learning Outcomes

Construct 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 should be used in designing and creating a helper robot?

- Demonstrate understanding of lines, shapes, and space; and the principles of rhythm and balance
- 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

Standards: Art & Photography

1. How can a robot have personality through physical attributes?
 - Uses digital painting to add color to their robot
 - Uses the Game camera to take photos of the designs

Unit Summary

Grade:

6

Subject:

Science & Technology

Duration:

1 week (50 minutes/day)

Syllabus Mapping:

- Living Things and their Environment
- Elements of Design
- Geometry
- Design Process for Innovation
- Robotics and Coding

Integration:

- Science
- Mathematics
- Arts
- Engineering
- Technology

Outcomes:

ACSSU094

Inquiry and Focus Questions:*Driving Question:*

In times of emergencies, plants and animals tend to be left behind. How do you design a robot to ensure that plants and animals are still taken care of and get the nutrients they need in order to grow?

Science:

- What matter do living things need in order to grow?
- How does matter move within an ecosystem?
- How does energy move within an ecosystem?

Engineering and Technology:

- How do plants and animals get the nutrients they need to grow?
- What types of materials are used for making a robot?

Arts and Mathematics:

- What shapes should be used in designing and creating a helper robot?

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

- Sustainability
- Technology

General Capabilities

- Teamwork & Collaboration
- Critical & Creative Thinking
- ICT Capability
- Numeracy
- Literacy
- Environmental 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 growth, survival and energy flow in organisms. 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 a helper robot that feeds plants and animals in the community in times of emergencies. Students test and refine the effectiveness of the materials used, while minimizing the environmental and financial cost. 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 explains the usefulness of living things, particularly plants and animals, to the ecosystem. They play an important role to all other living things, especially in terms of flow of energy and matter. As part of the project-based lesson, the teacher poses a challenge to continuously care for plants and animals, even during emergencies and disasters, such as forest fires in Australia. Students are tasked with researching technologies in sustainable gardening and farming. Also, they are to research about the proper ways and best practices in taking care of plants and animals from different parts of the world (i.e Safari in Africa).

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

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

Begins with a discussion about the importance of living things, particularly plants and animals, and their usefulness in society.

Teachers says “The growth and survival of living things are affected by physical conditions of their environment. Plants get the materials they need to grow primarily from air and water. They can survive with only air and water, but not animals. All animals require food they lack the ability to directly convert sunlight energy into usable energy. That is why, there is interdependency among animals and plants. A system in which organisms, such as plants and animals, interact and exchange matter and energy with each other and their environment is called an ecosystem. However, during emergencies and disasters, it is sometimes inevitable that plants and animals get left behind.

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

Q. In times of emergencies, plants and animals tend to be left behind. How do you design a robot to ensure that plants and animals are still taken care of and get the nutrients they need in order to grow?

Science:

- What matter do living things need in order to grow?
- How does matter move within an ecosystem?
- How does energy move within an ecosystem?

Engineering and Technology:

- How do plants and animals get the nutrients they need to grow?
- What types of materials are used for making a robot?

Arts & Mathematics:

- What shapes should be used in designing and creating a helper robot?
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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 technologies in taking care of plants and animals, especially during in times of emergencies.

Science:

- What matter do living things need in order to grow?
- How does matter move within an ecosystem?
- How does energy move within an ecosystem?

Engineering and Technology:

- How do plants and animals get the nutrients they need to grow?
- What types of materials are used for making a robot?

Arts & Mathematics:

- What shapes should be used in designing and creating a helper robot?

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- 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. Pre-test on living things and their environment
2. Quality of student research and project journal
3. Reasoning and problem solving
4. Time management, collaboration, problem-solving skills
5. Project works (later lessons)
6. Photo Essay (later lessons)

Lesson 2: Farming and Exploring

Introduction to the Lesson

Teacher guides the students in identifying and describing living things, particularly plants and animals, in their immediate surroundings. Students explore, survey and take photos of the different plant and animals, within the game. The students may also survey animal and plant species in the different continents within the game (i.e. Polar Cap, Savana, etc.). They learn about how plants and animals can be used for food and fibre production. Using the Farming tool, they are to build a farm and expand it by adding new crops and animals, in order to increase food supply and craft more types of food.

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 exploring in the game.

