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Recommended Citation

Nicole L. Fonger, "A Heart-Centered Stance: Receptivity to Algebra Teachers' and Students' Multidimensional Experiences," *Journal of Humanistic Mathematics*, Volume 11 Issue 1 (January 2021), pages 225-264. DOI: 10.5642/jhumath.202101.12. Available at: <https://scholarship.claremont.edu/jhm/vol11/iss1/12>

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A Heart-Centered Stance: Receptivity to Algebra Teachers' and Students' Multidimensional Experiences

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Synopsis

The algebra classroom in urban public high schools in the United States is a complex space, ripe with many challenges and opportunities. In this paper I introduce the notion of a heart-centered stance for the teacher and the educator and a method of engaging in creative expression for reflection and introspection toward individual change in the rich context of the high school algebra classroom. My evolving relationships with two high school algebra teachers, observations of their classrooms, as well as my own self-study and professional growth, are incorporated into this paper as I introduce and exemplify two tenets of a heart-centered stance: multidimensionality of experience and receptivity to relatedness. This study suggests the possibility of using creative artistic expression and a self-study approach to support the transformation of educators' perspectives toward research, creative activities, and outreach that are receptive to the mathematical experiences of teachers and students in our local communities.

Keywords: school algebra, self-study, heart-centered, experience, humanistic, theory and praxis, mindfulness

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Figure 1: A visual abstract for this paper.

1. Introduction

One adage for research in mathematics education asserts that in order to change something you must understand it, and in order to understand something you must change it [9]. From this adage, I have come to view change and understanding as going hand and hand. This paper is largely motivated by a desire to move toward a better understanding of both the context of high school algebra as a complex space in an urban public school district, and my role in affecting change in this place. Algebra continues to play a gatekeeper role for students, limiting their access to higher level mathematics (cf. [1]). The pernicious gatekeeper role of school algebra elevates its importance for students' path to graduating high school and beyond.

I begin from a place of seeking to understand the context of school algebra through the practices of being present to and reflecting on my experiences in visiting and conversing with teachers and students who teach and learn in urban public high schools in a mid-sized city. It is in these introspective practices, as well as my long-standing goal of seeking to better understand this context, that I find inspiration for moving toward change.

1.1. Purpose of This Paper

Broadly, this paper developed from an introspective journey toward crafting my research, creative scholarship, and outreach activities in ways that are receptive to the experiences of teachers and students in my local community schools. The purpose of this paper is to introduce the tools I have used to probe the issues and questions that emerged from seeking to better understand the targeted contexts and communities that comprise high school algebra in an urban public school district.

In this paper I discuss two types of tools: a mode of inquiry, and a stance or perspective. Specifically, I elaborate a method of self-study and creative expression that I have employed for personal and professional growth toward individual transformation. Figure 1 is a visual abstract for this paper and an example of this type of visual expression; Figure 2, in a similar fashion, captures the purpose of this paper in visual and textual form. As an emergent finding of employing this method, I introduce a heart-centered stance that involves awareness of multiple dimensions of experience of self and others, and receptive relations in community spaces.

My evolving relationships with algebra teachers in my local community, as well as my own self-study and professional growth, fuel my writing. I draw inspiration from a drive to introduce greater opportunities for mathematical inquiry in algebra classrooms, which are important spaces for all community members including parents, teacher educators, leaders, teachers, and students. I believe that for a student to engage in mathematical inquiry, they must be positioned as agents of their own learning, and given opportunities to ask questions, explore alternatives, and construct their own interpretations and practices to engage in mathematical experiences that are connected to their experiences, perspectives, language practices, and contexts. In this framing, students' experiences, contexts, cultures, language and social practices are centered before content (cf. [4]). This paper represents an initial step in a longer-term trajectory of exploring how my work as a mathematics education researcher might support the co-creation of this vision of mathematical inquiry with teachers, students, and community members.

Figure 2: A sketchnote of the two-fold purpose of this paper to: (a) introduce a method and (b) elaborate a framework in moving toward a better understanding of school algebra and my role in affecting change in this place as a mathematics education researcher, teacher educator, parent, and community member.

1.2. Structure of This Paper

I open by sharing the context of school algebra from my perspective based on the experiences I have had in interacting with two high school algebra teachers and their students in urban school classroom spaces. I share these stories with the intention of humanizing the nature of school algebra, a particular place within the system of schooling, our communities, and the field of mathematics education. These stories help set the stage for the methods and key findings.

