



## Learning Mathematics Through Sequences of Connected, Cumulative, and Challenging Tasks: A Self-Determination Theory Perspective

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Substantial evidence suggests that using problem-solving approaches as part of mathematics instruction can have positive influences on improving student outcomes. However, to date, streamlined and rigorous processes to accurately evaluate and interpret student progress through problem-solving in mathematics are limited, particularly within early years contexts.

This PhD study investigated the experiences of Year 2 students (7-to-8 years old) as they learned mathematics through sequences of challenging tasks. Conducted over a nine-month period, this research used a parallel mixed-methods design to investigate changes in students' mathematical competence and attitudes towards challenging tasks. Data comprising written assessments, lesson observations, work samples, and interview responses were triangulated to determine the holistic effect that learning through sequences of challenging tasks had on students' learning experiences in mathematics.

The findings reported all students demonstrated an improvement in mathematical competence and attitudes towards challenge as a result of their learning experiences. There was substantial evidence that at all levels of analysis, students developed basic mathematical knowledge and facts whilst simultaneously demonstrating productive problem-solving skills. The findings from the qualitative analysis showed that in addition to this improvement in mathematical knowledge and skills, many dispositional behaviours were exhibited throughout lessons that offered critical insights into students' problem-solving proficiency. Specifically, the analysis of focus student interview data showed students gained a sense of satisfaction in being able to engage in the mathematics autonomously; learn from their mistakes; and overcome challenge as their mathematical understanding developed. Moreover, specific and unique turning points in students' learning trajectories were identified, reinforcing the notion that mathematical improvement is contingent on far more than a mastery of content knowledge.

Overall, the findings from this PhD investigation suggest that there are multiple benefits for early years students to learn mathematics through problem-solving approaches. The study has implications for policy and practice in both the ways problem-solving approaches are implemented and how student learning is evaluated across the early years of schooling.

[For more information, please refer to the following paper presented at the 46<sup>th</sup> Annual Conference of MERGA in July 2024.](#)  
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