Kai's Clan Lesson Plan – Protect the bees.

Suitable Years 4 to 6. This lesson has been adapted from Kai's Clan Projects.

Image from [Bees and the SDGs.](#)

Background to mission:

Bee populations are diminishing across the globe and the reduction in pollination threatens our food security and biodiversity. The parasitic Varroa mite has arrived in Australia threatening the lives of native and farmed bees. These mites live and is inside bee colonies and feed off honeybee larvae and adult honeybees. Bees

Bees provide a range of services to our ecosystem, most notably the pollination of food crops. Potentially they can contribute towards 15 of the United Nation's Sustainable Development Goals (SDGs) playing an essential role in biodiversity conservation.

SDG 2: Zero Hunger

End hunger, achieve food security and improved nutrition and promote sustainable agriculture. Bee pollination increases crop yield and enhances the nutritional value of fruits, vegetables, and seeds.
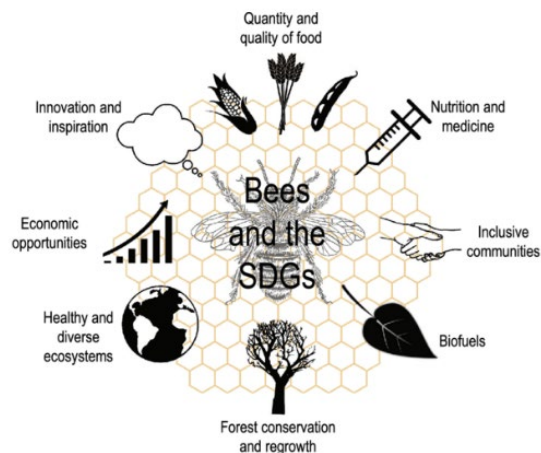
Australian curriculum

Digital Technologies (in this lesson plan)
- (AC9TDI4P01) define problems with given design criteria and by co-creating user stories
- (AC9TDI6P01) define problems with given or co-developed design criteria and by creating user stories
- (AC9TDI4P04) implement simple algorithms as visual programs involving control structures and input
- (AC9TDI6P05) implement algorithms as visual programs involving control structures, variables and input

HASS (extension of concept)

- (AC9HS4S05) draw conclusions based on analysis of information
- (AC9HS5S05) develop evidence-based conclusions
- (AC9HS6S05) develop evidence-based conclusions

Science (extension of concept)
- (AC9S5U01) examine how particular structural features and behaviours of living things enable their survival in specific habitats
- (AC9S6U01) investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions

Sustainability - Futures

Sustainable futures require individuals to seek information, identify solutions, reflect on and evaluate past actions, and collaborate with and influence others as they work towards a desired change.

Learning intention:

- Explore how bees pollinate flowers and collect nectar to make honey.
- Identify how bees dance to share messages.
- Investigate how bees communicate through chemical signals.
- Move a robot through programming pathways.

Introduction:

Students begin to research information on bees. Bees are team players and need to work together for the survival of the colony. They need to find pollen and nectar from the best food sources. Find out more about how bees work as a community.

- How bees collect nectar to make honey
- How bees communicate
- Ask a biologist

Activity 1: Buzz About

Bees are busy creatures buzzing about fields all day. Your robot is a bee and needs to fly to a flower to collect nectar and return to the hive. Place your robot at the hive and program it to fly out to a flower using the forward block.
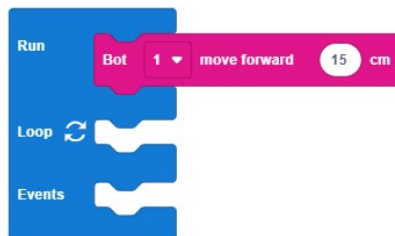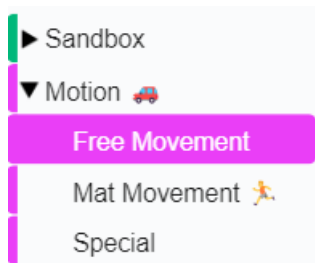

Move to the flower:

In *Motion tab* area, select the *Free Movement* section and drag the *move forward* block to the *Run* section.

Select your robot (Bot 1) and type a number for the distance in cm's to the flower.
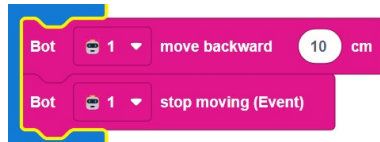

Turn:

Using the turn left or right blocks, point the robot bee to the flower and type in how many degrees to turn. Add an additional move forward block so the robot can reach the flower.
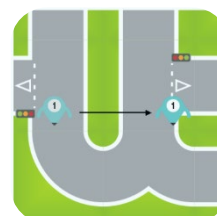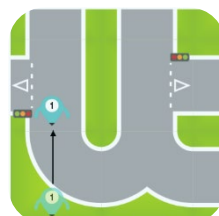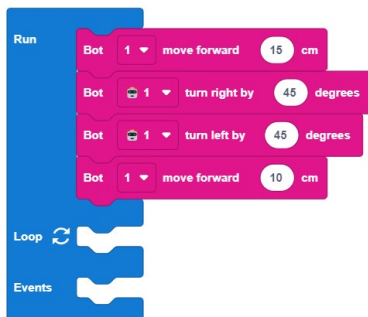
Return to the hive:

Using the previous steps, add additional blocks such as move backwards and turn for the robot bee to return to the hive.