In the sections that follow, I briefly introduce a self-study methodology and a method of creative visual expression through sketches, videos, and art collage. I have used these methods to make sense of the issues, contexts, and experiences of the teachers and students I interacted with from the opening context. I then introduce two tenets of a heart-centered stance — multidimensionality of experience, and receptivity to relatedness — that emerged from this introspective study. I exemplify these two tenets through two vignettes.

The vignettes illustrate how I have used the heart-centered lens in my interactions with the two ninth-grade algebra teachers and their students, and how my own research agenda is shifting in relation to these glimpses into meaningful math learning. I close with a discussion of how one might adopt a heart-centered stance to further illuminate a humanistic view of school algebra.

2. Situating High School Algebra in an Urban Public School District

The interested scholar, student, parent, administrator, or teacher can learn a great deal about the context of school algebra by investigating various challenges and issues through careful readings of research reports, policy reports and standards documents, or headlines in newspapers about failure rates and test scores. In another approach, by reaching out to, observing, and having prolonged conversations with high school algebra teachers and students in one's local community, one can begin to uncover a part of the story of school algebra that textures and provides nuanced understandings to the complex nature of school algebra that is seemingly absent in such aforementioned reports. In the following, I share some of what I am learning from two ninth-grade algebra teachers, whom I call Ms. B and Mr. JR, on their experiences of the realities of school algebra in an urban district in the Northeastern United States. I focus these stories on the issues, tensions, and experiences these teachers shared that communicate some of the challenges they face, and questions they have asked.

Ms. B and Mr. JR teach in different high schools, serving different populations of students in the same urban public school district. By “urban” I mean geographically in a city that has a population between 100,000 and 250,000 people [21]. In this particular district, a total of 19,668 students were enrolled in the 2017-2018 school year, with 88% of students (17,317 students) classified as economically disadvantaged, and 6% of students classified as homeless (1,246 students). This district serves predominantly minoritized groups²,

² In my use of the term “minoritized”, I follow I.E. Smith’s definition: “groups that are different in race, religious creed, nation of origin, sexuality, and gender and as a result of social constructs have less power or representation compared to other members or groups

with 49% of students in this district identifying as black or African American (9,737), 13.4% Hispanic (2,626 students), 7.5% Asian or Native Hawaiian / Other Pacific Islander (1,498), 1.1% American Indian or Alaskan Native (212), 6% Multiracial (1,208) [25, 26].

2.1. Poverty and Absenteeism; Can Mindfulness Support Student Engagement?

There are three central issues that Ms. B perceives as related to the landscape of algebra education in high school: poverty, trauma, and stress. One of Ms. B's students shared, "I have so much stress." In this high school, of the 1,854 students, about 80% of students are taking algebra in ninth-grade. Teachers, and more broadly the whole school staff, struggle to support students in attending school regularly. In Ms. B's words, there is "chronic absenteeism," which suggests that the school is struggling to provide systematic supports to overcome this long-standing challenge. Ms. B also spoke of the challenge of engaging students in meaningful ways in the classroom. She reflected on some of the strategies she uses to actively engage students during instruction. For example, Ms. B is exploring "How can mindfulness support students' productive disposition in algebra?"

After classroom observations and meetings with Ms. B, where she articulated a goal of supporting more students to enter the "STEM pipeline", I created the visual (Figure 3) as an expression of how Ms. B communicated the "landscape" of algebra education.

2.2. Tensions in Teaching for Passion in a High-Stakes Testing Environment

In my early conversations with him, Mr. JR shared that this was his second year teaching at a high school in the district; he had previously been teaching for over 15 years at various high schools, including high schools in the suburbs, at innovative schools, and in urban public schools in other cities. From Mr. JR's perspective, the nature of the Algebra Regents³ exam is consuming.

in society" [31].

³ In New York State, the Board of Regents has set the policy that "Any student who in the 2013-14 school year or thereafter, regardless of grade of enrollment, begins his or her first commencement-level math course culminating in a Regents Exam in June 2014 or later

Figure 3: A sketchnote of Ms. B's description of the landscape of school algebra.

