TEACHING WITH TECHNOLOGY: EXPLORING THE USE OF ROBOTICS TO TEACH MATHEMATICS

Robots, once the providence of science fiction are now part of the classroom. **CATHERINE ATTARD** explains how to evaluate their use.

In this edition of Teaching with Technology, I would like to explore the value of using simple robotics such as BeeBots and ProBots to enhance the teaching and learning of mathematics in the primary classroom. Before making the decision to use such technologies, it is important that they be evaluated in terms of their affordances and constraints. In other words, teachers need to understand how each individual technology could enhance the learning and teaching of specific mathematics content, and, just as importantly, when the use of a specific technology could hinder, limit or distract the learning and teaching of particular mathematics content.

Generally, robotics such as the Bee Bot (Figure 1, over) or the ProBot (Figure 2, over) are used to address outcomes linked to the Science and Technology learning area. However, they can be used as a tool to enhance student engagement with mathematics while at the same time addressing content and processes from within the mathematics curriculum.

The main feature of the BeeBot is that it allows students to program up to 40 steps by using forward, backward, left and right turn arrows. Each forward or backwards movement is 20 cm in length. A variety of commercially produced grids are available for the BeeBot and teachers and students can also make their own, providing great flexibility in terms of how the BeeBot is used. The BeeBot is suitable for students in Foundation through to Year 3 and beyond.

The ProBot is similar to the BeeBot but has the added affordance of allowing students to program the degree of turn and the length of travel forward and backwards. The ProBot has a pen mechanism that allows the opportunity for students to record their programming. This affordance makes the ProBot an excellent tool for mathematical problem solving and investigation, and provides work samples that can be used for assessment purposes.

The following is a table listing the affordances and constraints of BeeBots and Probots. The third column, Curriculum Links, provides some links to the Australian Curriculum content descriptions that could be addressed through the identified affordances. These links are by no means exhaustive. Other content descriptions could also be addressed, depending on the design of the mathematics lesson and the creativity of the individual teacher. It is also important to bear in mind the potential to address the proficiencies through the use of robotics.

	Affordances	Constraints	Curriculum links
BeeBots  Figure 1	Provide opportunity to: • practise language of position • follow and give a set of instructions • engage in the problem-solving process • integrate with other content areas of mathematics through the use of a variety of grids/mats • use informal or formal units of measurement to move the BeeBot from one location to another.	• Can distract young students from the focus of the lesson if that focus is not on position and movement (for example, if the lesson focus was computation). • Can potentially shift the focus of the lesson to the technology itself, rather than the mathematics being taught. • It is more challenging for the teacher to gather evidence of student learning, although this can be achieved through other technologies such as photographs and video recording.	**Location and transformation:** *Foundation:* Describe position and movement (ACMMG010). *Year 1:* Give and follow directions to familiar locations (ACMMG023). *Year 2:* Interpret simple maps of familiar locations and identify the relative positions of key features (ACMMG044). *Year 3:* Create and interpret simple grid maps to show positions and pathways (ACMMG065). **Using units of measurement:** *Year 1:* Measure and compare the lengths and capacities of pairs of objects using uniform informal units (ACMMG019). *Year 3:* Measure, order and compare objects using familiar metric units of length, mass and capacity (ACMMG061).
ProBots  Figure 2	Provide opportunity to: • practise skills relating to location • use knowledge and skills relating to angles to create geometric constructions • follow and give a set of instructions • investigate length using formal units of measurement • gather student work samples.	• Can distract young students from the focus of the lesson if that focus is not on position and movement (for example, if the lesson focus was on computation). • Can potentially shift the focus of the lesson to the technology itself rather than the mathematics being taught. • Does not lend itself easily to integration with other strands of the mathematics curriculum.	**Geometric reasoning** *Year 3:* Identify angles as measures o turn and compare angle sizes in everyday situations (ACMMG064). *Year 4:* Compare angles and classify them as equal to, greater than or less than a right angle (ACMMG089). *Year 5:* Estimate, measure and compare angles using degrees. Construct angles using a protractor (ACMMG112). **Shape** *Year 4*: Compare the areas of regular and irregular shapes by informal means (ACMMG087). Compare and describe two dimensional shapes that result from combining and splitting common shapes, with and without the use of digital technologies (ACMMG091). **Using units of measurement** *Year 5:* Choose appropriate units of measurement for length, area, volume, capacity and mass (AMMG108). *Year 6:* Convert between common metric units of length, mass and capacity (ACMMG136).