

# HARLEY HITCH

AND THE IRON FOREST

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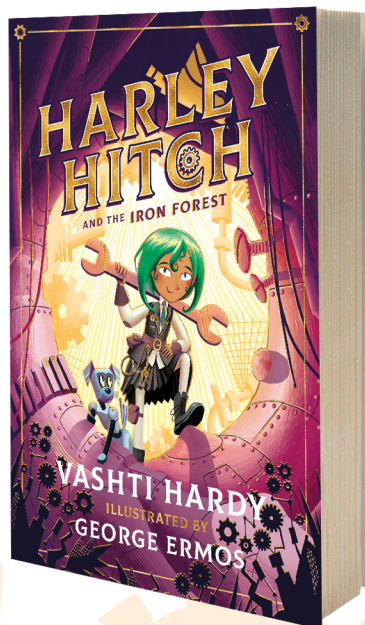
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# LESSON PLAN: YEAR FIVE



## OUTCOMES

- To explore the process of 'bot adaptation' in Harley Hitch and the Iron Forest
- To explore the key features of an annotated diagram
- To design an adapted bot and present their ideas in the form of an annotated diagram

## CURRICULUM LINKS

### Reading

- Summarising the main ideas drawn from more than one paragraph, identifying key details that support the main ideas

### Writing

- Identifying the audience for and purpose of the writing, selecting the appropriate form and using other similar writing as models for their own

### D&T

- Generate, develop, model and communicate ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design

## RESOURCES

- *Resource Sheet 1: Grandpa Eden's Robot Adaptations*
- *Resource Sheet 2: An Annotated Diagram of the Indoor Mechani-Weather Robot*
- *Resource Sheet 3: Planning Bot Adaptations*

## LEAD IN

Read as far as page 77 in *Harley Hitch and the Iron Forest*, and give out *Resource Sheet 1: Grandpa Eden's Robot Adaptations* for children to follow. Ask children to re-read the passage and identify and summarise the key adaptations that Grandpa Eden made to his indoor mechani-weather robot. Take ideas and make a list. Discuss ways that you could show these adaptations on paper, if you were trying to describe the indoor mechani-weather robot to a friend.

Ask children what an annotated diagram is and discuss key features (clear drawing, neat accurate lines from a feature to a short sentence that offers information about the feature, plain English, sentence punctuation, a clear title). As a class, come up with annotations for the indoor mechani-weather robot then show children *Resource Sheet 2: An Annotated Diagram of the Indoor Mechani-Weather Robot*.

## TASK

Explain that children are going to work in pairs to design their own specially adapted robot from an every-help-bot. They will need to decide what role or job it is adapted for (e.g. cooking, sports, performing arts) and come up with at least four design features that make it extra good at that job.

Children can use *Resource Sheet 3: Planning Bot Adaptations* to record their thoughts and ideas, planning the adaptations and identifying how these will look and work. Once children have developed their ideas, they should draw a detailed annotated diagram of their bot, using the key features of this text form, as discussed in the lead in.

## PLENARY

Invite the class to share their robot designs as part of a bot-design competition. They could imagine they are presenting their bot to Harley and Grandpa Eden, explaining how each feature works. They could then take part in a Q&A session where children scrutinize one another's designs.

Continue reading the story to the class and discuss how different people behave towards their bots.

## EXTENSION

Children have a go at making a prototype for their robot, based on their design.



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# RESOURCE SHEET 1: GRANDPA EDEN'S ROBOT ADAPTATIONS



Grandpa Eden nodded proudly. "It's all down to our indoor mechani-weather robot."

A robot walked out from behind a large palm. She was a little taller than Grandpa Eden, with human-looking limbs.

"She's called Daisy and is Grandpa Eden's finest garden invention. He adapted her from an every-help-bot. He's making more for the Horticultural Society too."

The robot put a metal finger to the pot of a nearby cucumber plant.

Grandpa patted the robot on the back. "She's fitted with over fifty sensors and probes so that she can detect which plants need which weather at any time. Right now,

she's checking the soil moisture levels."

"Incredible," said Cosmo.

"If the weather gets too cold, she can shine like the sun. Daisy, would you mind showing the young man, please?"

In an instant, Daisy's face glowed golden orange, casting a warm light over the cucumber plant. Then her hand flipped back and a sprinkler spout watered the plant.

"Wow!"

"Her chest can hold over a hundred litres, and she pops outside to fill up when it's raining. Very economical.

