Lesson Plan

Poop to Power

Grade: 6-7 | Subject: Science & Technology | Duration: 40 Minutes



Dairycraft Overview

Learning Objectives

This Minecraft world supports the following main achievement objectives:

- Teach students about the versatility of milk, as well as concepts such as states of matter and chemical/physical changes.
- Teach students about the nutritional benefits of milk.
- Teach students about life on a working farm, career options associated with dairy farming, and the layout and machinery used in modern farms.
- Teach students about waste management and renewable energy production on dairy farms.
- Teach students about how technology is transforming dairy farming.
- Teach students about the relationship between crop farming and milk production.

How to Use Dairycraft

Dairycraft is a fully automated Minecraft educational world, so there is no need for teacher input once students are in-game. Additional teacher input or guidance may be beneficial for students below the set lesson grades.

- Dairycraft has been designed as a single-player educational game. When completing most lessons, extensions, and sub-activities, each student should be in their own Minecraft world.
- Dairycraft can function on any device compatible with Minecraft: Education Edition.
- For collaborative play, students can be grouped into teams to complete the major extension task: building their own farm based on the knowledge they have learned.
- If you are new to Minecraft: Education Edition, the '[Support Center]' on the Education Edition website provides all the information you will need to get started.

Activities for Students

Dairycraft contains six main activities for students, each of which can be played independently of the others. It will benefit students to have completed Lesson 2 before proceeding with other lessons, in order to have a basic understanding of the farm's layout. Each lesson has an extension task, and after all six lessons are completed there is one major

extension activity in which students are encouraged to build their own farm using the information they have learned from the lessons.

At points in the game, students may be given external links to videos that explain certain processes or concepts in more detail. Everything else they need to learn and interact with is contained within the game.

Dairycraft Map Layout



Lesson 4: Overview

This Minecraft-based lesson immerses students in the innovative practices of sustainable dairy farming, highlighting the transformation of agricultural by-products into valuable resources. Through this interactive experience involving activities and interacting with NPCs (non-playable characters), students will explore how manure is converted into renewable energy sources like methane gas and eco-friendly fertilizers, supporting both environmental stewardship and efficient farming operations, and apply their understanding in a knowledge test.

The lesson combines interactive gameplay with real-world applications, fostering curiosity and critical thinking about sustainability in modern agriculture within dairy farms.

Learning Objectives

Students will learn how to:

- Understand how manure contributes to sustainable farming practices on dairy farms.
- Identify the processes and technologies involved in converting manure into energy and fertilizer.
- Apply problem-solving skills to complete activities related to the production of methane gas in a biodigester, the fixing of a manure transfer pipe, and the recharging of a robot manure pusher.
- Appreciate the environmental benefits of biodigesters and manure management.

Curriculum Alignment

Designed for Grades 6 and 7 in the Ontario curriculum:

- Explore what makes ecosystems work, including how living things interact with each other and with non-living parts of the environment.
- Identify producers, consumers, and decomposers, and explain how energy and matter move through food chains.
- Explain why biodiversity is important, what can happen when it decreases, and how we can protect it.
- Look at a local biodiversity issue from different points of view.
- Compare the effects of using renewable and non-renewable energy sources, including how they impact people, nature, and the climate.
- Grade 6: Science and Technology B1.1 & B1.2

- Grade 7: Science and Technology B2.1, B2.2, B2.3, B2.4, B2.5
- Grade 7: Science and Technology E1.2

Overall Expectations

Students will learn how to:

- Identify the byproducts from manure and agricultural waste.
- Explain how methane gas is extracted from manure through a biodigester and used to power generators.
- Demonstrate an understanding of renewable energy sources and their applications.
- Develop problem-solving skills through hands-on activities.

Specific Expectations

Students will learn how to:

- Identify components of a biodigester and their function.
- Describe the environmental impact of methane as a greenhouse gas
- Demonstrate the process of manure collection and its transformation into a biogas and fertilizer.
- Participate in repairing a manure pipe and using problem-solving skills to complete the gas transfer within the biodigester.

Student Expectations

Demonstrate an understanding of the environmental effects derived from manure, how it can be recycled, and what benefits dairy farms can derive from proper manure management.

Activity and Extension Task Overview

During this lesson students will:

- Watch an introductory video about manure management and biodigesters (optional).
- Interact with six non-player characters (NPCs) to learn about how manure is managed effectively on dairy farms, and used to create additional resources like degraded bedding and methane.
- Repair a manure-pusher robot and a leaky manure pipe.
- Empty the biogas collected inside of the biodigesters by transferring methane to adjacent storage tanks.
- Restart the dairy farm’s generator using methane procured from farm manure waste.