According to the Educator's Guide, the Regents Examination in Algebra I is rigorous; "students will be expected to understand math conceptually, use prerequisite skills with grade-level math facts, and solve math problems rooted in the real world, deciding for themselves which formulas and tools (e.g., graphing calculators or rulers) to use" [23, page *iv*]. All students are required to pass the Algebra I Regents exam in order to earn a high school diploma. In the school district where Mr. JR and Ms. B teach, of the 2,460 high school students who took the Annual Regents (2017-2018), only 944 (or 38%) passed the Algebra I exam [25].

must take the New York State CCLS Regents Exam in mathematics that corresponds to that course, as available, and be provided with Common Core instruction. Most typically, this first course will be Algebra I (Common Core)." [24].

Mr. JR described himself to have been stymied by a system that is designed to weed out students based on their test scores; a system that is designed to weed out teachers who don't prepare students to get high test scores; a system that is funded based on student performance on a narrowly construed examination that barely scratches the surface of measuring students' capabilities and promise as individuals.⁴ At the time of this work (Spring 2018), Mr. JR expressed the great difficulty he was having in transitioning from an innovative, project and internship-based school to going back to teaching in a traditional model. He elaborated his sense of a "dichotomy" between teaching for the test versus teaching for mathematical passion and quantitative reasoning. With the reality of the standardized test and Regents Exam in Algebra I Common Core, he was facing real tensions in his instructional approach to working with youth. One of Mr. JR's students in Fall 2019, who self-identified as a non-native English speaker, said she had heard of the Algebra Regents exam, and heard from other students that it's hard. She reflected that she's not yet worried about the exam because she hadn't taken it yet; the exam was still several months away.

2.3. An Evolving Understanding of School Algebra and Open Questions

What I was observing in these two classrooms, and hearing from two teacher's perspectives, is how broader factors are at play in their educational contexts. Ms. B was attuned to the economic and social inequities and injustices affecting her students, which to her, play an important role in shaping students' engagement in school algebra in particular. For Ms. B, poverty is an important socio-economic issue that impacts her students, and thus her teaching of school algebra. According to 2018 Census data on the city in which Ms. B and Mr. JR teach, about one third of the population of this city lives in poverty. For Mr. JR, the focus on standardized testing as an important education policy in this school district was adversely affecting his teaching by stymieing instructional creativity and mathematical inquiry. The system of testing in New York State is carried out according to a policy mandate [25],

⁴ In examining enrollment data, a devastating trend is observed when comparing total district wide enrollment in 9th grade (2,154 students), to total enrollment in 10th grade (1,545 students), a loss of 609 students.

and is adversely affecting under-resourced schools that predominantly serve minoritized populations. Mr. JR is committed to developing relationships with students, who come from diverse contexts and use diverse language practices; he is aware of his role in the system of testing.

At the time of my observations and conversations with these teachers, their awareness of broader social issues and inequities were quite acute and very much alive in their classrooms. Both teachers reported feeling great tensions in their teaching practice and recounted myriad difficulties. In learning of these teachers' nuanced perspectives of the complex realities of school algebra in these schools (summarized in the visual presented below as Figure 4), I was left with many open questions. I aimed to relate to these experiences, yet didn't see a clear path forward. As a researcher, I was trained to design and study how curriculum and instruction might support students' meaningful learning of big ideas of algebra and algebraic thinking. I wondered: how can I better *understand* this context from teachers and students' perspectives?; what is my role in affecting *change* in this context?

Figure 4: A sketchnote summarizing the broad landscape of school algebra inspired by two algebra teachers' stories of their school contexts.

3. Self-Study Method

Self-study focuses on improvement on both the personal and professional levels [17]. Self-study builds on the personal processes of reflection and inquiry, and takes these processes and makes them open to public critique. Given that the focus is on the self, self-study research requires openness and vulnerability. Finally, self-study is designed to lead to the reframing and reconceptualizing of the role of the teacher. LaBoskey [15] emphasizes the multiple characteristics of self-study as follows: “it is self-initiated and focused; it is improvement-aimed; it is interactive; it includes multiple, mainly qualitative, methods; and it defines validity as a validation process based in trustworthiness” (page 817). Self-study researchers use their experiences as a resource for their research and “problematize their selves in their practice situations” with the goal of reframing their beliefs or practice [5, page 971]. Self-study tends to be framed through the question or concern under consideration so that it invokes the use of a method(s) that is appropriate for uncovering the evidence in accord with the intent of the study [19].

