Enhancing Problem-Solving Skills Among Low-Progress Students in Singapore: Leveraging Variation Theory in Mathematics Education

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Problem-solving serves as a central focus of Singapore's Mathematics curriculum, and one common mathematics instructional practice is the use of worked examples. This practice not only promotes mastery of learning, but also reduces unproductivity and cognitive overload in learning (Kaur et.al, 2021). To further enhance problem-solving competency, an alternative strategy is to teach mathematics through problem-solving, which involves presenting problems for students to solve before introducing related mathematical concepts (Takahashi, 2021). However, tension arises between students' inclination toward instrumental understanding and teachers' aim to cultivate relational understanding of mathematics. This tension complicates the cultivation of problem-solving skills, particularly for low-progress students who may face obstacles due to mathematics self-efficacy issues (Leong, 2023). Another challenge lies in the designing of problem-solving tasks such that it effectively emphasises the critical aspects students need to grasp while solving problems. Variation theory provides a way for teachers to think about how these critical aspects can be incorporated into problem-solving tasks. By discussing these crucial aspects during problem-solving sessions, teachers can help students build a bridge between their instrumental understanding and relational understanding of mathematics.

A baseline study, conducted at a local secondary school, analysed the dynamics of teaching mathematics through problem-solving for low-progress students. Data collected included video and voice recordings of a lesson, teacher post-lesson interviews, and lesson materials. I will explore the challenges and the complexities involved when teachers try to teach mathematics through problem-solving for low-progress students. Greater attention will be given to dissecting the task design and classroom dynamics between students and teachers in upcoming discussions. These insights will inform recommendations to improve future mathematics lessons, particularly when teaching through problem-solving for low-progress students. Following this, participants will be encouraged to offer their perspectives to further refine such lessons to maximise learning outcomes for low-progress students. These discoveries will aid in crafting an inventive pedagogical framework designed to enhance problem-solving skills among low-progress students among low-progress students in forthcoming research endeavours.

References

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