*Harley Hitch and the Iron Forest, pp74-76*



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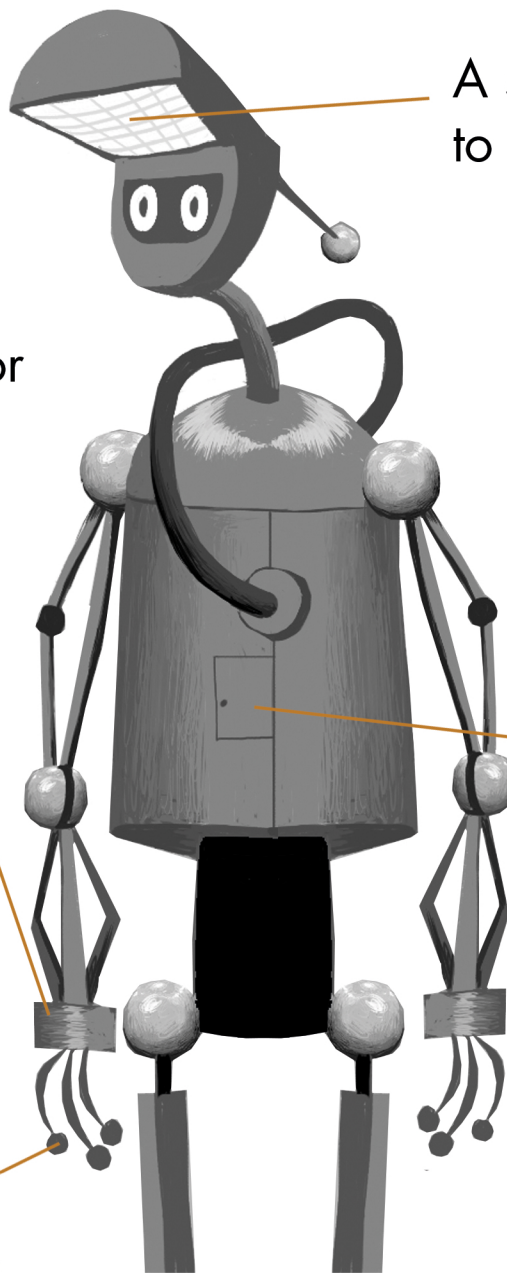
## RESOURCE SHEET 2: AN ANNOTATED DIAGRAM OF THE INDOOR MECHANI-WEATHER ROBOT

A sun generation unit to replicate sunlight.

A sprinkler spout for watering plants.

A water container chest that holds over a hundred litres at a time.

Over fifty sensors and probes to detect which plants need which weather at any time; for example she can check soil moisture levels.



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## RESOURCE SHEET 3: PLANNING BOT ADAPTATIONS

What will your bot be adapted to specialise in?

What are the key tasks it will need to perform?

What features might help it to perform these tasks?

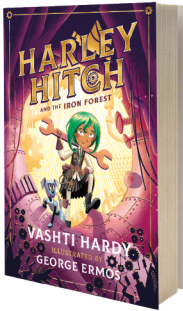
Where on your bot's body will these features be?

What will your adapted bot be called?



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# YOUR BOT-ADAPTATION



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# LESSON PLAN: YEAR SIX



## OUTCOMES

- To become familiar with the key features of a working water wheel
- To design and make a water wheel
- To describe how their water wheel will work and why it should be selected

## CURRICULUM LINKS

### Reading

- Summarising the main ideas drawn from more than one paragraph, identifying key details that support the main ideas

### Writing

- Identifying the audience for and purpose of the writing, selecting the appropriate form and using other similar writing as models for their own

### D&T

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups
- Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design
- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately
- Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

## RESOURCES

- *Resource Sheet 1: Water Wheel Design Task*
- *Resource Sheet 2: Water Wheel Design Process*
- *Resource Sheet 3: Design a New Water Wheel for Rusty River Watermill*

## TEACHER REFERENCE FOR DESIGN IDEAS:

<https://www.alternative-energy-tutorials.com/hydro-energy/waterwheel-design.html>

<https://www.clearwaycommunitysolar.com/blog/science-center-home-experiments-for-kids/how-to-make-a-water-wheel-experiment-for-students/>

## LEAD IN

Give children *Resource Sheet 1: Water Wheel Design Task* and read as far as page 32 in *Harley Hitch and the Iron Forest*, encouraging children to follow the excerpt that they have. Next, give out *Resource Sheet 2: Water Wheel Design Process* for children to look at. Ask children to discuss in pairs the order they think the design process happened in the story, based on Resource Sheet 1, and which parts were not included but should be part of the design process. Take feedback and confirm the order (Ideas, Design, Materials, Prototype, Testing, Improving).

