



LEVEL 1 2 3 4 5

Dissolving Sugar Crystals

THE LEARNING CONTEXT

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

- plan an investigation to answer a question using a "fair test" approach
- understand that scientists use a fair test approach to try and eliminate competing explanations for changes observed.

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

- Using systematic and creative processes of investigation, scientists produce a constantly evolving body of knowledge.
- Changing measurable variables such as the temperature of the solvent, the amount of stirring, or the surface area of the solute can alter the rate at which a substance dissolves.

The class began the study with exploratory activities from *Making Better Sense of the Material World* and an extended exploration of making crystals. The teacher modelled a number of investigations using their ideas. He introduced the term "variable" and the students identified all the variables that could be involved especially in the making of crystals. The statement "When I change...what will happen to..." was introduced and revisited a number of times as the students planned their investigations.

In their investigation, the students decided what they would change, what they would measure and identified the question they were going to investigate. At the end of their investigation they completed a report.

Teacher-student conversation

Teacher: What are some of the variables in your experiment?

Kiri: The temperature of the water, how much I use. Also how much sugar; the type of sugar and how much it got stirred.

Teacher: Which variables might you be able to control, and how?

Kiri: I can measure the amount of water. I can keep the amount of sugar – and the type of sugar – the same. I can make the temperature of the water the same every time and I could stir for the same time too.

WHERE TO NEXT?

To move Kiri towards the next learning step the teacher could help her focus on:

- finding a solution to the scaffold prompt, "Would the times you measured be the same if you repeated the tests?" (investigating in science)
- finding out where the sugar goes when she stirs the warm water (developing and communicating scientific understanding).

The teacher could ask Kiri:

- if a graph of her data would help her interpret her results – scientists construct graphs of their data to identify trends and patterns (investigating in science)
- if "Solubility of Sugar in Water" is an appropriate title for the report on this investigation (developing and communicating scientific understanding).

CURRICULUM LINKS

Science in the New Zealand Curriculum

Achievement Objectives

Level 3: Making Sense of the Material World

Students can investigate and report on temporary and more permanent changes that familiar materials undergo.

Science in the New Zealand Curriculum, page 94

http://www.tki.org.nz/r/science/curriculum/p94_95_e.php

Levels 3 and 4: Developing Scientific Skills and Attitudes

Focusing and planning: Students can ask questions of themselves, their group, and resource people and identify questions suitable for scientific investigation.

Science in the New Zealand Curriculum, page 44

http://www.tki.org.nz/r/science/curriculum/p44_51_e.php

Information gathering: Students can make observations and simple measurements.

Science in the New Zealand Curriculum, page 45

http://www.tki.org.nz/r/science/curriculum/p44_51_e.php

Processing and interpreting: Students can identify trends and relationships in recorded observations and measurements by making links within organised data.

Science in the New Zealand Curriculum, page 46

http://www.tki.org.nz/r/science/curriculum/p44_51_e.php

Reporting: Students can present what they did and what they found out in their investigations in ways and forms appropriate to their peer group.

Science in the New Zealand Curriculum, page 47

http://www.tki.org.nz/r/science/curriculum/p44_51_e.php

Level 3: Making Sense of the Nature of Science and its Relationship to Technology

Students can recognise when simple investigations can be classified as a "fair test" and make decisions about the worth of the results.

Science in the New Zealand Curriculum, page 30

http://www.tki.org.nz/r/science/curriculum/p30_31_e.php

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: Levels 1 to 4*. Wellington: Learning Media.



LEVEL	1	2	3	4	5
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Dissolving Sugar Crystals

WHAT THE WORK SHOWS

Kiri's investigation of the solubility of sugar in water and her report shows her understanding of the investigative process and the underlying scientific ideas.

Investigation: Solubility of sugar in water

<p>Brainstorm</p> <p>Things I could change or vary...</p> <ul style="list-style-type: none"> • temperature of water • amount of water • amount of sugar • type of sugar • stirring <p>Thing(s) I could measure</p> <p>amount of sugar left</p> <p>time it takes to dissolve</p>	<p>I will change...</p> <p>the amount of water</p> <p>I will measure...</p> <p>the time it takes to dissolve</p> <p>I will keep this the same to keep it fair...</p> <ul style="list-style-type: none"> • type of sugar • amount of sugar • temperature of water • stirring 	<p>My Question</p> <p>When I change the amount of water...</p> <p>what will happen to the time it takes to dissolve?</p>												
<p>What happened</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; padding: 5px;">What I changed</th> <th style="width: 50%; padding: 5px;">What I measured</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">the amount of water</td> <td style="text-align: center; padding: 5px;">the time to dissolve</td> </tr> <tr> <td style="padding: 5px;">50ml</td> <td style="padding: 5px;">54 seconds</td> </tr> <tr> <td style="padding: 5px;">100ml</td> <td style="padding: 5px;">46 seconds</td> </tr> <tr> <td style="padding: 5px;">150ml</td> <td style="padding: 5px;">42 seconds</td> </tr> <tr> <td style="padding: 5px;">200ml</td> <td style="padding: 5px;">40 seconds</td> </tr> </tbody> </table>		What I changed	What I measured	the amount of water	the time to dissolve	50ml	54 seconds	100ml	46 seconds	150ml	42 seconds	200ml	40 seconds	<p>What I found out</p> <p>That the more water there is the quicker it will dissolve, because there is more room for it to dissolve in the jar.</p>
What I changed	What I measured													
the amount of water	the time to dissolve													
50ml	54 seconds													
100ml	46 seconds													
150ml	42 seconds													
200ml	40 seconds													

Kiri's report of her investigation

Progress Indicator Investigating in Science

Using systematic approaches and scientific conventions
Kiri plans and carries out more systematic trials when she changes the amounts of water and uses measurements when she measures the time it took for the sugar to dissolve (see What happened).

Asking questions
Kiri's record of her brainstorm and presentation of variables ("things I could change and measure") indicates that she can generate and choose questions to investigate (see Brainstorm).

Processing and interpreting
She organises her data to display obvious trends and patterns and reach conclusions (see What I found out).

Reporting
Kiri presents an organised report of her investigation linking findings to her observations.

Progress Indicator Developing and Communicating Scientific Understanding

Using scientific ideas in constructing explanations
Kiri constructs a plausible explanation for an experience using some scientific ideas when explaining her findings.

Using scientific vocabulary
She develops and uses scientific vocabulary and symbols in her written report of her investigation (see What happened, and What I found out).