Please refer to the online lesson plan on the DT Hub to access all website links and additional resources.

## Learning hook

1. Talk to students about how animals have adapted over hundreds of thousands of years in order to survive in their environment. Polar bears have fur to help them stay warm in the arctic. Gekkos have suction pads on their feet to allow them to climb walls. And a green tree frog is camouflaged in its environment.

Many animals have also adapted defence mechanisms to help them survive against predators in their environment. A defence mechanism is a reaction an animal has to its environment, specifically predators, which helps it survive.

1. Explain that students will be watching and discussing the short video: ‘*World's weirdest: poisonous pufferfish vs. eel*’
   * 'In order to ensure we remember the facts we learn in the video, we will take notes. When notetaking, we only want to write down the key facts. Decide what is most important and write down only the keywords rather than sentences which will take too long. Or you can use some abbreviations to remind you about what you learnt.' Watch the video. Ask the students, 'What features do the puffer fish and eel have to help them survive?'
2. Lead a discussion about the key facts students have noted about the video.
3. In groups of approximately 5, ask students to list other animal defence mechanisms they know, organising their ideas so they can share them with other groups. After 15 minutes discussion and writing time, work with students to collate a list of the different animals and their types of defence mechanisms.
4. Lead a discussion about defence mechanisms in animals using the list of animals the students have shared. Ask students the following questions:
   * What conditions might result in a defence mechanism?
   * What advantage does the defence give the animal?
   * How is the defence mechanism connected to the animal's environment?

## Learning map and outcomes

1. Explain that students will be researching different animals and their defence systems and using littleBits electronic kits to build their own creature with its own defence mechanism.
2. By the end of the learning sequence students will be able to:
   * explain the features of defence mechanisms of different animals
   * explain how the defence adaptation helps animals to survive
   * draw a detailed prototype for a model of an animal
   * construct a model of an animal using littleBits and other materials
   * create and test a circuit containing a power source, input and output
   * explain how data flows through the digital system.
   * self-assess their learning based on given criteria.

## Learning input

1. Explain that students will research different types of animals and their adaptations, sharing their learning in a scientific diagram.
2. Model the drawing of a scientific diagram, explaining the following features.
   * The reason for using a scientific diagram is to identify the features of the animal.
   * Accurate features including colour and measurements should be used.
   * Diagrams should be labelled and explain what the person is seeing.
   * Information in the descriptions is factual.
3. Model for students how they might research different animals. List keywords to support them, such as 'defence', 'adaptation' and 'mechanism'. Encourage them to start with an animal they already know.'
4. Use an Internet search to show how the keywords above can be used to find information. Students may need support to identify relevant pages depending on prior knowledge.
5. Please refer to the online lesson plan on the DT Hub to access example sites.

Do the same with a print text, using the index page and scanning the text to find a relevant page.

1. Provide time for students to draw a labelled diagram of their animal. Discuss the importance of different defence mechanisms.
2. To reflect on research conducted, have a whole-group discussion.
   * List the different types of defence mechanisms the students found on different cards.
   * Order the cards into categories such as mimicry (sounds or looks like another animal), light (bioluminescence), coloration, pretending to be dead, trickery (pursuit deterrent) or physical or chemical combat.
3. Explain that adaptations that are beneficial to prey, such as chemical and physical defences, ensure that the species will survive.

Students research different animals using:

* an Internet keyword search
* a print text search, using index and scanning.

Examples of suitable animals are: frill-necked lizard, praying mantis, snake, caterpillar, zebra, anglerfish, dart frog, sleeper fish.

Students select one animal for their diagram.

They create a diagram of their chosen animal using labels to describe the features of the defence mechanism. For example: Frill-necked lizard – camouflage, frill, neck, scales.

Students may choose to label more than just defence mechanisms.

Students group the different defence mechanisms into categories such as mimicry (sounds or looks like another animal), light (bioluminescence), coloration, pretending to be dead, trickery or physical or chemical combat.

## Learning construction

1. Explain to students that they are required to make a creature and show how it responds to its environment (eg movement, light, temperature, touch) by using a defence mechanism (movement, light, coloration, trickery). They will be using littleBits to make the animal prototype.
2. Say: ‘You are now going to design your own creature and build it using our LittleBits. You need to make sure you have at least one defence adaptation on your creature. What kinds of ways could your creature adapt to its environment?’  
     
