INTRODUCTION

Reasoning with 3D Objects

Y3

Summary of learning goals

- This sequence explores symmetry and the composition of three-dimensional (3D) objects. This will require students to interpret and represent 3D objects in two dimensions.
- Students will apply their knowledge of transformations to show congruency or difference between objects. Applying transformations of these objects develops students' mental rotation skills.
- Students' abilities to work systematically are developed as they find all possible solutions in each task.

Australian Curriculum: Mathematics (Year 3)

ACMMG063: Make models of three-dimensional objects and describe key features.

ACMMG066: Identify symmetry in the environment.

Summary of lessons

Who is this sequence for?

- This sequence is for Year 3 students who have had prior experiences with identifying and creating symmetry in objects. They will need an understanding of transformations, particularly flips (reflections) and turns (rotations), and how these can be used to show congruency.
- Prior experience with 2D representations of 3D objects will also assist students with tasks.

Lesson 1: Building Symmetry

Students are presented with a non-symmetrical 3D model made of five interlocking cubes. They are asked to make the model symmetrical by changing the position of one block or by adding an extra block to the model. Students are asked to find all possible solutions to the challenge. As the students explore the different possibilities, the language of symmetry and transformations is explored.

Lesson 2: Four Cubes

This resource consists of two sections. The first section asks students to build objects using four cubes and following simple rules. After some exploration, they are encouraged to work systematically to find different solutions. Using transformations, the students reason and justify that all the constructions they have made are different and that they have found all possible solutions. In the second section, students then draw the 2D representations of these 3D objects.

reSolve: Mathematics by Inquiry is funded by the Australian Government and is managed by the Australian Academy of Science.

Reflection on this sequence

Rationale

Students' spatial reasoning skills are a significant indicator of their future performance in mathematics. These skills can be developed through practise and application. This sequence builds students' skills in key aspects of spatial reasoning, with particular focus on students' visualisation skills and their ability to mentally rotate an object, use transformations and identify symmetry.

It is common for symmetry and transformations to be explored with 2D objects in primary mathematics, whereas this sequence is built around 3D objects. Students' visualisation skills are built as they work with concrete models in different contexts and then construct 2D representations of 3D objects. Throughout the sequence they are also required to mentally rotate objects to assist in solving problems.

reSolve mathematics is purposeful

- Both tasks in this sequence invite students to construct and manipulate 3D objects made with interlocking cubes. The tasks' activities focus on building correct language use and students' abilities in the mathematical proficiencies of problem-solving and reasoning.
- The tasks are structured so that students move from hands-on exploration with the objects constructed, through to visualising the results of movements and rotations prior to physically manipulating the objects.

reSolve tasks are inclusive and challenging

- Both tasks in this sequence have a low floor and high ceiling, providing access and challenge for a wide range of abilities.
- The low floor of the task is demonstrated as students use trial and error with the concrete materials to find different solutions to the problems presented.
- The high ceiling of the task is demonstrated as students use spatial visualisation to find possible solutions without actually interacting with or manipulating the concrete materials.

reSolve classrooms have a knowledge-building culture

- There is a strong focus on building understanding through collaborative investigations. In the first task, students work as a class to find different ways that symmetry can be created by moving or adding blocks to a 3D object.
- The second task encourages the teacher to set up a class display of different possibilities for the way four cubes are joined together. Using this display, the class must reach consensus that they have found all possibilities and that each construction displayed is unique.