Game Sandbox Activity (30 minutes)

Farming and Exploration using the Game Camera

1. Students should explore the area and take pictures by letting their character walk or ride vehicles.
2. They should survey the area and snap photos of the different plants and animals they see around them.
3. They may also survey other species found on other continents, such as the Polar Cap, Savanna Grasslands, and Tropical Rainforest.
4. Using the game's Mission Journal, students should explain the photos they've taken.
5. They should name the photos in their journal and write about the characteristics of those plants and animals.
6. Using the Farming Tool, students should build and expand the farm with new crops and animals.
 - Ideally, crops should include corn, rice, and fruit trees.
 - Crop farms grow fruits, vegetables, grains and cotton.
 - Animal farms raise animals for meat, eggs, milk, and fibre.
 - In the game, there are also fish farms in the rivers and oceans where fishes like carp, salmon, and shellfish are raised.

Documentation using Game Camera

- Using the game's Mission Journal, students should explain the photos they've taken.
- Students should add notes on their journal describing the plants and animals they've seen in the game.

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. Photography and literacy skills, specifically for the Mission Journal
3. Reasoning and storytelling
4. Time management, collaboration, problem-solving skills

Lesson 3: Prototyping a Garden-tending and Feeding Robot

Introduction to the Lesson

Teacher guides the students in identifying parts of a robot in order to build a garden-tending and animal-feeding robot. Based on their design plan from lesson 1, students can begin a robot prototype using the game's *Builder Tool*. They should be able to explain appropriate materials and design consideration used in making the robot helpful in sustainable farming and gardening.

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)

Prototype:

1. Students are tasked with using the game's *Builder Tool* to construct a garden-tending and animal-feeding robot.
2. The robot design should include important components
 - e.g. locomotion unit, battery, engine, camera, solar panels, data link, and sensors
3. The robot should also be constructed using appropriate materials to make it adaptable in times of emergencies, and any weather.
4. Building blocks should include a variety of geometric shapes and materials including metal, carbon fibre etc.
5. Ideally, the robot should be remote-controllable using the games' *Block Coding Tool*.
6. Students can also use the Painter Tool to add a color scheme to their robot.
7. Students may also opt to craft their own pre-built robot using the game's advanced crafting tool.

Documentation using Game Camera:

- Students should take pictures of their prototype different stages of construction.
- 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 thinking and reasoning
3. Time management, collaboration, problem-solving skills
4. Engineering approach, construction, and other considerations that the student should describe/explain
5. Logical and computational thinking

Lesson 4: Testing, Refining, and Finalizing the Robot

Introduction to the Lesson

Teacher explains that coding allows people to give computers instructions using programming languages. The students make connections between robotics and coding and how these make machines or robots useful. Students understand that coding a robot gives it a form of Artificial Intelligence and allows it to make different decisions based on different variables. Students test and refine their robot with a focus on AI.

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 finalizing their robot designs.

Game Sandbox Activity (30 minutes)

Refining the Prototype:

1. Students add Block Code to their robot to improve its functionality.
2. Students use the following to evolve the Robots 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:
 - Activate the remote control
 - Make the robot play a "beep" sound while it is moving
 - The camera focus should be able to switch between the player's avatar and robot's view
 - Activate the in-game camera for taking photos of the world
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 Game Camera

- Students should take pictures of their finished robot at different angles and in action.

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 thinking and reasoning
3. Time management, collaboration, problem-solving skills
4. Engineering approach, construction, and other considerations that the student should describe/explain
5. 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 garden-tending and animal-feeding robot design, and design thinking 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 matter do living things need in order to grow?
 - How does matter move within an ecosystem?
 - How does energy move within an ecosystem?
 - How do plants and animals get the nutrients they need to grow?
 - What types of materials are used for making a robot?
 - What shapes should be used in designing and creating a helper robot?
 - What environmental conditions did you design your robot for?
 - What were the major design considerations and why? What materials did you use and why?
 - How many different geometric shapes did you use in your robot design? And can you name them all?
 - 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

Handy Links & Resources

From Us to You!

- Check out how these robots are taking a leap forward toward greenhouse automation. [READ](#)
- Take inspiration from these garden-tending robots to keep your plants growing and healthy. [READ](#)
- Learn more about battery-powered feeding robots. [READ](#)
- Read more about parts of a robot. [READ](#)

Other Multimedia Resources

- Learn more how you can feed animals automatically with this feeding robot. [WATCH](#)
- Check out this easy-to-make Walking Robot which can be adopted for a fun and interesting STEAM project with Engineering and Technology. [WATCH](#)
- Read more about how schools are pushing to teach coding in the classroom. [WATCH](#)
- Learn more about how to get kids hooked on coding. [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.

Support & Help

If any questions or issues, please contact our school community support team

support@planeteersgame.com

You can also check our FAQ at

<https://support.steamcraftedu.com/>