- Take notes as they learn, and complete a randomized knowledge test.
- Complete an extension task involving learning about solar power production on dairy farms and how this benefits the environment, and complete a randomized knowledge test.

Activity: Learning, Knowledge Test, and Production

Student spawns outside the freestall barn, opposite the storage barn.

STEP 1 | Introduction

- NPC ‘Joseph’ welcomes student and offers an optional video to watch.
- Student chooses whether or not to watch the video, then proceeds to explore the farm and talk with each NPC.

STEP 2 |Manure Expert and Robot

- Student visits NPC ‘Eva’ who explains what cow manure is and how the roaming manure robot helps to clean the barn.
- NPC ‘Eva’ directs student to begin a small activity to help restart one of the manure robots.
- Student collects a charged battery from the farm office and replaces the empty batters in the robot manure pusher, which then resumes its manure-pushing duties.
- Students returns to NPC ‘Eva’ to confirm they have completed the task.

STEP 3 | Knowledge Test

- Student takes a knowledge test based on the information they have just learned.
- Student needs to answer two randomized questions successfully in order to proceed. Incorrect answers prompt a review and retest.

STEP 4 | Pipe Leak Challenge

- Student is directed by NPC ‘Eva’ to locate and repair a damaged and leaking manure pipe, using in-game tools.
- Student follows the manure collection pipe along its path to find where it is broken, clears the fallen tree, fixes the leak, and re-enables the flow by pushing a lever.
- Successful completion wins a pail of speed-boosting milk, and student is directed to the manure pits.

STEP 5 | Manure Pit

- Student meets NPC ‘Constantin’ who explains what manure pits are and their environmental effects.
- NPC ‘Constantin’ offers an optional video to watch. Student chooses whether or not to watch the video, then proceeds to the biodigester control room.

STEP 6 | Biodigester Control Room

- Student meets NPC ‘Ann’ who explains what biodigesters are, how they work, and what byproducts they create.
- Student completes a task: using the biodigester control panel to transfer methane gas from the biodigesters into the gas storage tanks, where it is then used to power the farm’s biogas generator.
- NPC ‘Ann’ congratulates student on completion of the task, and rewards them with two pails of strength-boosting milk, before directing them to the generator shed.

STEP 7 | Generator Shed

- Student encounters the generator operator, NPC ‘Tony’, who explains what a generator is, how it works, and its connection to the biodigester on the farm.
- Student completes a task: turning on the generator, powering it with the biogas that they previously exported from the biodigester.

STEP 8 | Knowledge Test

- Student takes a knowledge test based on the information they have just learned.
- Student needs to answer two randomized questions successfully in order to proceed. Incorrect answers prompt a review and retest.

STEP 9 | Reward and Feedback

- Upon successful completion of the test, student is rewarded with a pail of speed-boost milk and the choice to continue on to the extension task or return to the spawn room to choose the next lesson.
- If student decides not to continue with the extension, the exclamation point above the Lesson 4 NPC in the spawn room turns amber, indicating student has yet to complete the lesson’s extension task.

Extension Task: Learning About Solar Power

Student spawns outside the vehicle storage shed, adjacent to the gardens of the farmhouse.

STEP 1 | Introduction

- Student is introduced to the activity challenge by NPC ‘Varsha’. They need to select a vehicle from the shed and drive to the solar array at the edge of the dairy farm to learn more about solar power.

STEP 2 | Solar Expert

- Student encounters NPC ‘Jeff’ in front of the main relay building at the corner of the solar array.
- NPC ‘Jeff’ explains what solar power is, and how it benefits dairy farmers and the environment.

STEP 3 | Knowledge Test

- Student takes a knowledge test based on the information they have just learned.
- Student needs to answer two randomized questions successfully in order to proceed. Incorrect answers prompt a review and retest.

STEP 4 | Completion and Reward

- NPC ‘Jeff’ congratulates students for completing the task and extension task, and gives them the lesson-specific trophy.
- Student places their trophy in the spawn room trophy display cabinet for teacher verification. (The trophy and display cabinet demonstrate that student has completed the lesson in full.)

Miscellaneous

If you are experiencing technical problems or bugs with this lesson, please report them directly through our website's bug report form: crackedcubes.co.uk/report-a-bug.

For general information about Minecraft: Education Edition, including additional information on how to play and set up lessons, please head to the dedicated Minecraft Education support center: edusupport.minecraft.net/hc/en-us.