



EPISODE 3: CHANGING THE LIGHTBULB

JIVI'S MACHINES



THE WHEEL & AXLE

TO TEACHERS AND PARENTS

A large focus in teaching science is around encouraging both curiosity and the skills and dispositions to be able to find out or test things for yourself. This includes developing an understanding about how science itself works. The New Zealand Curriculum calls this the Nature of Science.

Tips about how to encourage these aspects are given in a



Use these to get your children talking, discussing, testing and thinking about the science involved in Jiwi's Machines. Have fun! The science content involved in Jiwi's Machines relates to the Physical World Achievement Aims of the New Zealand Curriculum.

<http://nzcurriculum.tki.org.nz/The-New-Zealand-Curriculum/Learning-areas/Science/Achievement-objectives>

THE WHEEL & AXLE

We first met a Simple Machine – the **wheel** and **axle** – in EPISODE 1, TOAST BITE. Here, our knowledge of the wheel and axle is extended as Jiwi and Luke show how using a wheel and axle reduces friction.

ACTIVITY 1: FEEL THE FRICTION (10 – 20 minutes)

BIG SCIENCE IDEA: Friction between moving objects can be reduced by using wheels.

This idea can be introduced by using a sled (snow toboggan, old boogie board, sack with rope tied to the front) and asking one child to sit on it while another pulls them along. How easy was it to pull someone on a sled? What was making it difficult? How might it be made easier? Then compare this to pulling someone along on wheels (borrowing the caretaker's hand cart, skateboard, go-cart) or you could use dowels (eg: broomstick handles) underneath the sled if you have them. How do wheels make it easier to move this heavy load? They reduce the amount of contact and friction between the sled or cart and the ground. The amount of surface area contact is a big factor in the amount of friction.



ACTIVITY 2: SURFACES (10 – 30 minutes)

BIG SCIENCE IDEA: The type of surface affects the amount of friction between moving objects.

Another factor affecting friction is the type of surface (whether it has grip or is made smooth, as Luke suggested, by adding soap or oil). In EPISODE 2: IT HAS A VIRUS!, Jiwi wondered what might happen in the CUP FRICTION CLIP if the surface was altered. You may like to try the sled activity above on a variety of surfaces like grass, concrete, the long jump pit, carpet, bark in the playground. How does the surface affect the amount of effort needed to move the load?

EXTENSION: BIKE TYRES (30 minutes)

BIG SCIENCE IDEA: Greater contact with surface area means more friction.

Another way of experiencing the effect of the amount of friction is to compare riding a bicycle across concrete with its tyres properly inflated and then again with them half deflated. Which felt easier to ride? Why might this be? Can you explain this in terms of surface area and friction? Look at the tyres of a road bike and of a mountain bike. Think about the terrain they are designed for and then, using your knowledge of friction, explain why their tyres are so different.

BUT WAIT... THERE'S MORE:

If it is summertime, you could make a fun connection with a water slide (or long roll of polythene) outside on a nice day. Children could experience the slide in three ways.

-  Firstly with no water.
-  Secondly with a hose running over it to wet it well.
-  Thirdly by adding a little detergent to the slide.



JIWI WONDERS

-  What questions do you have about wheels, axles and friction?
-  What would you like to investigate? Have a try.



CHALLENGE:

DESIGN A VEHICLE TO MOVE A LOAD
(1 - 1.5 hours)

BIG SCIENCE IDEA: The amount of friction depends on the surface type and the force pressing two surfaces together.

In small groups, use all your understanding of wheels, axles and friction to make a vehicle to carry a 400gm can of food (or any available weight) the furthest with one standard push.

You will need to find a way of making the same push for each vehicle, e.g. a ramp. You will need to decide together what the test surface will be. Carpet? Concrete? Lino? Wood? Glass?

Depending on the children's age, give them items suitable for making a vehicle. For younger children give existing wheels and axles, maybe from a Lego or K'nex set. For older children offer old DVD / CDs or milk bottle tops with a hole drilled in the middle, kebab sticks, toothpicks and straws. The best challenge of all is to have to make your own wheels - perhaps from polystyrene trays (such as those they sell packaged meat on).

Provide thick card, polystyrene meat trays, margarine pottles, ice cream containers, kebab sticks, toothpicks, straws, scissors, tape and some cans for testing.

Have a sharing time where each group demonstrates their vehicle and explains: what their thinking was as they made the vehicle, what led them think that (what evidence from previous activities they used), how did they test it, where was friction useful and where was friction a problem?

USE EVIDENCE

As they design and build students should be encouraged to ask and answer questions such as:

How do you know that?
What makes you think so?
How could you check that?
So an example of this would be...

Can you think of an example when this wouldn't work?

MATERIALS

<p>Activity 1 A sled Dowels or a hand cart, skateboard</p>	<p>Activity 2 As for Activity 1 but with a range of different surfaces</p>	<p>Extension Bicycle Bike tyre pump Water slide</p>	<p>Challenge 400gm can or other constant weight Surface for moving on Wheels – Lego, K'nex CDs, DVDs, Bottle tops with holes in middle Polystyrene trays Compasses Thick card, Margarine / ice cream containers, Kebab sticks Toothpicks Straws, Scissors, Sellotape</p>
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NZ CURRICULUM PLANNING SUMMARY

<p>Contextual Achievement Objective: PHYSICAL WORLD; Explore and investigate physical phenomena in everyday situations.</p>	<p>Nature of Science Achievement Objective: UNDERSTANDING IN SCIENCE; when an explanation correctly predicts an event, confidence in the explanation as science knowledge is increased.</p>
<p>Big Science Idea: Friction between moving objects can be reduced by using wheels.</p> <p>Greater surface area contact means more friction.</p> <p>The type of surface affects the amount of friction between moving objects.</p> <p>The amount of friction depends on the surface type and the force pressing two surfaces together.</p>	<p>Big Nature of Science Idea: Scientists make predictions and design investigations based on previous research, discussion with others and prior experience.</p>
<p>Weblinks: http://scienceonline.tki.org.nz/Nature-of-science/What-is-the-Nature-of-Science/Teacher-suggestions-Understanding-about-science/Predictions-based-on-existing-knowledge</p> <p>http://scienceonline.tki.org.nz/Introducing-five-science-capabilities/Use-evidence</p>	<p>Capability focus: USE EVIDENCE; In science, explanations need to be supported by evidence.</p>