How much nectar can you   collect? Visit trees and bushes as well as flowers.

Activity 2: Dancing Bees

It is important for bees to tell each other where food is, and they communicate this to each other through dance. This could be a round dance or a waggle dance across the honeycomb. The scout bee does this to tell other bees where to find nectar. It is a round dance if the food is within 100 metres of the hive. The bee's wings vibrate as it moves in a large circle and then turns and moves in the opposite direction.
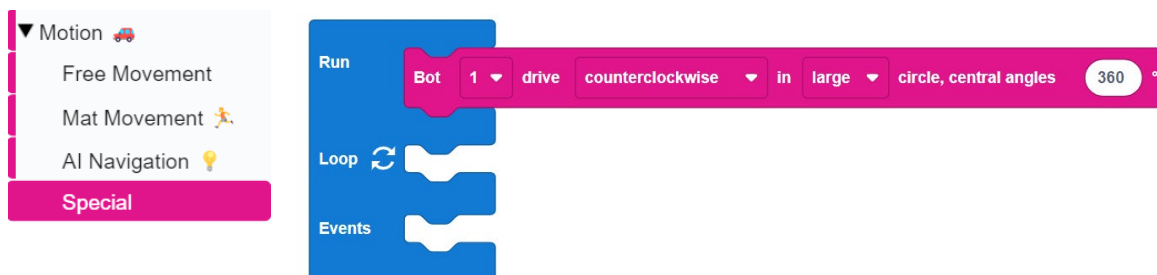
Round Dance
- How can you make your robot go around in a circle?
- What does the round dance look like?
- How can you make the circles a different size?

Watch these film clips to find out more about bees communicating through dance.
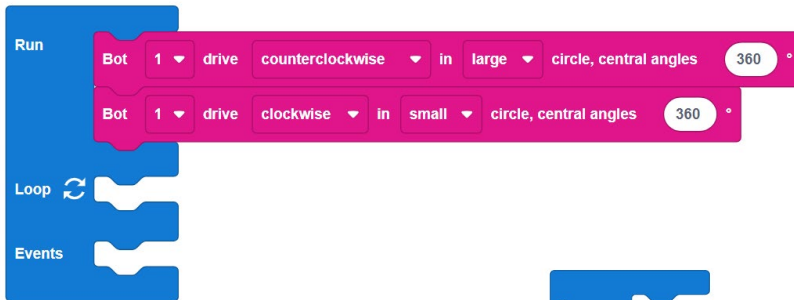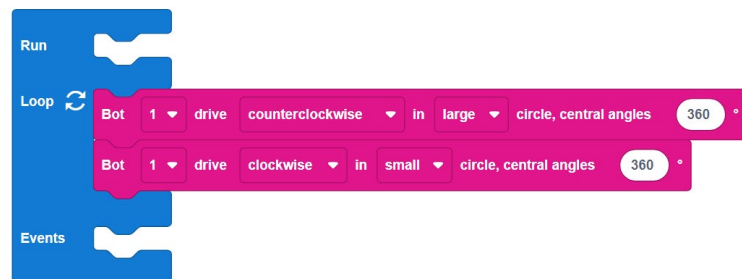
- [Round dance](#)
- [Bee dance language](#)
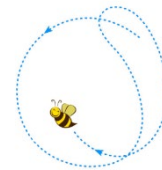
Now it's your turn to make the robot bee dance using some new blocks. You may need to break this problem into steps – like two circles. This could be done using the turn blocks from the previous lesson. Today we will learn about a new block found inside the *Special* section in the *Motion* tab that will drive the robot in circles clockwise and counterclockwise. How many degrees do you need to make a circle? It will also contain a variable to change the size of each circle to small, medium, or large. Test you code by clicking on *Run* to see what happens.

The next step is to do a second smaller circle in the opposite direction to complete the dance. Click Run to see what happens this time.

Your robot bee has only moved once in each direction. What do you need to do to make it *repeat* the round dance?


Activity 3: Waggle Dance

The other communication dance bees perform in the hive is known as the waggle dance. Bees perform similar movements to the round dance doing a figure 8 but also waggling the abdomen. The body angle and time length of the dance tells the other bees the direction and distance to find food that is more than 100 metres from the hive. The more shaking or waggling the further away the food source is.

Watch this film clip to find out more about bees communicating through the waggle dance.

