Spying on Starfish

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CONNECTED
SCIENCE • TECHNOLOGY • MATHEMATICS
2012 LEVEL 4

Overview

In "Spying on Starfish", students are introduced to the work of Dr Miles Lamare, who tested a new tagging technique that could be used on sea stars. Although tagging marine animals is a common practice, tagging a sea star presented Dr Lamare and his team with several challenges.

Curriculum context

TECHNOLOGY

TECHNOLOGICAL KNOWLEDGE

Technological modelling

Achievement objective(s)

L3: Students will understand that different forms of functional modelling are used to inform decision making in the development of technological possibilities and that prototypes can be used to evaluate the fitness of technological outcomes for further development.

L4: Students will understand how different forms of functional modelling are used to explore possibilities and to justify decision making and how prototyping can be used to justify refinement of technological outcomes.

Key ideas

- Technological modelling involves collecting evidence that can be used to make decisions.
- Technological modelling is an essential part of developing a new technological outcome.
- There are two types of technological modelling:
  - functional modelling: testing design ideas
  - prototyping: testing a finished outcome.

ENGLISH

READING

Ideas

Achievement objective(s)

L4: Students will show an increasing understanding of ideas within, across, and beyond texts.

Indicators

- Makes meaning of increasingly complex texts by identifying and understanding main and subsidiary ideas and the links between them.
- Makes connections by thinking about underlying ideas within and between texts from a range of contexts.
- Makes and supports inferences from texts with increasing independence.

The Literacy Learning Progressions

The literacy knowledge, skills, and attitudes that students need to draw on by the end of year 8 are described in *The Literacy Learning Progressions*.

Meeting the literacy challenges

The following strategies will support students as they engage with the information and ideas in the text. Once they understand what the article is about ("the story"), they will be able to explore the key technology ideas outlined in the following pages.

The *Connected* series includes a range of texts that provide opportunities for students to locate, evaluate, integrate, and synthesise information and ideas.

It is expected that students will read across the range of texts in this *Connected* to develop their literacy skills and their understanding of the topic.

Text characteristics

- Explanatory text in the form of an interview
- Limited scientific and technical vocabulary.

1. MAKING CONNECTIONS

Students are likely to have come across other examples of animals being fitted with tracking devices. Before the reading, prompt them to activate their prior knowledge. **ASK QUESTIONS** about animals they know of that have had tracking devices attached to them. ("Wetas with Backpacks" in *Junior Journal*, No. 13, 1995, newspaper articles about monarch butterflies and godwits being tagged, television footage of the penguin Happy Feet being fitted with a tracking device.)

Can you think of when scientists have used technology to track animals?

Why might sea animals be more difficult to track than land animals?

2. FINDING THE MAIN IDEAS

"Spying on Starfish" explains how scientists found a way to study the movements of sea stars off the coast of Fiordland.

The main ideas in the text are:

- It's difficult to track marine invertebrates.
- Scientists used functional modelling and trialled a prototype to work out how to attach electronic tags to sea stars.
- It's now possible to get detailed information about the behaviour of sea stars.

Explain that Rebecca's questions are pointers to the main ideas in the article.

This text has no headings to signpost the contents. However, Rebecca's questions indicate the information that will follow in Miles's responses.

3. SUMMARISING

Model ways that students can summarise the information in the article. They could use a graphic organiser, such as the one below.

Issue	Action taken	Outcome
Finding tags small enough to attach to sea stars.	Found tags manufactured in Iceland.	Successful – the tags were small, attachable, and durable.
Attaching tags to sea stars.	Tried using rubber band straps.	Unsuccessful – sea stars could get out of them. Doubts about durability of rubber.
	Tried piercing one arm of sea star and attaching tag with stainless steel wire.	Successful – tags stayed in place.
Would tags change sea stars' behaviour?	Observe tagged and untagged starfish.	Successful – behaviour not affected.

4. REFLECTING ON THE TEXT

PROMPT the students to clarify their understanding by asking questions.

Why would the scientists want to know how often sea stars move to and from the mussel beds?

Can you think of other information scientists might want to find out about sea stars?

Do scientists always know why they want information before they look for it?

Do you ever find information useful long after you first discovered it?

Exploring the technology

The following activities and suggestions are designed to support students to develop understandings about the importance of technological modelling when developing a technological outcome.

Key ideas

- Technological modelling involves collecting evidence that can be used to make decisions.
- Technological modelling is an essential part of developing a new technological outcome.
- There are two types of technological modelling:
  - functional modelling: testing design ideas
  - prototyping: testing a finished outcome.

We are reading this article to find out about the kinds of knowledge people need to make technological outcomes. Write down any questions you think of while reading this article.

Activity 1: *Technological modelling and attributes*

Explain what technological modelling is, that is, collecting evidence to guide decision making.

Have students brainstorm the attributes of an everyday technological outcome. For example, a backpack needs to be light, big enough for books, strong, waterproof, and comfortable.

