

Understanding Strategies of Multiplication and Division Through Worked-Out Examples Using an Inquiry-Based Approach

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Keywords: worked-out examples, multiplication, division, inquiry-based approach

Aim and Literature

The study aimed to enhance prospective elementary teachers' conceptual understanding of multiplication and division strategies. This project examined whether combining worked-out examples with an inquiry-based approach could improve comprehension, confidence, and instructional readiness.

Cognitive science shows that worked-out examples with step-by-step reasoning build procedural and conceptual understanding when paired with self-explanation and peer discussion (Atkinson et al., 2000; Renkl, 2002; Chiu & Chi, 2014). Inquiry-based learning fosters exploration but can overwhelm learners without scaffolding (Kirschner et al., 2006). Integrating both provides structure, guided inquiry, and collaborative meaning-making in mathematics.

Methods

Pre-service elementary teachers were randomly placed in groups of four and given worksheets with fully solved examples. Each group studied two different multiplication or division strategies (e.g., area model, lattice, box method, repeated subtraction, grid, and traditional algorithms). For 15–20 minutes, groups discussed the correctness of each solution and compared methods, leading to rich inquiry about how multiplication strategies relate to identifying divisors in division. After the initial discussions, a carousel activity began: two members from each group rotated to teach their strategies to another group while learning two new ones from the remaining pair. Each rotation lasted 20 minutes, and after four rotations all teachers had learned all eight strategies before returning to their original groups. Throughout the activity, students engaged actively, communicated clearly, identified patterns, and explained their reasoning, showing deeper inquiry than in previous semesters.

Discussion

Students exhibited greater mastery and confidence in explaining and applying all multiplication and division strategies. Students expressed satisfaction and reported that teaching peers enhanced their confidence and understanding. Combining worked-out examples with inquiry-based instruction created an engaging and supportive learning environment where all students participated meaningfully. The approach promoted mathematical discourse, peer collaboration, and self-explanation, key components of conceptual understanding. Integrating worked-out examples within an inquiry-based framework effectively supported preservice teachers' conceptual and procedural fluency in multiplication and division. This approach empowers future teachers to confidently teach diverse mathematical strategies and foster conceptual understanding among their own students.

References

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