



# Developing Interest and Relating Scientific Learning to the Wider World

## Investigating in Science

### Thinking in Scientific Ways

ACCESS THE SCIENCE EXEMPLARS ONLINE AT [www.tki.org.nz/r/assessment/exemplars/sci/](http://www.tki.org.nz/r/assessment/exemplars/sci/)

LEVEL 1 2 3 4 5

## Sounds of a Bottle Organ

### THE LEARNING CONTEXT

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

- contribute to an investigation and recognise patterns
- explain how low and high pitch occurs
- share and discuss their observations in an attempt to make sense of the evidence.

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

- Sound is caused when waves of vibrations pass through a substance.
- The number of waves occurring every second (the frequency) determines the pitch (how high it is).
- Scientists share their ideas and use evidence to support or refute them.
- Scientists share and discuss their observations and look for patterns.

The class started with an activity to determine their prior knowledge. Then the teacher encouraged some exploratory learning experiences such as listening to body sounds, balloon sounds, and sounds in the environment. The students formed groups and made bottle organs with jars of coloured water. Each group tried changing the levels of water and investigating the different sounds.

The teacher asked the groups the following questions:

- Which jar sounds the highest?
- Which jar sounds the lowest?
- Why does the jar with the smallest amount of liquid make a high sound?
- Why does the jar with the most liquid make a low sound?
- Do the sound vibrations move slower with more water? Why?

To answer these questions the students shared their ideas and reflected on the investigative process.

### Teacher-student conversation

- Teacher: Why does it matter how you hit the jar?
- Josh: Because if you hit where there's lots of air, the sound is different from if you hit where there's water. Using metal or wood makes a difference too.
- Teacher: So it's not just the level of the water in the jar, but all those variables that can affect the sound. How could you get rid of some of these variables?
- Josh: We're going to use the same thing for hitting all the jars, try to hit them all in the same way – not too hard and not too soft – and find the best place to hit that will work with all the jars.

### WHERE TO NEXT?

To move Josh towards the next learning step the teacher could help him focus on:

- reflecting on, and evaluating the investigative process, and challenging or checking evidence (thinking in scientific ways)
- suggesting his own questions for investigation and carrying out simple trials to test his ideas (investigating in science).

The teacher could:

- provide opportunities for Josh and the class to share their ideas, reflect on and evaluate the investigative processes, and the quality of the evidence collected (thinking in scientific ways)
- continue to develop Josh's investigative skills in other contexts, especially in trialling and testing in order to consolidate his skills (investigating in science).

### CURRICULUM LINKS

*Science in the New Zealand Curriculum*

#### Achievement Objectives

#### Level 2: Making Sense of the Physical World

Students can investigate and describe their ideas about some everyday ideas of physical phenomena.

*Science in the New Zealand Curriculum*, page 74

[http://www.tki.org.nz/r/science/curriculum/p74\\_75\\_e.php](http://www.tki.org.nz/r/science/curriculum/p74_75_e.php)

#### Levels 1 and 2: Developing Scientific Skills and Attitudes

**Processing and interpreting:** Students can identify trends and relationships in recorded observations and measurements by suggesting links between these.

*Science in the New Zealand Curriculum*, page 46

[http://www.tki.org.nz/r/science/curriculum/p44\\_51\\_e.php](http://www.tki.org.nz/r/science/curriculum/p44_51_e.php)

#### 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](http://www.tki.org.nz/r/science/curriculum/p28_29_e.php)

### REFERENCE

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



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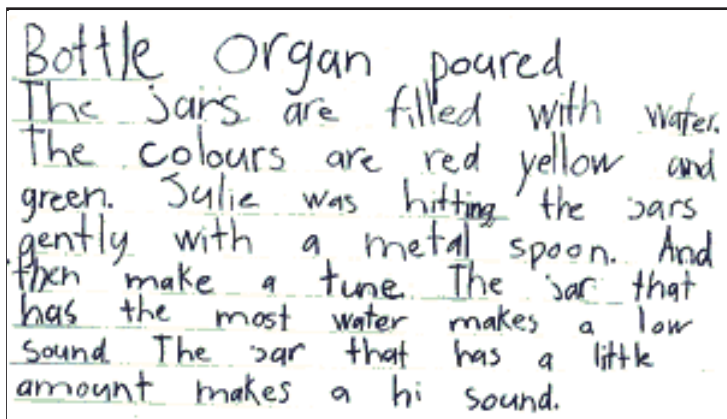
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## Sounds of a Bottle Organ

### WHAT THE WORK SHOWS

Josh's written report and picture show how he created a bottle organ and played a tune on it. His work shows how he explored a scientific experience, made a significant contribution to a class discussion, and reported his findings.



Josh's written report



Josh's bottle organ

### Progress Indicator

#### Developing Interest and Relating Scientific Learning to the Wider World

##### Experiencing and showing awe, wonder, and interest

The students wanted to play a tune on their water organ and asked for help from a musician to help them tune the organ.

### Progress Indicator

#### Thinking in Scientific Ways

##### Suggesting explanations

Josh joins in a class discussion and *suggests cause-effect links for observations or events.*

##### Comparing and evaluating explanations

Josh challenges the evidence provided by others about his scientific ideas *but accepts that his ideas may change if someone suggests a better idea.*

##### Understanding how the science community operates

He recognises that there is conflicting evidence in the results gathered by class members *but recognises that scientists test their ideas to select the best explanations.*

### Progress Indicator

#### Investigating in Science

##### Exploring a situation

Josh *makes observations and look for patterns or relationships.*

##### Using systematic approaches and scientific conventions

Josh *carries out observations and simple trials based on his own ideas* by deciding to hit in the middle of where the liquid was, in each jar. *He collects relevant data* after it was agreed that a gentle tap was the most appropriate (see Josh's written report).

##### Processing and interpreting

In his report he *reaches a conclusion to a simple investigation and links it to his own understanding.*

##### Evaluating the investigative process as a continuous activity

Josh concludes that the way in which the jar was hit, was very important. This leads to further discussion *on the features of class investigation and suggestions of simple improvements* (see Teacher-student conversation).

##### Reporting

Josh *reports on some of the investigations in an organised way.*