SUPPORTING THE WHOLE STUDENT: BLENDING THE MATHEMATICAL AND THE SOCIAL EMOTIONAL

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This case-study sought to describe instruction that supported students' mathematical learning (ML) and social-emotional learning (SEL). Transcripts from audio-recorded lesson observations and teacher interviews, field notes, and written teacher reflections were collected to answer two research questions: (1) In what ways does a high school mathematics teacher support ML and SEL during instruction? (2) How does the teacher characterize her attempts to provide social-emotional and mathematical supports during instruction? Preliminary findings suggest that strategies for revising ideas and handling errors support students ML and SEL.

Keywords: Affect, Emotion, Beliefs, and Attitudes; Classroom Discourse; Equity and Diversity; High School Education

Traditionally, research in mathematics education has focused much of its attention on achievement. However, a growing body of research suggests that maintaining a focus on achievement ignores other key factors in understanding students' learning of mathematics, especially in discussion- and collaboration-oriented classrooms of the reform era (Bargagliotti, Gottfried, & Guarino, 2017; Battey & Levya, 2016; Horn, 2008). More specifically, researchers have highlighted the importance of understanding the social and relational aspects of particular learning contexts (Battey, 2013; Battey & Levya, 2013; 2016; Hackenberg, 2005; 2010; Moschkovich, 2002).

Across a variety of contexts, researchers have noted the importance of teacher-student relationships (Allexsaht-Snider & Hart, 2001; Averill, Anderson, Easton, Smith, & Hynds, 2009; Delpit, 2012; Hackenberg, 2005). These relationships are especially important – and complex – when students and teachers from different cultural backgrounds come together to pursue the learning of mathematics (Battey, 2013; Delpit, 2012; Hackenberg, 2010). Therefore, the primary goal of this study is to describe mathematics instruction that fosters students' development of positive relationships with individuals and mathematics within the classroom.

Theoretical Framework

Seeking to understand the social and relational elements of instruction is a complex undertaking (Battey, 2013; Hackenberg, 2010; Horn, 2008). A previous study (Gartland, 2019) identified instructional moves made by a third-grade mathematics teacher that supported students' mathematical learning (ML) *and* their social-emotional learning (SEL). Additionally, Bargagliotti, et.al. (2017) linked instructional choices made in kindergarten mathematics to students' learning *and* social-emotional development. However, I have yet to locate literature on supports for ML and SEL at the high school level. This study addresses that gap.

Supporting Mathematical Learning

Positive social interactions and relationships within the classroom are a necessary element of instruction. Thus, Battey's (2013) framework for *relational interactions* to help define what I consider to be instruction that supports ML. A relational interaction is "a communicative action or episode of moment-to-moment interaction between teachers and students, occurring through verbal and nonverbal behavior that conveys meaning and can mediate student learning" (Battey & Levya,

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2013, p. 981). A relational interaction can be categorized as: addressing behavior, framing mathematics ability, acknowledging student contributions, attending to culture and language, or setting the emotional tone (Battey, 2013). These categories take into consideration a teacher's Mathematical Knowledge for Teaching (Loewenberg Ball, Thames, & Phelps, 2008) and other instructional practices for focusing students on mathematical ideas (Battey, 2013). Thus, I consider instruction that supports ML to be the observable relational interactions and instructional decisions associated with meeting a particular mathematics learning goal.

Supporting Social-Emotional Learning

Instruction that supports students' SEL has been most systematically researched in the K-6 context (Weissberg & O'Brien, 2004). However, with increasing numbers of districts adopting SEL initiatives, the Collaborative for Academic, Social, and Emotional Learning (CASEL) has taken a leading role in working with schools to research and promote SEL best practices (Blad, 2015) at all levels of schooling. Across SEL curricula and policy documents, several key features emerged. Instruction that supports SEL in students can be defined as what a teacher does to promote self-awareness and self-management of feelings, positive identity development, and decision-making skills among students (CASEL, 2019; Elias & Moceri, 2012).

Blending Mathematical and Social-Emotional Supports

More research shows the benefits of SEL-focused interventions than on intentional blending of academic *and* social-emotional supports (CASEL, 2019; Weissberg & O'Brien, 2004). Even fewer studies directly link ML and SEL. In one such study, Bargagliotti, et.al. (2017) highlighted relationships between kindergarten mathematics instruction and academic and social-emotional outcomes. Although they noted several positive associations between mathematics instruction and *both* academic and social-emotional outcomes, they warned "readers against generalizing these findings to grade levels beyond kindergarten" (p. 27). In response to their concern, this study aims to explore similar phenomena at other grade levels.

Since little research exists that explicitly describes instruction that supports both ML and SEL, other literature informs potential areas of overlap. Real-time reports of academic-SEL integration in school districts (CASEL, 2018) as well as research on learning from errors in mathematics (Steuer, Rosentritt-Brunn, & Dresel, 2013; Zander, Kruetzman, & Wolter, 2014) point to instruction on the handling of errors as a means for improving discussion and collaboration. Futhermore, instructional strategies such as *rough-draft talk* (Jansen, Cooper, Vascarello, & Wandless, 2017) can provide students with opportunities to discuss not only errors but also incomplete mathematical thoughts in ways that enhance the learning experience. These findings highlight a space for potentially observing instruction that supports both ML and SEL.

Guided by these ideas, this study explored two research questions: (1) In what ways does a high-school mathematics teacher support ML and SEL during instruction? (2) How does the teacher characterize her attempts to provide social-emotional and mathematical supports during instruction?