For each attribute, discuss what technological modelling would have helped test that attribute. For example:

Technological outcome	Attribute	Technological modelling
Backpack	Light	Prototype trialled with possible users
	Strong	Fabrics tested for strength
	Big enough for books	Drawings to show size in relation to books

Identify the attributes of the microcomputer tags described in "Spying on Starfish", for example, the tags needed to be small, attachable, durable, and safe for the starfish.

Identify examples of technological modelling (for example, exploring rubber band model, stainless steel model).

What attributes did they test?

What other forms of technological modelling are the researchers likely to have done? (Drawings, circuit diagrams, prototype)

Activity 2: *Tagging technicalities*

Many other types of animals, including eels, sharks, and bees, have been tagged for research purposes.

In 2007, scientists tagged 16 kūaka (bar-tailed godwits) to track their journey from New Zealand to Alaska. Eight of the birds carried "backpack tracking devices", and a further eight had devices surgically implanted.

One of the kūaka carrying the tracking device on its back landed in Papua New Guinea then headed towards Australia instead of flying on to Alaska. Scientists think that the weight of the backpack may have affected the bird's flight pattern.

Have students read about E3 (www.kcc.org.nz/story-e3) and then watch the video about satellite tagging on www.sciencelearn.org.nz/Contexts/Flight/Sci-Media/Video/Satellite-tagging and then the video about the impact of the transmitters on the birds on www.sciencelearn.org.nz/Contexts/Flight/Sci-Media/Video/The-impact-of-transmitters

What challenges did the technologists consider when designing a way to track the kūaka? What similarities are there between tracking a godwit and a sea star? What are some major differences?

Ask students to compare the methods of tracking the birds.

Discuss whether the backpack model was a failure.

Was it possible for the technologists to know in advance how well the backpack trackers would perform? What factors could they predict? What factors were out of their control? What limitations were there on the amount of testing they could do? How should the model be adapted if the trial were to be repeated?

Activity 3: *Designing a tag*

Watch the video on www.sciencelearn.org.nz/Contexts/Life-in-the-Sea/Sci-Media/Video/Why-tag-a-starfish

Dr Miles Lamare used waterproof tags developed by an Icelandic company. The tags record temperature and depth and have been used on marine animals. They can be used internally and externally because the tag is made from "bio-compatible material" (that is, material that does not endanger the tagged animal). The casing is non-transparent so sunlight cannot affect the measurements.

Have students research other tagging methods.

What relationship is there between the materials used and the performance properties of the product? How could the products be adapted to track other animals?

Useful links include:

- www.techlink.org.nz/curriculum-support/indicators/knowledge/level3.htm
- www.techlink.org.nz/curriculum-support/Progression-Diagrams/TP.htm
- http://news.nationalgeographic.com/news/2008/11/081114-bees-radio-tracking-missions.html
- www.monarch.org.nz/monarch/projects/taggingtransects/how-and-why-to-tag-monarchs/
- http://topp.org/about_topp

Have the students design a tag for an animal of their choice. Create a bank of questions that they can consider when developing their technological outcome.

Who will use it?

How will it be used?

Will the animal be harmed or affected in any way?

What environment(s) will it be used in? How will its design relate to these environments?

What are the limitations of the device? Are there any ways to address these?

Discuss how technological modelling could help a technologist answer some of these questions.

Activity 4: *Intervention implications*

Technologists design and create technological outcomes that can have positive and negative effects on the environment, people, and other animals. For this reason, they have to think critically about what they make, how they make them, and what effect the outcomes might have.

What does thinking critically mean? Why is it important?

What were the positive and negative effects of the computer tags for the starfish?

How could you decide whether an outcome was a good idea, even before you started designing it?

What is the difference between something being "fit for purpose" and something being a good design?

Who should decide whether an outcome is fit for purpose?

Use the framework and information provided on the Science Learning Hub website to discuss ethical issues related to tagging using another famous godwit, E7. (www.sciencelearn.org.nz/Contexts/Flight/Teaching-and-Learning-Approaches/Tracking-E7)

MINISTRY OF EDUCATION RESOURCES

- www.sciencelearn.org.nz/Contexts/Life-in-the-Sea/Sci-Media/Animations-and-Interactives/Marine-ecosystem
- www.techlink.org.nz/curriculum-support/indicators/knowledge/level3.htm
- www.techlink.org.nz/curriculum-support/indicators/knowledge/level4.htm
- www.techlink.org.nz/curriculum-support/indicators/nature/level3.htm
- www.techlink.org.nz/curriculum-support/indicators/nature/level4.htm
- www.techlink.org.nz/curriculum-support/Progression-Diagrams/CoT.htm
- www.techlink.org.nz/curriculum-support/Progression-Diagrams/TM.htm

ISBN: 978 0 7903 4143 9 (ONLINE)