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Promoting Rehumanizing Mathematics Through Embodied-Focused Noticing

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REHUMANIZING MATHEMATICS THROUGH EMBODIMENT-FOCUSED NOTICING

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In this manuscript we, six math teacher educators (MTEs), share a collaborative self-study investigation into increasing our embodiment-focused noticing. Initially, we individually viewed cognitive interview videos and recorded our embodiment-focused noticings. Next, we met as a group to share, compare, and merge our noticings. We used the merged noticings to develop an exemplar and a rubric. We will discuss how layering an embodiment lens over our noticings can contribute to rehumanizing mathematics.

Keywords: Teacher Noticing, Equity, Inclusion, and Diversity

Background and Theoretical Perspectives

We are six math teacher educators (MTEs) with different lived experiences and areas of expertise. As critically conscious MTEs, we acknowledge that social, cultural, and political factors impact our noticings (Louie et al., 2021; Seda & Brown, 2021). We believe our differences strengthened this collaborative self-study because our diverse perspectives pushed us to broaden our noticings. We embarked on this collaboration due to a common problem of practice. The preservice mathematics teachers (PSTs) we work with often notice from a narrow or deficit perspective, exclusively attending to only what students say or write, often ignoring valuable embodiment evidence. Our collaborative self-study draws upon the literature on teacher noticing, rehumanizing mathematics, and embodiment. The conference theme of "Engaging All Learners" is embedded throughout this theoretical brief report in that we discuss that developing a broad assets-based perspective on noticing that considers student embodiment can promote rehumanizing mathematics for all levels of mathematics educators.

Noticing

Noticing is multifaceted, but one essential aspect is what it means to acknowledge a critical event in the noticing model. A critical event, as defined by Rotem and Ayalon (2023), is the ability, through attending and interpreting, to fully see a myriad of evidence that represents an individual's mathematical thinking and provides an opportunity to facilitate instructional strategies that support deeper understanding. It is the crucial moment in which an observer can fully see the way in which a task is being evaluated and performed, allowing instructional strategies to match the needs of the students and push their thinking forward (van Es, 2011). Noticing mathematical understanding can never be isolated to the physical act of solving a task, because individuals bring past histories and social structures that operate within their schema with them as they engage in mathematics. The triad of noticing (attend, interpret, respond, or AIR) requires the observer to pay full attention to significant mathematical details along with the personal effects demonstrated by the student when approaching a task (Jacobs et al., 2010). Critical events, also identified as pivotal teaching moments (Stockero & Van Zoest, 2013) occur

when teaching episodes provide a transition that allows instructors to change the trajectory of student thinking and consider all dimensions found within the structure, which include cognitive, affective, and social aspects of the teaching and learning process.

Rehumanizing Mathematics

To promote more equitable noticing, we layered Gutiérrez's (2018) rehumanizing mathematics (RM) framework as a lens over the AIR framework. There are eight dimensions in the RM framework. The three dimensions most relevant to our self-study include: (1) emotions and body, (2) participation and positioning, and (3) broadening mathematics. Attending to students' body movements can promote rehumanizing mathematics by broadening what counts as mathematical understanding and who is considered mathematically competent. This is because children often show their mathematical thinking in physical movements (e.g., finger counting), facial expressions, or utterances of thought before they can cognitively process and express a verbal explanation. According to the RM framework, teachers can promote equity by holding high expectations for all students, avoiding deficit views of diverse students, focusing on sensemaking instead of answer-getting, valuing diverse contributions, leveraging early conceptions, and acknowledging and positioning all learners as brilliant mathematicians.

Embodiment

Embodiment refers to the use of "body-based resources to make meaning and to connect new ideas and representations to prior experiences" (Nathan, 2022, p. 4), including gestures, body forms, simulations, and the use of materials (e.g., manipulatives). The literature suggests that attending to embodiment may promote equity by expanding educators' ideologies and pedagogies. Noticing embodied actions can serve as micro and macro affirmations that promote equity and access (Abrahamson, et al., 2020). Attending to embodiment may expand educators' views of evidence of learners' mastery of the counting principles (Gelman & Gallistel, 1978). Embodied cognition has become prevalent in math education literature (e.g., Abrahamson et al., 2020; Alberto et al., 2022; Alibali & Nathan, 2018; Nemirovsky & Ferrara, 2009; Nemirovsky et al., 2012; Tall, 2008), though it remains a broadly interpreted term. Noticing how students coordinate units is related to embodiment because students initially rely on concrete objects, their fingers, and visual representations to explain their mathematical reasoning. Therefore, an observer who uses embodiment as evidence is capturing a more accurate assessment of students' understanding of mathematics. Below is a figure of the relationships among noticing of embodiment and RM (adapted from Moss & Poling, 2019; Thomas et al., 2017).