Methods

Participant

This paper presents the preliminary findings from a case-study (Hatch, 2002) of one high-school mathematics teacher, Ms. Yang. She has 5 years of experience teaching at a large suburban high school, and she has taught versions of Geometry, Algebra, Pre-Calculus, and Calculus. Ms. Yang actively participates in professional development and continuing education focused on improving students' discussion of mathematics.

Data Collection

A variety of data was collected over the course of a high-school semester. Four audio-recorded observations of an 80-minute, semester-long, college-preparatory, integrated mathematics course were conducted. In addition to the audio-recordings, each observation also generated field notes, a transcript, and a written teacher reflection. Finally, following the final observation, Ms. Yang participated in a half-hour semi-structured interview (Strauss & Corbin, 1994).

Data Analysis

Data analysis is currently ongoing. Thus, data has been, and will continue to be, coded using multiple approaches. First, a priori codes informed by the literature were applied to the data. More specifically, data was coded for observed relational interactions (Battey, 2013), which constitute ML supports, and observed SEL supports (CASEL, 2019). Next, an open coding process was used to reveal any unanticipated themes or patterns (Hatch, 2002). Codes have been compared and grouped using a constant comparison approach (Strauss & Corbin, 1994). Observation data has been more thoroughly analyzed than the interview data at this point.

Preliminary Findings

The following sections present two emerging themes. First, rough-draft talk frequently stood out as an instructional practice that supported ML and SEL in Ms. Yang's class. Second, while reflecting on and discussing her own teaching, Ms. Yang consistently linked student feelings of comfort and confidence with high quality mathematics.

"I'm Not Looking for a Final Answer."

To the left of Ms. Yang's Smart Board was a section of decorated space dedicated to "Rough Draft Talk," in which paper cut-outs of hands giving a "rock-on" gesture contain examples of what constitutes rough-draft talk. On another wall, the "Rights of Learners" (Kalinec-Craig, 2017) were listed: students in this classroom always have the right to be confused, to make a mistake, to say what makes sense to them, to share unfinished thinking and not be judged, and to revise their thinking. These displays and the consistency with which she referred to aspects of rough-draft talk as conceptualized by Jansen, et. al. (2017) and the rights of the learner showed that they were an integral part of her teaching practice. Most importantly, instructional practices involving rough-draft talk emerged as the ones most frequently supporting both ML and SEL.

While coding the data for relational interactions and SEL supports, references to and the use of rough-draft talk appeared often. To investigate relationships between the three constructs further, excerpts that illustrated the principles for supporting rough-draft talk (Jansen, et.al., 2017) were selected. Then, any codes for ML supports (i.e. relational interactions) *and* SEL supports associated with the excerpts were noted. This process allowed connections to be drawn between key features of each construct. Table 1 summarizes the relationships between the principles for supporting rough-draft talk and observed instruction that was coded as a relational interaction *and* a support for SEL. Also included in the table is an excerpt illustrating each principle.

Table 1: Rough-Draft Talk as a Support for Mathematical and Social-Emotional Learning

Principles for Supporting Rough-Draft Talk	Corresponding ML Categories	Corresponding SEL Supports
1) Foster a culture supportive of intellectual risk taking	Framing mathematics ability; setting the emotional tone	Promoting decision-making skills

Example: "Can I see your graph? Would you be willing to share it on any of these boards? No pressure, no pressure…Oh! Snaps! Snaps! Hey, and that's your right, right? Share unfinished thinking. No one's judging you. Thank you for even starting this off."

2) Promote the belief that learning mathematics involves revising understanding over time	Acknowledging student contributions; addressing behavior	Promoting self-awareness and self-management of feelings; promoting positive identity development

Example: "Do you know all the words for the different transformations? Can you rattle them all off? …How about this, if you don't know them just say left/right, up/down, big/small. Okay? Mirror. Whatever it is. Then we'll refine those words together."

3) Raise students' statuses by expanding on what counts as a valuable contribution	Acknowledging student contributions; framing mathematics ability	Promoting positive identity development

Example: "Thank you! For being honest about that! How many of us felt that way? Like, 'the three minutes lapsed and I don't have any idea what is happening.' Hey! Look around the room. Everybody's in the same boat as you. You're good. Alright, so help each other out."

"Be Brave. Be Kind"

A second finding is that when discussing her own instruction Ms. Yang tends to focus on decisions related to student discussions of mathematics. In describing those decisions, she almost invariably links the decisions to perceived student comfort and confidence. For example, Ms. Yang explained that "the students shared how it's not so much what their teachers say that makes them feel devalued, but it's what [their teachers] don't say when they present an answer that makes them feel like there was something inherently wrong with their response." In working to avoid those types of interactions, Ms. Yang expects herself and her students to live by the class motto: "Be brave. Be kind." She believes that deeper and higher quality mathematics discussion, and therefore learning, will take place only after students feel comfortable and confident in the classroom. This finding will likely be expanded as the analysis of the interview data is completed.

Discussion and Conclusion

Individually, these findings identify a particular instructional strategy that supports both ML and SEL and highlight the ways in which a high-school teacher characterizes her own attempts to provide such supports. Taken together, these findings suggest that teachers who attend to student comfort and confidence within the classroom are likely to be implementing instructional strategies that support both ML and SEL. This is significant because such limited research exists beyond the K-6 grade bands related to the integration of ML and SEL. More specifically, it provides a viable starting point for future research.

Limitations associated with the single-participant case-study design prevent generalization and establishment of any links between the support of ML and SEL and student learning outcomes. Additionally, this study excludes the student perspective. Thus, immediate future research will focus on collecting and analyzing student data to continue gaining a deeper understanding of instruction of this type.

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