Watch this short BBC video about water wheels and this short Dengineers clip on water wheel design. As a class, come up with some ideas for how to design and make a new water wheel for the Rusty River Watermill (see teacher reference links for ideas to guide children). What properties would the materials need to have for a water wheel (waterproof, strong, rigid)? Can children suggest some possible options?

## TASK

You will need a range of materials and tools available for this activity (e.g. plastic cups, aluminium foil, wooden sticks, strong card) for children to explore.

Replicate the task that Harley and Cosmo were set, and challenge children to design and make a water wheel using materials of their choice. Children can work in teams of two or three and use the design process that Harley and Cosmo followed using *Resource Sheet 3: Design a New Water Wheel for Rusty River Watermill* to guide them.



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# LESSON PLAN: YEAR SIX

## TASK CONT.

Encourage children to draw on their science knowledge from Year 5 to design a water wheel that uses different sized gears to turn as a result of the water wheel moving, which in turn makes something else move.

Ask children to sketch their design, annotating key features and materials they will use. They should write a description of how their design will work and why it should win the challenge!

## PLENARY

Invite the class to share their water wheel designs, imagining they are presenting their design to Prof Sparks, explaining how each feature works and why they have selected the materials they have. They could then take part in a Q&A session where children scrutinize one another's designs.

Continue reading the story to the class and discuss how the design process can be hit and miss, noting that when one thing doesn't work it is important to try different things, not just to give up.

## EXTENSION

Children create a prototype for their water wheel and test it out. Have a design-off just like in *Harley Hitch and the Iron Forest* and celebrate the models.



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# RESOURCE SHEET 1: WATER WHEEL DESIGN TASK



The class started planning their designs.

As it turned out, Harley found she was glad she was working with Cosmo after all. He didn't talk too much and seemed happy to follow her ideas. He also had some good thoughts on energy-saving mechanics and became chattier the longer the lesson went on. He was probably feeling nervous about starting at a new school and fitting in, so she felt a little bad for being so rude to him earlier.

Halfway through the lesson, the pair had finished their designs and collected the materials for their prototypes.

"Right, Cosmo, you get what we need from the box of components, and I'll get the liquid light for power."

Harley went to the store cupboard. Fenelda was already in there, gathering what she needed.

"Did I hear you say liquid light? Here, let me pass you some," Fenelda said sweetly. "I hope you didn't mind me pointing out that you were late this morning."

Harley glared flatly. The golden light bulb badge

gleamed on Fenelda's waistcoat and Harley imagined how satisfying it would be when Fenelda was forced to hand it over.

"It's just that I'm going to win Pupil of the Term again, so I have to do what I need to do. I'm sure you understand, having won it, let's see..." She paused and moved to count on her fingers, then shrugged. "Never."

Harley gritted her teeth and snatched the bottle before she could retort with something rude. "We'll see about that." She stomped back to her desk.

"Everything all right?" asked Cosmo.

"Let's get this finished," Harley said. The smug look on Fenelda's face made her even more determined that their design would be a success.

At the end of the lesson, Professor Spark gathered them round to view the class's creations. Excited fizzles bounced quietly inside of Harley as she surveyed the prototypes.

*Harley Hitch and the Iron Forest pp27-29*



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## RESOURCE SHEET 2: WATER WHEEL DESIGN PROCESS

What order did Harley and Cosmo complete their design process in?

Which things did they not do?

When should they have completed these extra task?

Ideas

Design

Materials

Prototype

Testing

Improving



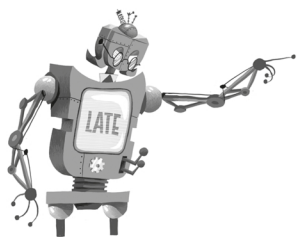
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# RESOURCE SHEET 3:

## DESIGN A NEW WATER WHEEL FOR RUSTY RIVER WATERMILL



Where will the water enter the wheel?



How will you ensure the water is caught in the wheel?



How will you use cogs/gears to ensure that you can capture the energy of the moving water wheel?



What materials will you use?

Draw your design here:



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