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Enhancing Metacognitive Awareness and Confidence in Mathematical Problem-solving: a Study of the S.t.a.r.s Metacognitive Framework

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Abstract

This study explores the influence of the S.T.A.R.S Metacognitive Framework on students' metacognitive awareness, regulation, and confidence during mathematical problem-solving. The framework, anchored in Zimmerman's cyclical model of self-regulated learning and Pintrich's phases of metacognition, consists of five stages: Stop, Think, Act, Reflect, and Share. A student perception survey was administered to two secondary-level mathematics classes. Both Classes A and B implemented the framework through teacher scaffolding and a customised chatbot was designed to support students learning. Data was analysed descriptively across five frequency categories (Always, Often, Sometimes, Rarely, Never). Findings revealed strong engagement with the Stop, Think, Act, and Reflect phases, demonstrating enhanced planning, monitoring, and error correction. The Share step, linked to peer reflection, showed weaker uptake, highlighting the need for further scaffolding. Confidence gains were evident in both groups, with Class B reporting stronger "Always" and "Often" responses, suggesting that technology-enhanced scaffolds amplify students' confidence in problem-solving. Implications for pedagogy, teacher professional development, and integration of digital tools are discussed.

Keywords: Mathematics, Metacognition, Self-Regulation