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The Role of Pictures and Reasoning in Preservice Teacher's Arithmetic Word Problem-Solving

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Abstract

This study investigates how preservice teachers use pictures in their written solutions to arithmetic word problems and how these visualisations reflect their reasoning processes. A total of 144 written solutions from 36 preservice teachers were analysed. The findings reveal notable differences in the types of pictures used and the reasoning processes employed by the preservice teachers, depending on whether the problems involved fractions. In fraction-related problems, preservice teachers predominantly used representational, informational, and organisational pictures, which is lacking in non-fraction problems. Reasoning processes such as selecting and exploring were common across both problem types. However, attributes such as reconfiguring, encoding, and abstracting appeared more frequently in solutions to nonfraction problems. This result suggests that, although preservice teachers more often employ visual tools when solving fraction tasks, they do not fully exploit these tools to support deeper conceptual understanding or the problem-solving process. The study highlights the need to develop preservice teachers' competencies in using visualisations to effectively represent the problem-solving process by reasoning about the mathematical concepts involved in problems. These findings provide concrete suggestions aimed at strengthening preservice teachers' skills in using visualisations and reasoning, which equip them to better support students' mathematical reasoning in their future classrooms. The study also contributes to a deeper understanding of how visual tools and reasoning interact in mathematics education, thereby addressing existing gaps in the research.

Keywords: drawings; mathematical concepts; mathematics education; teacher education; reasoning attributes