Writing and Math: A Brief Review of Strategies, Implications, and Effects on Achievement

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Introduction

Disciplinary literacy refers to the specialized communication used by experts in different disciplines (Shanahan & Shanahan, 2012). Students need to be able to express their ideas and understandings using the vocabulary and components unique to each discipline (math, science, history, etc.). Writing specifically provides an opportunity to create meaning and assess one's own thinking process (Martin & Polly, 2016) producing implicit and explicit use of cognitive and metacognitive processes to facilitate learning (Card, 1998; Graham et al., 2020; Hebert & Powell, 2016; Pugalee, 1997, 2001).

Findings

Graham et al. (2020) reviewed outcomes writing had on learning for students in grades 1 to 12. Through their 56 investigations, statistically significant average weighted effect size of 0.30 supported the idea of writing improving learning across all observed content areas. The writing-to-learn concept effect size was considered substantial based on prior observed effect sizes (Bangert-Drowns et al., 2004) as well as another Graham study with Perin (2007) that reported an ES of 0.23 when evaluating students in a slightly smaller range of grades—4 to 12.

Student Recommendations

- Use precise, math specialized vocabulary
- Write simple, punctuated sentences
- Explain reasoning explicitly stating theorems, rules, processes, and proper interpretation of symbols
- Reflect and critique methods and solutions

Teacher Recommendations

- Explain how communicating mathematically is the key to creating meaning
- Provide explicit examples of how mathematicians communicate through text, mechanics of writing for a "math audience," and proper vocabulary usage
- Model construction/critique of mathematical arguments, recognizing patterns, and stating problems in words
- Teach students ways to represent data through symbols, graphs, tables, number lines, equations, diagrams, sentences, etc. just like in the construction of basic language
- Facilitate student discussion about the problem-solving process: comprehension, accessing prior information for potential application, concept synthesis, evaluation of ideas/reasoning, calculations, interpretation of conclusions, and proofs of solution
- Allow regular time for students to write formally (proofs, models, writing of problem-solving processes, argument critique, etc.) and informally (journaling)
- Scaffold the writing process from teacher only while students observe/copy to student independent writing with individual prompting as needed

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