- [The waggle dance](#)

The waggle dance looks like a figure 8 with a straight line through the centre. The bee waggles back and forth in a straight line and then circles to repeat the dance. The length of the middle line is called the waggle run. The longer the waggle run the further away the food source. The angle of the dance also shows the direction to fly from the hive in relation to the sun.
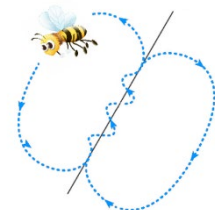
How will you move the robot bee to perform a waggle dance?

Start by breaking the problem into small steps and think about how you programmed the round dance. This might be two large circles in the opposite direction. Remember the circles are next to each other and not over the top. Then how will you create the waggle run through the centre? How long will it be? Using the same blocks as the round dance to create a circle. Decide if you want a small, medium, or large circle. Remember how many degrees to add so there is a straight line up the middle. Do you need a full circle? Try different angles to see what works best.
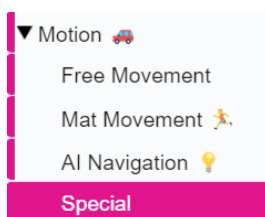
How will you create the straight line and the waggle? Try these blocks and experiment with how far forward to move and what the left and right angles might be.

Activity 4: Smell, Smell, Smell

Another way bees communicate is through body chemical signals. These are called pheromones which are released during different types of activities such as egg-marking, foraging, and sending alarm signals. When a bee stings an animal or human it sends out alarm pheromones which attract bees to the location, and they all respond to the danger defensively. Did you know that the alarm pheromone smells like bananas!

Watch these film clips to find out more about bees communicating using pheromones.
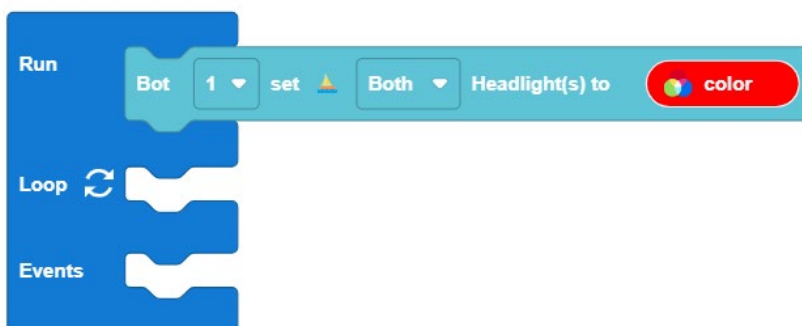- What is the alarm pheromone?
- How honeybees communicate
- Bees wasps and danger pheromones

Alarm Pheromone

In this lesson we will use the robot's red LED to show the alarm pheromone has been released.

In _____ Bits tab area, select the *Sight* section and drag the *headlights* block to Run. Set the colour to red to change the LED colour of both headlights.


Homing Pheromone

Worker bees release a hormone from the Nasonov gland to help the forager bees find their way back to the beehive. The worker bees use fanning with their wings to spread the smell around.

Watch What is the nasonov gland? To find out more.

In this lesson we will add another headlight block and his time use a different colour to signal a new pheromone has been released. Maybe use green to signal home. This activity could be combined with Activity 1 Buzz about to the pheromone is released after the bees have finished tasks such as collecting nectar.
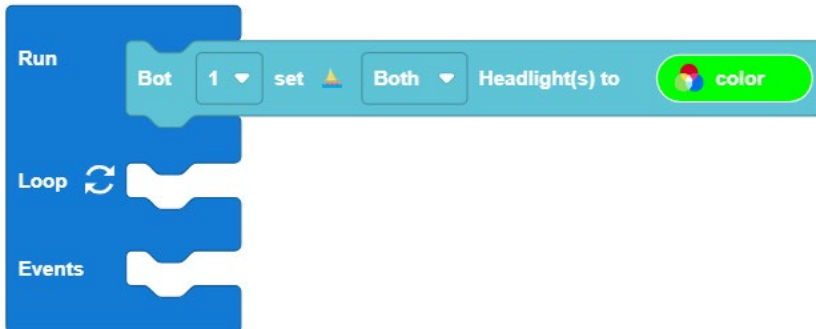
Assessment

Assessment will depend on your classroom needs and goals. We have some tips and resources to support assessment below.

Observation can be used to check students' ability to carry out tasks aligned to the Australian Curriculum.

Allow students time to practice with the robot so that they feel comfortable using the functionality and in navigating around a mat. A checklist can help support observations.

Teachers observe students using the Kai's Clan robots, creating their algorithms and debugging.

Use questioning to elicit student understanding of the functions of the robot and their algorithmic thinking.

For more assessment resources we recommend the Digital Technologies Hub:
https://www.digitaltechnologieshub.edu.au/teach-and-assess/

For more information

Please visit our webpage https://csermoocs.adelaide.edu.au/lending-library
Email cser@adelaide.edu.au