A guiding aim of the self-study I report in this paper was to better understand how my perspectives and practices could be related to an agenda for mathematical inquiry in urban public high school algebra classrooms. Said otherwise, through this self-study, I was aiming to better understand my role as a mathematics education researcher, teacher educator, and community member in advancing an agenda for change in school algebra toward mathematical inquiry in partnership with teachers, students, and community members. I hypothesized that if I better understood and made my own perspectives explicit, I might improve my ability to connect more deeply with and gain a better understanding of others’ perspectives as a grounding for collaborative change.

3.1. Creative Processes

I engaged in cycles of self-study and reflection over an extended period of time during observations, interactions, and the writing process (July 2017–May 2020). I employed multiple artistic modes of expression including collages, sketchnotes, video, poetry, and personal history journaling (cf. [15, 18, 30]). Other data sources I used include observational fieldnotes and art.

In Spring 2018 I conducted five classroom observations of two different algebra teachers (Ms. B and Mr. JR), and subsequently engaged in reflection through the creation of sketchnotes and drawings.

Largely, my creative process involved a stance of interrogation and empathy (Figure 5a), with a desire to balance visuals and text. In this process, I engaged in introspection and a process of visual sense-making. This creative process was focused on processing experiences in a visual format, acknowledging that active introspection can bring forth wisdom. “I often search outside myself #habit when really the answer lies inside of me #introspection #wisdom” (Figure 5b).⁵ In the method of creative expression explored in this paper, both the process of creative expression and the products of that process are important.

Figure 5: Expressing introspection through creative processes of interrogation and empathy with text and images.

⁵ Given their prominence in social media (e.g., Twitter, Instagram), the hashtags (#) are used in this paper to symbolically represent a call for deeper connection to others engaged in reflection and conversation about their habits, introspection, and wisdom.

3.2. Positionality and Reflexivity

Processes

Positionality is partly a description of an author's worldview [6] that articulates some of the dimensions involved in how one sees and interacts with the world (cf. [13]). A statement of positionality tends to include a description of the self in relation to the subject being studied, the participants of the study, and the research context being studied through a particular process [12]. It also tends to account for personal beliefs, values, cultural orientations, and life experiences. Reflexivity is a process of engaging in an awareness of one's own role and positionality in relation to their research [12]. Foote and Bartell [6] emphasize the importance of explicitly addressing how one's own life experiences are in relation with the research being conducted, and how one's identity may introduce potential biases to the research.

Illustrated in the visuals in Figure 6, the process of reflexivity and awareness of one's positionality are significant components of consciousness raising. Particular attention is given to behavior (how do you act), world view (how do you see), and ethics (what do you believe?) [7]. Said otherwise, reflexivity is a process of active reflection on positionality that can make visible the invisible.

Figure 6: Reflexivity and positionality.

As such, throughout the research reported in this paper, I was engaged in a reflexive process of understanding my role and world view in relationship to the participants and contexts I was studying. Following Foote and Bartell [6], I gave explicit attention to both similarities and differences between my own experiences, context, and identity on the one hand, and the research setting, and research participants on the other.

Engaging in reflexivity and expressing positionality were creative processes. Consider Video 1 below, an expression of the active construction of ideas through piecing together images and text.

Video 1. Reflexivity and Positionality, available at <https://youtu.be/VWD8cNTVTlw>, last accessed on January 21, 2021.

Researcher positionality

I identify as a White female mathematics education researcher, mathematics professor, and mathematics teacher educator. I believe that the world and all humans in the world are in symbiotic relation (nature of social reality), that an individual constructs her/his own reality in relation to their experiences and what is deemed viable according to their current schemes and operations (nature of knowledge), and that all humans experience suffering (human nature). In the construction of individual experience, meaning is a creative act. I believe that it is paramount to provide spaces and places in education wherein our children can unfold into their full potential. An important aspect of my identity as a mathematics education researcher is to seek to understand and transform the opportunities students have for meaningful mathematics learning in classroom spaces in the communities I live in.

