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Why Do Students Struggle with Percentage Problems? Examining Challenges in Answer and Task Formats

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Abstract

Although students' difficulties with percentages are well-known and crucial for daily life, their underlying causes remain unclear. The present study aimed to address this gap by systematically analyzing basic characteristics of percentage problems—with a focus on answer (e.g., open-ended vs. multiple-choice) and problem (e.g., mere calculation vs. word problems) formats. We first evaluated potential biases in the frequency distributions of specific answer and problem formats, before analyzing their association with students' performance, leveraging a naturalistic large-scale data set (>18,000 students; 1.5 million problems). Students were most frequently confronted with the most difficult answer and problem format, with more than half of all percentage problems formulated as word problems using an open-ended answer format. In contrast, problems including visualizations were least common even though they were performed best. We conclude that higher frequencies of visualization problems early on when percentage learning may ease harder problems like word problems.