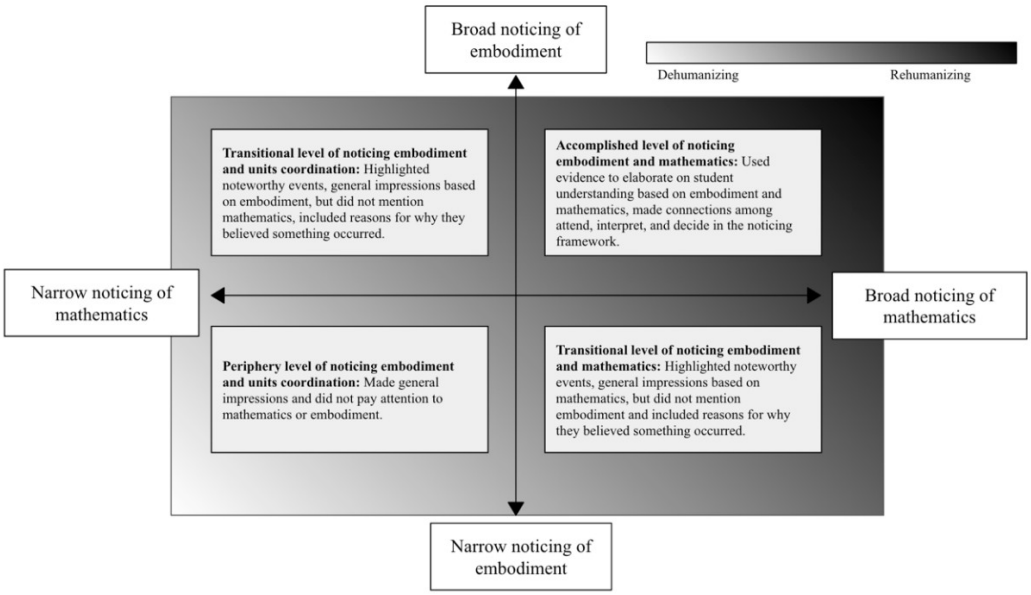

Figure 1: Rehumanizing Noticing through Embodiment

Methodology

We adopted a collaborative self-study methodology for this research (Butler & Bullock, 2022). According to Kosnik and colleagues (2009), the characteristics of self-study methodology include openness, multiple perspectives, collaboration, paradoxical nature, reframing, and postmodernism. Throughout this self-study, we pushed each other to keep our minds open to perspectives that differed from our initial stances. Additionally, collaboration with each other played a critical role in helping us consider concepts from multiple perspectives. The nature of this self-study was paradoxical because as "critical friends" we pushed each other to question and reframe our initial beliefs. Finally, we adopted postmodern assumptions, recognizing how our life experiences influence our beliefs and our beliefs are not necessarily the "best practices."

Data Collection and Analysis

Initially, we individually viewed a cognitive interview video from the course resources of *Mathematics for Elementary Teachers: A Contemporary Approach* by Musser and colleagues (2013) and recorded our embodied noticings. In the video, a second-grade boy is given six blocks and asked, "Is the number of blocks even or odd?" We chose this video because it addresses a common early conception and the video frame includes the student's face and body, providing us with opportunities to attend to embodiment in our noticings. In the video, the student initially declared that six is even without any interaction with the blocks, suggesting a unitizing strategy. When asked how he knew, he initially organized the six blocks into two rows of three, stating they were "even." When asked to explain, the student used a different method, likening even number to having "partners" and combining the blocks into three groups of twos. Ball and Bass (2003) reported that third-grade students might perceive numbers like six as both even and odd because of their reasoning that the number of groups of two is odd. Further exploration showed that third-grade children may use fair sharing, groups of two, or the alternation of even and odd numbers on the number line strategies (Bass, 2005). Next, we met as a group to share, compare, and merge our noticings. We used open coding to analyze our individual noticings and develop a merged embodiment exemplar (Corbin & Strauss, 2014).