My own experiences in mathematics classrooms feel quite different than those of the teachers and students whom I observe and interact with in my local community. As an algebra student, I was intrinsically motivated to learn math, competed with others in my class to earn the top grade, and did not feel pressure to perform on high-stakes exams. As a former algebra teacher, I taught in a private high school, with mostly white students and white teachers, and in a public high school, with mostly non-white students. At the time of my teaching, there were no mandated pressures to prepare students to perform well on high-stakes tests.

Most of my academic experiences while being indoctrinated to the field and profession of mathematics education research focused on curriculum, student cognition, and instruction. My interactions with research participants (ninth-grade algebra teachers and students) focused on issues of curriculum and instruction and student thinking (e.g., how could we co-design lessons that would support students' mathematical thinking?). Later, during my post-doctoral research and training, I learned new theoretical and philosophical orientations toward education. Notably, Gloria Ladson-Billings introduced me to theories of culturally relevant pedagogy (e.g., [16]), and the importance of centering on student experience as key to the work of teaching. I also learned curriculum theories from Michael Apple, and the political nature of curriculum and standards. I was also deeply engaged in yoga, and learned the power of mindfulness as a form of healing practice in day to day living, including education.

My experiences as an algebra student and teacher, doctoral student and postdoctoral researcher, have shaped both my worldview on the sociopolitical nature of schooling, and the connectedness of human experience through suffering (traumas) and healing practices. Now, while engaging with teachers and students in my local community, I am attuned to teachers' discussions of the sociopolitical and relational dimensions of their teaching. I am also biased in paying attention to the curricular and instructional decisions teachers and administrators make, the presence or absence of student voice and mathematical reasoning, and the nature of teacher-student relationships in spaces that may or may not promote healing and growth.

4. A Heart-Centered Stance

In this section I introduce a heart-centered stance that emerged from self-study, that takes openness and relatedness as core in human experience in the context of mathematics teaching and learning. One tenet of this stance is consciousness of multidimensionality of experience. A second tenet of this stance is receptivity to relatedness. The roots of this lens have ties to the notion of consciousness-raising (e.g., from traditions of mindfulness, cf. [14]) and the ethics of caring; by becoming more aware our own experiences, we can become more present to relating to others' experiences (see also [27]).⁶ See Figure 7.

Figure 7: A sketchnote of the tenets of a heart-centered stance.

⁶ Editor's note: Also see "Motherhood and Teaching: Radical Care" by K. Simic-Muller (*Journal of Humanistic Mathematics*, Volume 8 Issue 2 (July 2018), pages 188-198; available at <https://scholarship.claremont.edu/jhm/vol8/iss2/21/>) for a related notion: radical care.

4.1. Multidimensionality of Experience

Figure 8 visually elaborates a conceptual frame of multidimensionality of experience, with an individual at the center with the cognitive dimension emanating as the z-axis, an emotional dimension emanating as the x-axis, a social dimension at the y-axis, and a body awareness dimension at the center origin. The dimensions of experience and learning identified in this frame include: (a) a cognitive dimension of “I am thinking”; (b) an emotional dimension of “I am feeling”; (c) a social dimension of “I am participating in practice”; and (d) a body awareness dimension of “I am sensing.” This conceptual frame guides my perception of my own experience and of others’ experiences as multifaceted.

Figure 8: Conceptualizing multidimensionality of experience and learning.

This multidimensional lens aligns with theories of learning that account for a complex interplay of emotive (feeling), cognitive (thinking), and social (cultural participation) dimensions of learning (e.g., see [11, 20]), and even bodily sensations through embodied cognition (e.g., [22]). Developing an awareness

of the multiplicity of dimensions of human experience—both in one’s self, and in others—may require a process of consciousness-raising. I explore some of the reflective processes I’ve pursued from this lens toward individual transformations and growth as the basis for meaningful mathematics education.

4.2. *Receptivity to Relatedness*

Receptivity to relatedness means being open to connecting to another human being by interacting, listening, asking questions, and being present. From this stance, the work is to be present to experience, without judgement; assuming a non-judgmental awareness, a key aspect of practicing mindfulness [14]. At the core of this tenet is perspective taking. I believe perspective-taking is an essential act of connection, or relatedness. While practicing a moment of caring, one engages in perspective taking; to see things as another sees and feels them [27, page 32]. As Paolo Freire writes in *Pedagogy of the Heart*, “To be in the world necessarily implies being *with* the world and *with* others” [8, page 4, emphasis in original]. I understand this to mean, in part, consciousness-raising and connecting as human beings.