   Tell students that they need to use at least one sensor as this will act as the environment in the animal’s adaptation.   
     
   The complexity of the sensors used will depend on the number of littleBits you have access to. The Deluxe kit comes with button sensors and sound sensors. Other sensors can be purchased separately (eg light, motion, pressure, temperature and bend sensors).
3. Explain that littleBits are electronic building blocks. Each block has a specific function such as sound, sensors or motion. The blocks snap together using magnets to make simple and complex circuits. The pieces are colour-coded dependent on their function (eg input, output). A circuit is an electrical device that provides a path for electrical current to flow.
4. Provide time for students to actively explore littleBits, discussing questions students have
   * Ask them what they notice about how they fit together
   * What are they observing and learning about the bits?
   * How does the order change the circuit?
5. On a board, write the words ‘input’, ‘output’, ‘wire’, ‘power’ and their associated littleBits colours. Ask the students: ‘What do these words mean? How can we describe their function?’  
     
   * Input - controls the circuit using information or data being transferred to the circuit
   * Output – the actions that result following an input
   * Power – allows the circuit to function
   * Wire – allows the circuit to be lengthened

Allow students plenty of time to become familiar with what the littleBits can do.

1. Explain to students that ‘data’ is the information or message that is sent through the blocks of the circuit.
   * Tell them: ‘When we put the blocks in a line of connecting bits, they pass on data from one bit to the next. For example, the battery sends the power to the button. When the button is pressed it allows the data to be sent to the buzzer, which makes a noise.’
2. Encourage students to explain what is happening at each step of the circuit. For example: ‘The power runs to the slider which tells the buzzer to be soft or loud.’
3. Encourage students to ask questions and offer explanations about what they are doing and how the system works.
4. When you are confident students have an understanding of how the littleBits work and can confidently explain how the system works, they can begin to design and label their chosen animal.
5. Here are some example littleBits projects for inspiration:

* Anglerfish
* Animal projects
* Bioluminescence
* Rude animal

## Learning demo and reflection

1. Students complete a self-reflection. Explain to students that by self-reflecting and assessing ourselves, it helps us make decisions about our learning that will help us improve next time.
2. Ask students to think back about the journey they took with their designs.
   * ‘Think about how you have improved over the learning sequence. What did you know about input and output before you started, compared with your understanding now? What do you think helped you to learn?’
3. Explain to students how to complete the self-assessment.
   * ‘The self-assessment is for you so it is important to be honest with yourself. It asks questions about your learning about animals and also about the digital system, litteBits, which we used.’
4. Create an opportunity for students to share their learning and demonstrate how their animal works by holding an animal adaptation expo. Use tables spread around the room to display animals.
   * Invite other classes to visit and learn.
   * Or split the class in half and have half visiting each animal table while the other half explains their learning.

Note: Teachers can use an adapted self-assessment checklist throughout the learning sequence to ask questions and identify any learning opportunities. You could also have a conference with each student to compare their self-assessment with your own assessment of their learning.

## Curriculum links

| Links with Digital Technologies Curriculum Area | |
| --- | --- |
| **Strand** | **Content Description** |
| **Knowledge and Understanding** | Examine how digital systems form networks to transmit data (AC9TDI6K02)  Investigate the main internal components of common digital systems and their function (AC9TDI6K01) |

| Links with other Learning Areas | |
| --- | --- |
| **Learning Area** | **Strand and Content Description** |
| **Science** | Science Understanding  Examine how particular structural features and behaviours of living things enable their survival in specific habitats (AC9S5U01) |

## Self-assessment

This self-assessment checklist can be modified for assessment by teachers.

|  |  |  |  |
| --- | --- | --- | --- |
|  | I need help | I am able to | I can teach others |
| I can explain how different animals use defence adaptations. |  |  |  |
| I can give examples of different types of defences in animals. |  |  |  |
| I can explain how the environment can create a reaction from an animal. |  |  |  |
| I can explain how an adaptation helps an animal to survive. |  |  |  |
| I can explain all of the components in the circuit. |  |  |  |
| I can find the input and outputs in my circuit. |  |  |  |
| I can explain the flow of data being transmitted in my circuit. |  |  |  |
| My circuit uses an input for the environment. |  |  |  |
| My circuit has an output for the defence. |  |  |  |
| My circuit has more than one input or output. |  |  |  |
| I can explain how my circuit works, using the animal as an example. |  |  |  |
| My reflection: | | | | |