Self-Explanation Improves Mathematics Learning in Low Prior Knowledge Students

Katherine L. McEldoon & Bethany Rittle-Johnson
Vanderbilt University

Current Focus
Is self-explanation effective for learners with low prior knowledge?

Self-Explanation
Self-explanation, or generating explanations to oneself in an attempt to make sense of new information, can promote learning (e.g., Rittle-Johnson, 2006). Self-explanation has been found to be beneficial, even against rigorous time on task controls (McEldoon, Durkin, & Rittle-Johnson, 2012).

The learning benefits of this activity have not been investigated specifically in low prior knowledge learners, who may not be as able to successfully utilize explanation for learning.

Low Prior Knowledge
A median split of pretest performance identified 55 low prior knowledge students.

Knowledge of equivalence is typically assessed through equation structure knowledge. Problems of the form 3 + 4 + 8 = ___ + ___ ask learners to determine whether the left-hand side (3 + 4 + 8) is equal to the right-hand side, which requires students to determine the number that needs to be added to a known group of numbers (3 + 4 + 8) to maintain equivalence.

Summary
These findings suggest that prompts to self-explain are a useful activity even for low prior knowledge students, who may not have a large knowledge base to draw from when constructing their explanations.

Additionally, self-explanation seems to be particularly effective for fostering procedural transfer. This ability to solve novel and more challenging problems is a very important and desirable educational outcome.

The findings also suggest that sometimes less uninstructed problem solving practice is more, as the control group often had higher posttest scores than additional-practice.

The findings suggest that self-explanation prompts have unique learning benefits for low prior knowledge learners, even when compared to alternative uses of time.

References

Conceptual Knowledge
Procedural Knowledge

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References

Self-Explain 4 Sets
Control 4 Sets
Add’l Pract. 8 Sets

Method

- DOMAIN: Mathematical equivalence is the principle that two sides of an equation represent the same value
- Foundational for algebra (Falkner, Levi, Carpenter, 1998)
- 3 + 5 + 6 = ___ + 6
- 117 2nd through 4th graders with less than 75% correct at pretest on conceptual and procedural knowledge of mathematical equivalence

Results

Post & Retention Tests

Conceptual Knowledge
No Differences
Self-Explain > Add’n Practice
Control > Add’n Practice

Procedural Knowledge
Self-Explain > Add’n Practice
Control > Add’n Practice

Procedural Transfer
Self-Explain > Add’n Practice
Self-Explain > Control

Assessment Components

Knowledge of equivalence is typically assessed through equation structure knowledge. Problems of the form 3 + 4 + 8 = ___ + ___ ask learners to determine whether the left-hand side (3 + 4 + 8) is equal to the right-hand side, which requires students to determine the number that needs to be added to a known group of numbers (3 + 4 + 8) to maintain equivalence.

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Notes:
- School of Education.
- Self-explanation prompts have unique learning benefits for low prior knowledge learners, even when compared to alternative uses of time.

Contact
Katherine L. McEldoon
Vanderbilt University

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