The heart-centered lens is an organizing construct intended to help make sense of mathematics teaching-learning situations by foregrounding the complexity of human experience and human relatedness. By working toward cultivating a better understanding of one’s own experience as multidimensional, we might come to develop a stronger ability to cultivate relatedness toward others. Said otherwise, by knowing ourselves through multiple dimensions, we can in turn see others through those same dimensions or lenses.

5. Learning to “See” Through a Heart-Centered Lens

In this section I share two vignettes that exemplify a heart-centered stance toward teaching and learning in school algebra. I begin in the context of Ms. B’s classroom to introduce Vignette 1, on mindfulness in mathematics. This vignette focuses on applying a lens on multidimensionality of experience. Second, I return to Mr. JR’s classroom to discuss teacher and student experience through Vignette 2, which focuses on the practice of relational receptivity.

I close this section with some reflections on vulnerability, voice, and shifts in discourse. These reflections focus on how a heart-centered lens is supporting an individual transformation and expansion of my research program in mathematics education. Table 1 summarizes the content of this section.

Table 1: Vignettes and Reflections Illustrating a Heart-Centered Stance.

Vignette / Reflection	Summary	Interpretation
Vignette 1: Multidimensionality of experience in Teaching Mindfulness in an Algebra Classroom	Ms. B's teaching of mindfulness in the algebra classroom resonates with students' affective experiences in school such as stress, and calmness.	Mindfulness is a tool that can help one gain insight into the cognitive, bodily, emotive, and social dimensions of being. Breathing and mindful listening are self-care practices that seem to support students' release of stress and sense of calm in an algebra classroom.
Vignette 2: Relational Receptivity in Teacher-Student Relationships in an Algebra Classroom	Mr. JR feels great pressure to prepare students to pass high stakes tests. He builds close relationships with students that guide his lessons, and connect his interests to algebra.	The connections teachers and students form are central to meaningful teaching and learning of algebra. These receptive relations are an important grounding for meaningful learning in school classrooms.
Reflection: Individual Transformation and Expansion of a Research Agenda in Math Education	A heart-centered lens broadens what and how I see in making sense of the classroom learning contexts in school algebra. As a result, my research agenda is shifting.	Being present to and reflecting on the lived realities of teachers, students, administrators, and community members provides an important grounding for my individual transformation. This guides my decisions as a researcher who aims to improve school algebra in my community.

5.1. Vignette 1: Multidimensionality of Experience in Teaching Mindfulness in Mathematics

Mindfulness in Ms. B's algebra class

This vignette focuses on better understanding the tenet of multidimensionality of experience as evidenced in Ms. B's classroom, and her teaching of mathematics and mindfulness. Recall the stories and experience Ms. B shared

about high school students' experiences, and the description of the landscape of school algebra. In Ms. B's case, she perceived a great need to support her students in more than just mathematics, especially, for example, for students struggling with trauma.

Ms. B has introduced mindfulness practices such as deep breathing, and relaxing to the sound of a chime, in order to create a sense of calmness in her algebra classroom. One activity she used was Mindful Listening: "Listen to the sound of the chime. When you can no longer hear the chime, raise your hand." I had the opportunity to observe students during this lesson, and later have conversations with some of Ms. B's students on the day before the Algebra Regents exam. I asked a small group of 9th grade students, "How did the mindfulness activities go for you this year?" One student said "I have so much stress. They help me be less stressed." When I asked "How do you like the mindfulness activities?", another student said "I really like them. They help me calm down." Of the 29 algebra students Ms. B polled in June 2018, on average, students rated their enjoyment of the mindfulness listening activity (chime) at 67 out of 100. Students also think that other ninth-graders will benefit from mindfulness, with an average rating of 70/100.

Why mindfulness in mathematics?

