



LEVEL 1 2 3 4 5

Testing Materials for a Farm-bike Jacket

THE LEARNING CONTEXT

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

- investigate using "fair testing" as independently as possible
- explain how the properties of materials influence their selection for various uses.

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

- Scientists use "fair tests", controlling all the variables except those that are manipulated and responded to, when this is a good way to answer their question.
- Scientists compare their results by measuring them where possible.
- The uses of materials depend on their range of properties.

The students began by working in groups on the properties of materials, using activities taken from pages 102–103 of *Making Better Sense of the Material World*. The students used the library and the Internet to find the origins of various common materials and ways to test the materials for their properties and uses. In their groups, they identified some "mystery fabrics" supplied by the teacher and investigated the best material to use for a face mask to protect against dust on a dusty track. The class compared and discussed the various approaches used by the groups.

The teacher used a class discussion about the hazards of farm-bike riding (a familiar experience for these rural students) to lead into discussion about the properties that riders need in their protective clothing. Each student chose one of the properties and developed ways to test various fabrics for that property.

During their investigations, the students made progress reports. Their reports generated discussion that helped them to improve their investigations. On completion, the students shared and discussed the results of their investigations in class presentations. Finally, the students used the information they had gathered to design an ideal farm-bike suit.

Although it's not illustrated here, the teaching also provided for self-assessment and peer assessment as the investigations proceeded. The teacher could use the students' assessment results to plan further opportunities for them to conduct investigations.

Teacher-student conversation

Planning Ben's investigation:

Teacher: What will you test your materials for and why?

Ben: I'm going to test them for being durable when they're getting rubbed against the road, when they're wet, and for getting sharp objects fired at them because those are all things that can happen when you're riding a motorcycle that you need protection from.

Teacher: What fabrics do you predict will be the front-runners?

Ben: I think the leather will come first because it seems stronger, then rugby jersey fabric because it seems thicker.

WHERE TO NEXT?

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

- evaluating his investigation, for example, by asking "How can you be sure that your measurements are reliable?" and "Would repeated tests get the same results?" (investigating in science)
- explaining more challenging situations requiring the coherent connection of a range of scientific ideas. The consistency of his achievement at level 4 and the brevity of his labels suggest that Ben is capable of this (developing and communicating scientific understanding).

The teacher could:

- focus on another type of investigation in a unit on the Material World (for example, systematic, detailed observing)
- provide opportunities, in a unit on the Material World, for Ben to use his own ideas on clothing for other uses (for example, what to wear when using a chainsaw).

CURRICULUM LINKS

Science in the New Zealand Curriculum
Achievement Objectives

Level 4: Making Sense of the Nature of Science and Its Relationship to Technology

Students can plan and carry out a "fair test" and make decisions about whether the conclusions drawn from an investigation are soundly based.

Science in the New Zealand Curriculum, page 32
http://www.tki.org.nz/r/science/curriculum/p32_33_e.php

Levels 3 and 4: Developing Scientific Skills and Attitudes

Focusing and planning: Students can design "fair tests", trials, and surveys with an attempt to control for obvious variables.

Science in the New Zealand Curriculum, page 44
http://www.tki.org.nz/r/science/curriculum/p44_51_e.php

Level 4: Making Sense of the Material World

Students can:

- investigate and group common materials in terms of properties
- investigate and explain how uses of everyday materials are related to their physical and simple chemical properties.

Science in the New Zealand Curriculum, page 96
http://www.tki.org.nz/r/science/curriculum/p96_97_e.php

REFERENCES

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

Ministry of Education (2001). *Making Better Sense of the Material World*. Wellington: Learning Media.



