SEL P Case Study Executive Summary: LEGO Robotics; do they increase engagement and understanding in year eight mathematics?

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Purpose:
To increase engagement of students in year eight mathematics through the use of robotics.

Student Cohort/Audience:
There are 24 students in this cohort, 11 girls and 13 boys. Within this group there are 4 students who have NEPs and 3 students who have been identified as EALD.

Activity Description:
Students will work collaboratively with Lego robotics kits to design ‘drawing’ robots, which they can program to draw various quadrilaterals. Students will be introduced to the properties of quadrilaterals and angle properties before they start the design process. As a group, they will investigate the properties of the quadrilaterals and design and program a robot. They will evaluate the effectiveness of their robot and propose and implement any changes required to draw more accurate quadrilaterals. Students will complete a pre- and post-topic survey to measure their attitude and engagement in the topic. Students will also complete a pre- and post-test to measure their growth in understanding in the topic.

Links to ACARA or Other Identified Learning Outcome:
ACARA Mathematics Year 8: Geometric reasoning
Establish properties of quadrilaterals using congruent triangles and angle properties, and solve related numerical problems using reasoning (ACMMG202)
Find perimeters and areas of parallelograms, trapeziums, rhombuses and kites (ACMMG196)

ACARA Digital Technologies Year 8: Processes and Production Skills
Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors (ACTDIP029)

General Capabilities
ICT Capability: Level 5 - Generate ideas, plans and processes
Use appropriate ICT to collaboratively generate ideas and develop plans

Critical and Creative Thinking: Level 5 - Identify and clarify information and ideas
Clarify information and ideas from texts or images when exploring challenging issues

Imagining possibilities and connect ideas
Draw parallels between known and new ideas to create new ways of achieving goals

Seek solutions and put ideas into action
predict possibilities, and identify and test consequences when seeking solutions and putting ideas into action

Graduate Qualities and Capabilities
Using Technology
Initiative and Enterprise

What were the Outcomes?
Collaborative work:
Working within groups allowed students to work and learn collaboratively. They had the opportunity to learn how to work within small groups, between small groups and individually. Group dynamics and individual roles were defined by the class and were often reviewed throughout the unit. A result of this explicit group work teaching, at the end of the unit, 67% of students agreed or strongly agreed with the statement ‘we learn how to work with each other as a team and how to work independently’.

Contextualising learning:
Students were introduced to a range of concepts across the unit, but each related back to how what they are learning would impact on their robot design or programming. The aim of this was to improve student understanding of why we need to learn this. In the post-unit survey only 17% of students disagreed with the statement ‘the teacher helps me see the significance of what we are learning’.

Student Engagement:
The primary purpose of the case study was to improve student engagement in year 8 mathematics. The unit was a mixture of theory lessons and practical, hands on lessons using the LEGO robotics kits. At the end of each lesson, students completed an ‘exit survey’ where they placed a red, yellow or green face on their names describing whether they understood the content and enjoyed the lesson. Periodically, students also completed a short survey where they explained why they chose their colour and how the lesson could have been improved. In the post-unit survey only 22% of students disagreed with the statement ‘what we were learning was very interesting’.

Student Achievement:
To measure individual growth over the unit, each student completed a pre- and post-content test. The two tests were identical and consisted of a variety of questions related to quadrilaterals. The post-test results showed an average test result increase of
18%, with 22% more students achieving a passing grade or higher. More importantly, only 17% of students disagreed with the statement ‘I felt proud of what I achieved’.

**Identified Issues?**

**Time management**

This unit was designed to be conducted over a 4 week period. This was not the case, as the unit was partially taught by a student teacher and the lead teacher was away for professional development for a few days. This meant the unit became disjointed as the practical lessons could not be conducted when the lead teacher was away. This was rectified by adjusting the assessment piece to include a drawing of one quadrilateral rather than two.