Mindfulness in education continues to gain traction as a mainstream approach to supporting emotional well-being of students and teachers in classrooms (e.g., see [32] for a meta-analysis). Another oft-cited goal for teaching mindfulness in education is to improve social-emotional intelligence. Perhaps such efforts would be productive in working toward a vision in mathematics education that does not lead to students' disaffected mathematics identities and anxieties, and instead leads to meaningful engagement for all, a more humane course for students and teachers [1].⁷

From a heart-centered stance, practicing mindfulness in mathematics might expand one's awareness of the multidimensionality of doing mathematics in

⁷ Editor's note: Also see "On Contemplation in Mathematics" by F.L. Wolcott (*Journal of Humanistic Mathematics*, Volume 3 Issue 1 (January 2013), pages 74-95; available at <https://scholarship.claremont.edu/jhm/vol3/iss1/7/>) for more on contemplative practices in the mathematics classroom.

classroom spaces. For instance, I have gained a heightened awareness of student experience in an algebra classroom that extends beyond the cognitive domain of thinking and reasoning, the social domain of participating and discussing, to the affective and physiological domains of feeling and sensing (See Figure 9).

Figure 9: Practicing mindfulness is one way to expands one's awareness of the multidimensionality of experience in mathematics classrooms.

Multidimensionality of experience vignette summary

From a heart-centered stance, it is not for me to judge or qualify the experience of teachers and students, but rather to be open to receiving their experience with compassion and kindness. It is from this compassionate stance that I have a greater sense of the need for reciprocal action or action that works together with those whom I serve, not for my own best interests. Perhaps this vignette points to a great opportunity to support trauma-informed care in the mathematics classroom. Just as the 9th grade algebra student reflected that mindfulness activities help them feel less stressed, one can consider mindfulness practices as healing practices. Through my own processes

and journey of active healing — which includes mindfulness practices — I have become more aware of the possibility that others may be suffering from and actively healing their own traumas as well. Such work may involve introducing mindful breathing in the math classroom, and creating environments that promote human connection and ease through lighting, and sound (see Figure 10).

Figure 10: Healing trauma-informed care: actions and environments.

I summarize these theory-informed practices, and the creative process through which the ideas emerged in Video 2 below.

Video 2. Mindfulness, Kindness, and Healing, available at <https://youtu.be/OATWCSnIq6E>, last accessed on January 21, 2021.

5.2. *Vignette 2: Relational Receptivity and Reality Math*

Recall some of the tensions expressed by Mr. JR on the reality of preparing students to pass the Algebra Regents exam and the desire to teach for mathematical passion. Mr. JR expressed a sense of fear and extreme pressure around the need for teachers to prepare students to successfully pass the exam, a gatekeeper for high school graduation and entry into STEM college or career pathways. The goal in this vignette is to share some examples of how I've observed and interacted with teachers and students that express the tenet of relational receptivity in classroom spaces. The tenet of relational receptivity between two individuals means to be present in relation to another person, to seek to understand and/or build a connection through interaction.

Reality Math

Mr. JR builds relationships with his 9th grade algebra students and regularly seeks to connect to their experiences, the communities they live in, and current events. This philosophy is aligned with a perspective on reality pedagogy ([3, 4]; also see Video 3) in that engaging students in meaningful learning means teaching based on the reality of students' lived experiences. To do this well requires openness to others' perspectives and experiences. It involves providing platforms for students' voices to be heard, with the goal of connecting the kinds of learning experiences that are happening in and out of school.

Teaching from a reality pedagogy perspective means being humble, positioning oneself as a content expert, and also seeking to be in relation with students, to better understand the lived multidimensionality of their experience.

Video 3. Reality Pedagogy for Math, available at https://youtu.be/OpCGNY15o_s, last accessed on January 21, 2021.

In my interactions with Mr. JR and his students, I have aimed to seek out possible connections between theoretical lenses on students' meaningful learning and the teaching-learning experiences occurring in schools. Part of the work from this perspective is to: (a) amplify and listen to youth voice on their experiences of algebra, and (b) narrate our own understanding of tensions and potential for transformative practices in algebra.

Figure 11 introduces a visual reflection on my observations of Mr. JR's classroom in Spring 2018. Notice Mr. JR's storytelling, student discourse and perceived engagement, as well as the bigger questions I was wondering, such as "What risks are palpable to support sense-making and meaning" in this context? Mr. JR expressed a sense of cultural sensitivity in his conversations with students. With a sense of kindness and openness, he drew on the language practices of his students and connected to students' contexts. Mr. JR drew on cultural practices that were relevant to his students' interests, such as baseball and music. He also designed lessons to unveil some of the social patterns in the city, such as white flight in the history of students' neighborhoods.