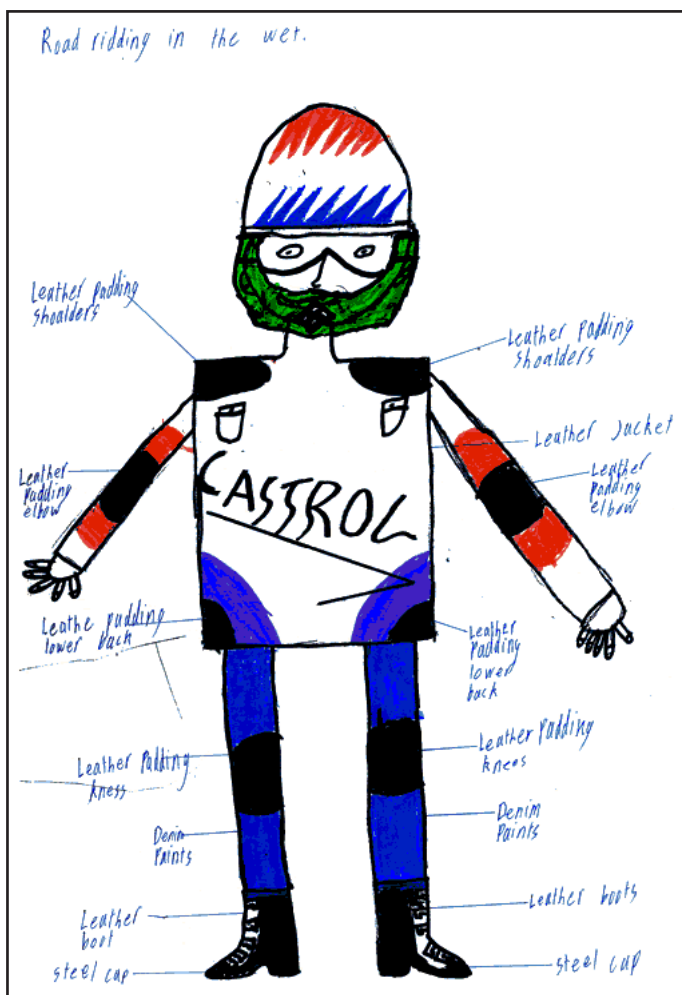
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WHAT THE WORK SHOWS

Ben completed a number of exploratory activities provided by his teacher and then went on to develop and carry out an independent investigation.

To complete the final activity, Ben drew together his learning about materials and properties and the needs of a motorcyclist in order to design a jacket that meets those identified needs.



Ben's ideal farm-bike suit

Progress Indicator Investigating in Science

Asking questions

Ben *discusses and chooses an interesting question to investigate.*

Using systematic approaches and scientific conventions

Ben *plans and carries out a systematic investigation to gather evidence to test his ideas.* He tests for durability by attaching various fabrics to identical wooden blocks and scraping them on the road over a measured distance. He observes each fabric for damage after one, ten, and 20 scrapes.

He *uses a scientific convention*, that is, "fair testing". There are, however, two scientific conventions Ben does not use. His report does not communicate very well the plan for his investigation, and he carries out only one set of measures for each fabric, so he has little evidence for the reliability of his test.

Reporting

Although he does not try to explain his findings, Ben *presents a well-organised report* in which he links the findings to his observations.

Progress Indicator Developing and Communicating Scientific Understanding

Using scientific ideas in constructing explanations

Ben selects different materials for various parts of the suit. In his presentation to the class, he is able to justify each choice with reference to the accumulated investigative results and take into account the need for protection against abrasion, water, and sharp objects. He *constructs an explanation for an experience, using appropriate scientific ideas.* He connects his scientific ideas and provides a coherent explanation, using aids to help the audience to understand.



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Transcript of student work

Aim Investigation
To find out which material is the most durable.

Prediction
- I think Nylon 4th
- Leather 1st it seems stronger Nylon 4th
- Rugby jersey 2nd seems thicker T shirt 5th

5 pieces of wood 8cm wide by 8cm long and 3cm thick
5 pieces of different material 22cm by 11/2 cm

Method
1. Get 6 different types of clothing 22cm by 11cm leather T-shirt, Nylon, rugby jersey, Denim. 5. Rub on road, 1, 10, 20.
2. Then find 5 pieces of wood 8cm by 8cm
3. Staple clothing to wood 6. Stop to look at difference
4. Put a mark on the road 62cm long

Results Notes
Leather .1. scratch no change. 10. a few minor scratchers
.20. still a few scratchers
T shirt .1. no change. 10. no protection. out of test
Nylon .1. no change .10 a few scratchers. .20. destroyed
Rugby top .1. No Change. 10. perfect. 20. fine
Denim. 1. no change. 10. perfect. 20 a few minor scratchers

Conclusion
After my investigation I have found out that the rugby jersey is the best fabric to wear on a motorbike then leather, Denim, Nylon, T shirt
How this was a fair test
- I rubbed the material within the same distance each time
- I rubbed them all just as hard
- I rubbed the same amount of times
- I rubbed the material in the same place.

Ben's report

Aim Investigation
To find out which material is the most durable.

Prediction
- I think Denim 3rd
- Leather 1st it seems stronger Nylon 4th
- rugby jersey 2nd seems thicker T shirt 5th

Apparatus
5 pieces of wood 8cm wide by 8cm long and 3 cm thick
- 5 pieces of different material 22cm by 11/2 cm

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Ben's report