MINING AUSTRALIA WITH LEGO

OVERVIEW OF MINING AUSTRALIA WITH LEGO

AUSTRALIAN CONTEXT

Mining is an industry that is at the heart of Australian culture and it has shaped our nation. Mining, over time, has continued to adapt to the needs of communities and our environment. LEGO provides a hands-on approach to explore the rich history of mining in Australia.

UNIT OVERVIEW

Students will use LEGO to show their understanding of everyday mining machines. Machines form an essential part of Australia's mining context, as they are needed for the transportation of goods and services and to improve the productivity of our mines. Students will construct machines in groups, allowing them to engage with the four twenty-first century skills (critical thinking, communication, collaboration and creativity). STEAM forms a central component of this unit as throughout the learning experiences students will be drawing scientific diagrams to communicate their thinking with their peers and teachers. Students will explore the history of machines used for mining in Australia.

OUTCOMES - AUSTRALIAN CURRICULUM

ACSHE035 People use science in their daily lives, including when caring for their environment and living things
ACSHE034 Science involves observing, asking questions about, and describing changes in, objects and events
ACSIS039 Use informal measurements to collect and record observations, using digital technologies as appropriate

LESSON SEQUENCE

Lesson	Learning	Assessment Task & Learning Criteria	Outcomes	Resources
1	Engage with the history of mining machines and construct a cart to carry ore from the mine	To create a moving cart that can: • Carry ore (a number of LEGO bricks) • Be attached to a LEGO horse	ACSHE035 ACSHE034	BricQ Motion Essential kit
2	Explore different mining vehicles used for transportation in mining in the past and construct a horse to pull the cart	To create a horse that can: • Pull the cart • Involves the motors to move the horse and cart • Can move the cart with the ore in it	ACSHE035 ACSHE034 ACSIS039	BricQ Motion Essential kit Spike Essential iPads with SPIKE App
3	Explore the tunnels constructed as part of mines and students create a series of 'tunnels' to program the horse and cart to go through	To create a series of 'tunnels' (LEGO frames) that: • The horse and cart can be programmed to move through a series of tunnels	ACSHE035 ACSHE034 ACSIS039	BricQ Motion Essential kit Spike Essential iPads with SPIKE App
4	Look at front-end loaders used in mining and students then construct a front-end loader	To construct a front-end loader that can: • Move along the ground • Lift up dirt (LEGO bricks) in the bucket • Empty dirt from the bucket	ACSHE035 ACSHE034 ACSIS039	BricQ Motion Essential kit Spike Essential iPads with SPIKE App
5	Construct a model of a drilling rig	To construct a drilling rig that: • Has a moving drill • Can move along the ground	ACSHE035 ACSHE034 ACSIS039	BricQ Motion Essential kit Spike Essential iPads with SPIKE App
6	Construct a model of a bucket wheel excavator	To construct a bucket-wheel excavator that can: • Move along the ground • That has a moving bucket-wheel	ACSHE035 ACSHE034 ACSIS039	BricQ Motion Essential kit Spike Essential iPads with SPIKE App