Findings

Figure 2 illustrates examples of narrow versus broad attending, interpreting, and deciding of embodiment (structure of figure adapted from Thomas et al., 2017). The rehumanizing of embodied noticing of student thinking could help advance equity and access by broadening what counts as evidence of mathematical understanding.

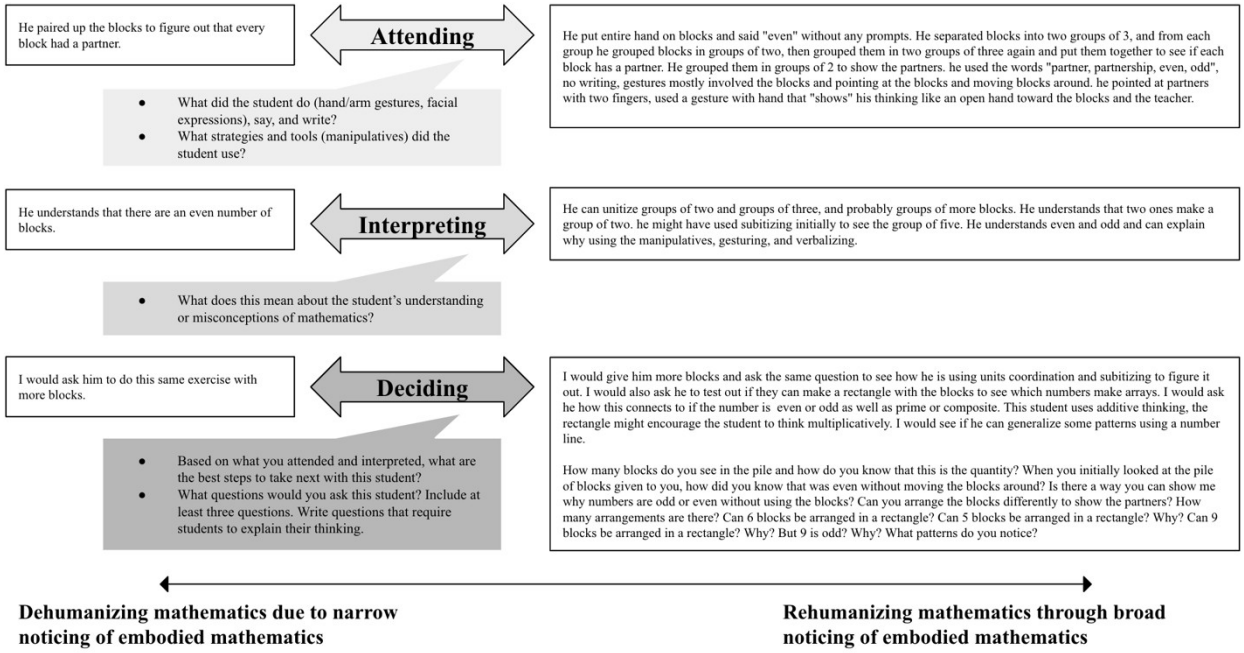

Figure 2: Examples of Noticing of Embodiment and Mathematics

Discussion

In this collaborative self-study we set out to illustrate what rehumanizing mathematics through broad noticing of embodied mathematics looks like. Based on our review of the literature, layering an embodiment lens over our noticing may promote equity and access by providing opportunities to highlight and leverage every student as a brilliant mathematician (Abrahamson, et al., 2020; Gutiérrez, 2018). Layering an embodiment lens over our noticing of mathematics provided an "aha" moment for us. We realized the limitations of our prior noticing work that had not explicitly or intentionally focused on embodiment. Through this collaborative self-study, we feel that we progressed from the transitional level (Quadrant IV) to the accomplished level of noticing embodiment and mathematics (Quadrant I). We attribute the broadening and rehumanizing of our noticing skills to our learning about the field of embodiment and our layering of embodiment lenses over our noticings of mathematics.

A limitation of our work is that we only viewed one cognitive interview video of one student completing one mathematics task. Moreover, having diverse MTEs view a representative collection of videos would enhance this study. MTEs could use the merged noticings we share in Figure 2 as an exemplar for preservice teachers (PSTs) or to develop criteria and gradations of quality for evaluating PSTs' noticings. This provocative collaborative self-study pushes the field to consider how layering an embodiment lens over noticing may rehumanize mathematics teaching and learning and promote equity and access. Additionally, it challenges the field to consider the nuanced complexity of potential critical events that may occur during the teaching and learning of mathematics.

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