



Thinking in Scientific Ways

Developing and Communicating Scientific Understanding

ACCESS THE SCIENCE EXEMPLARS ONLINE AT www.tki.org.nz/r/assessment/exemplars/sci/

LEVEL 1 2 3 4 5

Clay Marbles

THE LEARNING CONTEXT

The teacher's intended outcomes were for the students to:

- share their experiences of the observable changes in materials
- suggest explanations, based on their experiences and ideas, for the changes they observed in the properties of materials.

The intended outcomes were aligned to the following "big ideas":

- The properties of materials can change.
- Scientists devise theories to explain their observations.
- Scientists share and discuss their theories with each other.

The students explored substances such as concrete, plaster of Paris, and oobleck (see *Making Better Sense of the Material World*, page 65) and recorded their observations of the substances' physical properties. They then explored the properties of wet and dry clay. After reading a story about children in great-grandma's day making their own clay marbles, the students made some clay marbles. They compared the appearance and hardness of the wet and dry clay and recorded their findings.

The teacher wanted the students to share their thinking rather than just record their observations. She asked the students to create a piece of transactional writing conveying what they had found out about one of the substances they had explored. She instructed them to "Choose one of the substances, think about the changes that you noticed, and write down the reasons why you think they changed."

Teacher-student conversation

Before writing:

Teacher: How are you going to share what you found out with the rest of the class?

Lavan: I'm drawing a picture to show that you can squish the clay when it's soft but when it's hard your fingers can't dent it. Then I'll write what we did and what we observed and that I think the clay got hard because of the sun and the heater.

Teacher: What do you think the sun and the heater have in common that helped dry the clay?

Lavan: They're both hot. They have heat.

REFERENCES

Ministry of Education (1993). *Science in the New Zealand Curriculum*. Wellington: Learning Media.

Ministry of Education (1998). *Making Better Sense of the Material World*. Wellington: Learning Media.

Ministry of Education (1999). *Making Sense of Planet Earth and Beyond*. Wellington: Learning Media.

WHERE TO NEXT?

To move Lavan towards the next learning step, the teacher could help him to focus on:

- comparing his explanation with that of another student, for example, by asking him, "How could you check that your explanation is better than Alyson's?" (thinking in scientific ways)
- considering what happened to the water inside the clay that "dried up" and modelling this using role play, diagrams, or other materials (developing and communicating scientific understanding).

The teacher could:

- ask Lavan to collect different explanations about what he thinks is happening and to discuss his ideas with others
- explore the concept of "change" in other strands (for example, life cycles in *Making Sense of the Living World* or landform changes due to erosion by wind and rain in *Making Sense of Planet Earth and Beyond*).

CURRICULUM LINKS

Science in the New Zealand Curriculum

Achievement Objectives

Level 2: Making Sense of the Nature of Science and Its Relationship to Technology

Students can use a variety of methods to investigate different ideas about the same object or event.

Science in the New Zealand Curriculum, page 28
http://www.tki.org.nz/r/science/curriculum/p28_29_e.php

Levels 1 and 2: Developing Scientific Skills and Attitudes

Reporting: Students can share what they did and what they found out in their investigations in whole class situations or in groups.

Science in the New Zealand Curriculum, page 47
http://www.tki.org.nz/r/science/curriculum/p44_51_e.php

Level 2: Making Sense of the Material World

Students can investigate and describe everyday changes to common substances.

Science in the New Zealand Curriculum, page 92
http://www.tki.org.nz/r/science/curriculum/p92_93_e.php



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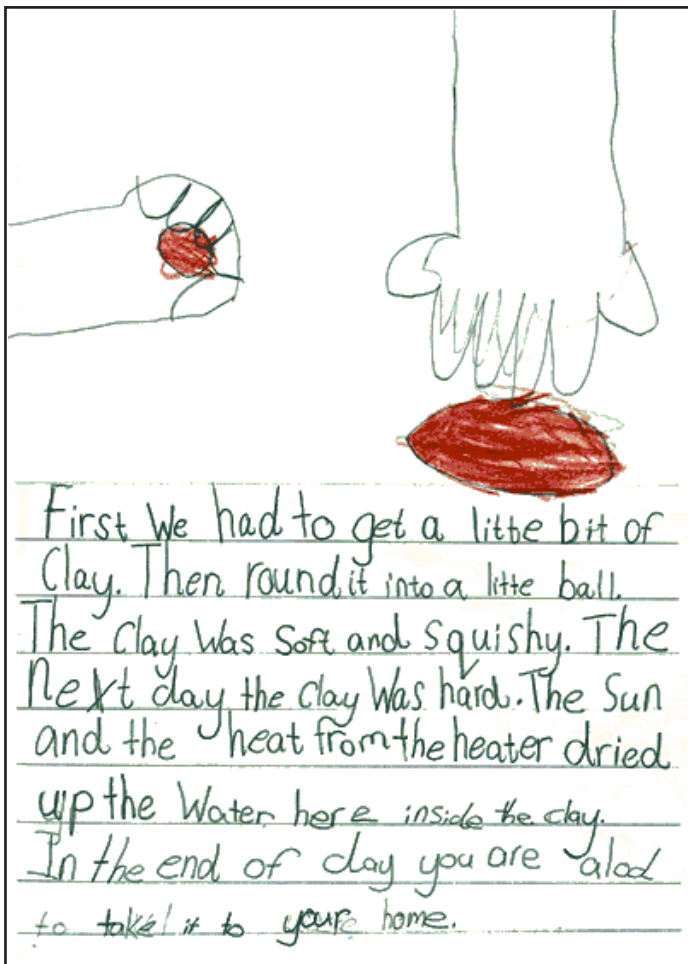
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WHAT THE WORK SHOWS

Most of Lavan's work fits indicators for "thinking in scientific ways" and "developing and communicating scientific understanding" at level 2 of the curriculum. However, his explanation that heat dries the water and changes the properties of clay places him at level 3 for "suggesting explanations" in the "thinking in scientific ways" matrix.



Lavan's report

Progress Indicator

Thinking in Scientific Ways

Suggesting explanations

Lavan suggests a cause-effect link for his observation that it is the water drying up inside the clay that causes it to change from feeling soft and squishy to hard.

Comparing and evaluating explanations

In his report, Lavan attempts to discuss his ideas with the class in order to reach an understanding about what evidence there was for the disappearance of the water from inside the clay and why the clay went hard. He accepts that his ideas could change if someone suggests a better idea.

Understanding how the science community operates

He recognises that scientists test their ideas to select the best explanations. He shares his own ideas through drawing and writing.

Progress Indicator

Developing and Communicating Scientific Understanding

Using scientific ideas in constructing explanations

Lavan offers explanations for ideas using some scientific ideas. He is moving towards level 3 in this aspect as he showed some understanding of the scientific ideas related to his experiences in his recognition that the heat from the sun and the heater dried the water in the clay.

Lavan's report shows some sequence and accuracy, and he is beginning to use drawings as simple aids in his explanations.

Using scientific vocabulary

Lavan experiments with vocabulary to describe his scientific investigation into the properties of the clay.