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Do student self-efficacy and teacher-student interaction quality contribute to emotional and social engagement in fifth grade math?☆

Daniel P. Martin [a,*], Sara E. Rimm-Kaufman [b]

[a] Department of Psychology, University of Virginia, Charlottesville, VA, USA
[b] Curry School of Education, University of Virginia, Charlottesville, VA, USA

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ABSTRACT

This study examined (a) the contribution of math self-efficacy to students' perception of their emotional and social engagement in fifth grade math classes, and (b) the extent to which high quality teacher-student interactions compensated for students' low math self-efficacy in contributing to engagement. Teachers ($n = 73$) were observed three times during the year during math to measure the quality of teacher-student interactions (emotional, organizational, and instructional support). Fifth graders ($n = 387$) reported on their math self-efficacy at the beginning of the school year and then were surveyed about their feelings of engagement in math class three times during the year immediately after the lessons during which teachers were observed. Results of multi-level models indicated that students initially lower in math self-efficacy reported lower emotional and social engagement during math class than students with higher self-efficacy. However, in classrooms with high levels of teacher emotional support, students reported similar levels of both emotional and social engagement, regardless of their self-efficacy. No comparable findings emerged for organizational and instructional support. The discussion considers the significance of students' own feelings about math in relation to their engagement, as well as the ways in which teacher and classroom supports can compensate for students lack of agency. The work has implications for school psychologists and teachers eager to boost students' engagement in math class.

1. Introduction

Student success in math is essential for a strong workforce because math provides the foundation for many science, technology, and engineering disciplines. Success in math hinges on students' engagement in math instruction (Hughes & Kwok, 2007; Marks, 2000). Recent recommendations from the National Council for Teachers of Mathematics (2014) highlight the importance of student engagement. According to NCTM Principals to Actions (2014), ideal math learning is not a passive process involving practicing procedures, memorizing formulas, and using standard algorithms. Instead, students develop understanding of mathematical procedures and concepts by making sense of mathematical tasks, engaging in reasoning, problem solving and discourse with their teachers

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* Corresponding author.
E-mail address: dpmartin42@gmail.com (D.P. Martin).
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and other students, and exploring mathematical problems in order to find a solution. High levels of student engagement are foundational to NCTM instructional approaches, an issue that is concerning given evidence showing that students vary widely in their engagement in learning (Fredricks, Blumenfeld, & Paris, 2004). Educators and school psychologists need improved understanding of the factors that contribute to engagement. Student engagement stems from both internal processes (i.e., intrapsychic experiences) as well as external supports (i.e., classroom experiences) that are present or absent in students' lives. Understanding the contribution of internal and external experiences on students' engagement in math is an essential step toward improving math achievement.

Research examining the factors contributing to student engagement in math is especially important during the late elementary school years. Learning math is a cumulative task and students who fall behind may find it difficult to catch up (Bodovski & Farkas, 2007). Further, math can be particularly challenging with periods in which students feel frustration and confusion as a natural part of the learning process (Licht & Dweck, 1984). In the presence of challenge, there are critical and important "emotional ingredients" required so that students maintain their involvement in learning and persist in the presence of adversity (Finn & Zimmer, 2012, p. 101). Self-efficacy is one such emotional ingredient. Students who experience high self-efficacy in math are more likely to persist at difficult tasks compared to those with low self-efficacy (Bandura, 1977). Understanding students' self-efficacy to learn math, the implications of these feelings for engagement, and the extent to which teachers can compensate for low self-efficacy sheds light on the student and classroom inputs essential for math learning.

1.1. Engagement in learning

Student engagement is regarded as a multi-faceted construct with psychological and behavioral components that are critical for learning (Fredericks, Blumenfeld, & Paris, 2004). As described by Reschly & Christenson (2012, p. 3), "student engagement is the glue, or mediator, that links important contexts – home, school, peers, and community – to students and, in turn, to outcomes of interest." Contemporary math classrooms represent an interesting context in which to study engagement given recent NCTM guidelines that emphasize teaching strategies designed to deepen students' engagement in learning. The NCTM themes encourage risk-taking, "productive struggle," and discourse about mathematical ideas (NCTM, 2014, p. 3) – themes that direct research interest toward emotional and social engagement in learning.

Emotional engagement refers to the emotions (i.e., enjoyment, interest, and pleasure) experienced when pursuing a particular subject or school-related task (Mahatmya, Lohman, Matjasko, & Farb, 2012). Students who are emotionally engaged enjoy the feeling of solving problems and find the material interesting. Emotional engagement relates to achievement indirectly (Finn & Zimmer, 2012); that is, emotional engagement relates to student participation in the classroom, which in turn, relates to achievement (Voelkl, 1997). Further, emotional engagement shows continuity over time; students showing higher emotional engagement during early school grades (first through third grade) have been shown to demonstrate improved academic performance in eighth grade (Ladd & Dinella, 2009).

Social engagement refers to the social interactions students have as part of academic instruction (Patrick et al., 2007; Rimm-Kaufman et al., 2015). Students demonstrate social engagement through their active participation in positive exchanges with peers that are connected to the instructional content of the lesson. For example, a student may demonstrate social engagement by working in a group to help one another solve a particular problem in class or by sharing instructional materials (e.g., math manipulatives) with other students. Patrick et al. (2007) showed that social engagement (i.e., task-related interaction) in fifth grade math class related to higher math grades, even after controlling for achievement in the previous year.

1.2. Factors influencing student engagement

Many factors influence students' levels of engagement in the classroom. We use the person-environment fit theory (Mitchell, 1969) as our conceptual basis to identify factors that contribute to emotional and social engagement. The person-environment fit theory posits that academic constructs (e.g., engagement and achievement) reflect the interaction between attributes of the student and his or her environment (Eccles, Lord, & Midgley, 1991). Applied to the math classroom, a student is more likely to succeed when the student's individual resources fit well with the demands of the classroom environment. Students become susceptible to academic decline without this fit in place. Consider the application of the person-environment fit theory to an academically demanding fifth grade classroom. If a student enters into the classroom environment with strong internal resources (e.g., self-efficacy), the student may be well equipped to face the challenges presented, resulting in more engagement in learning. Without these internal resources, the student may be less likely to perceive math as engaging. In the absence of internal resources, the student may rely on resources outside of themselves to compensate and boost their engagement. Students' sense of self-efficacy in math and supportive teacher-student interactions are internal and external factors that may promote engagement.

1.2.1. Self-efficacy

Self-efficacy refers to an individual's perception of his or her capacity to learn or perform a task in a given domain (Schunk & Pajares, 2005). By late elementary school, students have a well-developed sense of self-efficacy that is subject-specific and stems from their home, school, and peer experiences (Linnenbrink & Pintrich, 2003; Schunk & Pajares, 2005). Students with high self-efficacy tend to participate eagerly, persist in the face of challenge, and expend greater effort to reach a goal, whereas students with low self-efficacy tend to dwell on past mistakes and lessen their efforts in the face of difficult tasks (Bandura, 1977). Students' perceptions of their own self-efficacy in learning play a critical role in student motivation and engagement (Linnenbrink & Pintrich, 2003; Zimmerman, Bandura, & Martinez-Pons, 1992). High academic self-efficacy contributes to academic achievement (Appleton,