

Mathematical Dispositions of Pre-Service Elementary Teachers

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Dispositions include an individual's behavioral (i.e., things they say & do), cognitive (i.e., attention & memory), and affective (i.e., emotions & beliefs) tendencies (APA, 2020). In mathematics education, researchers discuss productive mathematical dispositions as a "...habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy..." (NRC, 2001, p.116). In contrast, unproductive dispositions (e.g., anxiety, avoidance) do not reflect a lack of ability but rather behaviors that can hinder students' engagement with mathematics (Feldhaus, 2014). Supporting the development of productive dispositions is therefore critical for improving students' mathematical knowledge and achievement (Awofala et al., 2022; Cobb & Hodge, 2002).

Pre-service elementary teachers (PSETs) often exhibit unproductive mathematical dispositions (Cornell, 1999; Patkin & Greenstein, 2020), including low confidence and avoidance behaviors, which may negatively influence their learning of mathematics, their future teaching, and their students' attitudes toward math (Beilock et al., 2010; Phillipp et al., 2007). Addressing these mathematical dispositions early in teacher preparation is essential. This three-year study examines PSETs' mathematical dispositions during their first mathematics content course, focusing on four key constructs: mindset, self-efficacy, anxiety, and avoidance. Data were collected via pre- and post-semester surveys, including validated scales for math anxiety, self-efficacy, growth mindset, and content knowledge in all three years. During the second and third years, students completed targeted in-class interventions guided by their instructors. Additionally, a subset of students (volunteers) participated in an eye-tracking study at the beginning and end of each semester. Eye-tracking technology (Eyelink 1000+) was used to assess implicit visual behaviors during arithmetic tasks, offering insights into math-related anxiety and avoidance.

In the baseline year (Fall 2023), 58 students provided matched pre- and post-data; in the intervention year (Fall 2024) there were 59 matched ones. Quantitative results revealed that students in the intervention semester showed a significantly greater decrease in math anxiety (mean change = -2.62 vs. -0.57 , $p = .048$) and significant gains in growth-oriented mindset (mean change = 1.58 vs. 0.21 , $p = .027$) and math content knowledge (mean change = 1.42 vs. -0.07 , $p = .0095$). Changes in self-efficacy and avoidance were not statistically significant. Preliminary eye-tracking data suggest that students with higher math anxiety exhibit lower fixation rates and durations during arithmetic tasks, indicating potential visual avoidance. These findings underscore the importance of targeted interventions to reduce math anxiety and foster productive dispositions among future educators. This research and its findings on interventions in mathematics content courses offer valuable contributions to the RUME community and to faculty teaching lower division mathematics courses for non-math majors. Moreover, it provides insights into the potential of multimodal data collection methods, such as eye tracking, for studying students' mathematical dispositions and learning processes.

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