LESSON 2: HORSE & CART

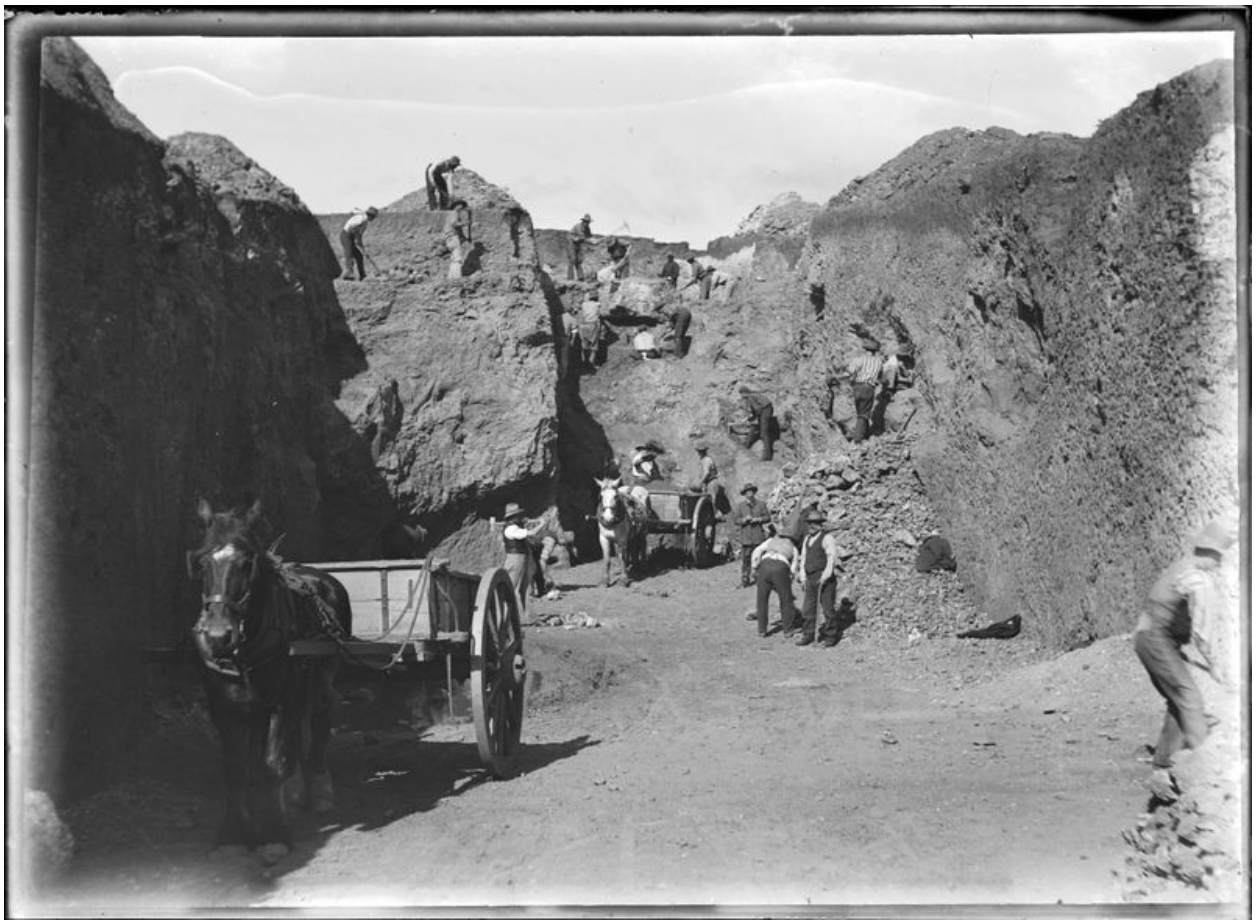

Image from Art Gallery of South Australia '*Miners scattered throughout open mine, horse and cart in foreground*' 1898-1936

OVERVIEW

Engage with the fascinating mining history of Australia and use this guided lesson to begin to unpack different machinery used in the past for transportation of ore in Australian mines.

LEARNING INTENTION

To build a horse and cart that can carry ore (LEGO bricks) and to see how far it can go in 20 seconds without spilling the ore.

SUCCESS CRITERIA

1. The horse can pull the cart whilst it holds ore (LEGO bricks)
2. The horse and cart can move a beyond a ruler length in twenty seconds
3. The horse and cart replicate a LEGO model of the traditional horse and cart used in the past for Mining in Australia

PREPARE

- Look at BricQ Motion Essential kit
- Look at Spike Essential kit
- Keep cart from previous lesson
- If necessary, revise these related vocabulary words: brainstorm, design, construct, test, iterate.
- Students organised into groups of 2-3 students
- 30cm rulers
- One iPad for group

ENGAGE (10 minutes)

- Discuss how horses and carts were used to transport ore around Australian mines
- Discuss brainstorming
- Students in groups can brainstorm different designs for a horse using the two LEGO kits

EXPLORE (20 minutes)

- Build a basic model, to inspire students to explore new ideas. This model will be shown to students before they have a go at constructing their design in groups.
- Explain to students that you will be asking them questions about how they are using their brainstorm, how they are constructing their horse, how they are testing their horse, and how they have been iterating their design and if they are able to explain and elaborate extra details about their horse design.
- Show students the coding to allow the horse to move and pull the cart and how they can control the speed of the horse and cart using the coding.
- Student groups will then construct, test and iterate their model of the horse and cart using 30cm rulers and the stop watch in the Clock App on the iPad.

EXPLAIN AND ELABORATE (15 minutes)

- Students will record their horse and cart on a video and answer the following questions:
    - How could your horse and cart be used in a mine?
    - Did you have to change your design from the brainstorm?
    - Is the model of the horse and cart different to what was used in the past and how?
    - How far could your model move whilst holding the ore (LEGO bricks) in twenty seconds?

EVALUATE

Ask guiding questions to explore students' thinking and to act as a means to support their construction process. The evaluate stage will occur throughout the lesson. To support the teacher's assessment of student groups, they can use the teacher observation checklist.

SELF-ASSESSMENT

Have each student choose the brick that they feel best represents their performance.

- Yellow: I think I can brainstorm to solve a problem.
- Blue: I can brainstorm to solve a problem.
- Green: I can brainstorm to solve a problem, and I can help a friend do it too.

PEER ASSESSMENT

In their small groups, have your students discuss their experiences working together. Encourage them to use statements like these:

- I liked it when you…
- I'd like to hear more about how you…

TEACHER OBSERVATION CHECKLIST

As students are engaging in the lesson the teacher can use questions and observations to complete the checklist. Students' engagement can be measured by using the following observational checklist:

Student name	Brainstorm	Construction	Testing	Iterates	Explain and Elaborates

Use the following numbers to reflect on student engagement and understanding. 1. Needs teacher support 2. Completes independently 3. Collaborates and communicates with peers 4. Uses creativity to collaborate and communicate with peers

ASSESSMENT TASK AND CRITERIA FOR HORSE & CART

TASK: To build a horse and cart that can carry ore and to see if it can go beyond a ruler length in 20 seconds without spilling the ore.

Student name: Class:

	4	3	2	1	0
ACSHE035 People use science in their daily lives, including when caring for their environment and living things	Designs a moving horse and cart that can move a beyond 30cm in twenty seconds	Designs a moving horse and cart that can move a less than 30cm in twenty seconds	Designs a moving horse and cart that is not coded to move.	Designs a horse and cart	Designs something
ACSHE034 Science involves observing, asking questions about, and describing changes in, objects and events	Continually uses questioning and observations to construct, test and iterate design	Uses some questioning and observations to construct, test and iterate design	Uses observations to construct, test and iterate design	Constructs and tests design	Constructs design
ACSIS039 Use informal measurements to collect and record observations, using digital technologies as appropriate	Continuously collects data on how the horse and cart moves and uses this to improve the coding so it can gain more distance within twenty seconds	Collects some data on how the horse and cart moves and uses this to improve the coding so it can gain more distance within twenty seconds	Observes how the horse and cart moves over twenty seconds	Shows that their horse and cart can move over the course of twenty seconds	Shows how their model moves over twenty seconds

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