Exploring ChatGPT as a Scaffolding Tool for Posing Mathematical Problems: Insights from Primary Pre-service Teachers

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Abstract

The study reported in this article investigated ChatGPT's role as a digital scaffolding tool for pre-service primary teachers engaged in mathematical problem posing focused on word problems, an area underexplored in research on generative AI in pre-service teacher education. Grounded in the Zone of Proximal Teacher Development (ZPTD) framework, the research examined how AI-mediated interactions support cognitive, metacognitive, and pedagogical dimensions of instructional design. Twenty-two pre-service mathematics teachers participated in a three-phase qualitative exploratory case study involving independent problem posing (Task A), AI assisted problem posing with ChatGPT (Task B), and subsequent written reflections and semi-structured interviews. Thematic analysis of task outputs, interaction logs, and reflective data revealed that ChatGPT provided multidimensional scaffolding (cognitive, metacognitive, strategic, affective, and pedagogical), which collectively enhanced participants' task quality and depth of reflection. AI-assisted tasks showed notable improvements in contextual relevance, problem structure, cognitive demand, and creativity compared to mathematical problems posed independently. Participants reported substantial shifts in instructional awareness, moving from procedural task design toward student-centred and imaginative problem construction. These findings suggest ChatGPT has potential as a reflective learning partner, supporting development of pedagogical reasoning and instructional creativity in teacher education. The study extends the ZPTD framework to AI-mediated contexts, offering theoretical and practical insights for integrating generative AI into professional learning for pre-service teachers.