In his classroom, Mr. JR regularly invites students to voice their ideas and perspectives on mathematics and on broader topics and issues, such as their interests in sports and music, the variety of languages they speak.

Figure 11: Context: Stifling nature of high-stakes test, what risks are palpable?

In one instance, for example, Mr. JR engaged one-on-one with a student who speaks Korean, to elaborate the meanings of mathematical terminology in multiple languages. In another example, Mr. JR asked the students who played sports to give relevant data from their experiences to inform the problem. In one interchange, Mr. JR. engaged students in a discussion of contexts relevant to their experience that tied to the mathematics lesson:

Mr. JR: What is your shooting percentage?

Student: 2 for 3 or 4 for 6

Mr. JR: Ok, so about 66%. Will the coach give her the ball?

Students: Yeah, percents matter.

Mr. JR: This is why I like stats.

I see this work as having great potential for reimagining the dreams and possibilities of public education in our city and state with a focus on engaging youth, teachers, and researchers in collaboration and community to expand what it means to teach and learn mathematics in meaningful ways (Figure 12).

Figure 12: Innovator's Compass: Principles, dreams, design, discover.

Relational receptivity

From a receptive stance, my goal is to be present in a non-judgmental way to the realities of school algebra for these students and teachers. Over time, with systematic reflection on experience (of my own, of students, of teachers),

I intend to shed light on how elements of being with the world, and with others (cf. [8]), can ground transformative practices in otherwise restrictive spaces. My hypothesis is that by deliberately creating open spaces for students to engage with mathematics in less scripted ways, from a heart-centered stance, and by inviting students to unfold, telling their stories through photos and narrative, can provide a grounding for transformative change (see Video 4). As Christensen [2] writes, narrative writing is the center of a social justice classroom (see Figure 13).

Video 4. Mathematical Expression (Heart-Centered Theory to Praxis, Part 2), available at <https://youtu.be/HsE9jlpTvUA>, last accessed on January 21, 2021.

Relational receptivity vignette summary

It is from being present to another's experience that individuals can build relationships that can guide meaningful action, such as improved opportunities for meaningful math learning in classroom spaces. For a teacher like Mr. JR, it can mean building classroom lessons that connect his own passion for mathematics with students' experiences outside of the classroom. For a math education researcher or interested community member such as myself, it can mean building relationships with teachers, students, or administrators who participate in the arena of school algebra, to come to better understand different perspectives and to move toward collective action toward change. Perhaps a reality pedagogy framework would be useful in guiding instructional interventions focused on student-centered inquiry in algebra.

Figure 13: A sketchnote of a Rethinking Schools article focused on narrative writing [2].

5.3. Reflections: A Shifting Research Agenda, Excavation of Dominant Discourses

From a heart-centered lens, I am seeing new aspects of meaningful math learning and teaching, and asking new kinds of questions that I hadn't considered before. Traditional perspectives on curriculum and student cognition seem to have veiled my eyes from seeing broader social structures of schooling, the implications of socio-political structures in particular cities and neighborhoods, and the rich nuances of teacher-student relationships in culturally diverse classrooms.

Asking new questions

While I have always framed my scholarship as aiming to contribute to a closer coupling of research and practice, I used to frame the issue of students' "failure" in algebra as something that needed to be "fixed." From a heart-centered stance, I now wonder:

How can my research agenda in mathematics education be crafted in ways that are truly responsive to and situated within the places, people, and contexts that I live in and engage with?

If I want to be committed to an agenda of linking research and practice in mathematics education, then a big part of my work should involve walking hand in hand through the struggle toward improved outcomes that are relevant and related to the experiences of teachers and students in my community. I am beginning to realize that we need to seek to better understand youth experience from more than social and cognitive dimensions on teaching and learning. I am beginning to see how the system of schooling, and policies on testing and accountability, play a large role in shaping the nature of the experiences students and teachers have together in school algebra classrooms. I am now asking:

How might I partner differently with students, teachers, and community leaders—in receptive relation—to better understand, center on, and support the rich complexity of students' multidimensional experiences in school algebra classrooms?

Having dedicated years to studying students' thinking and conceptions, and curricular and instructional innovations designed to engender change in cognitive structures, I found a vulnerable state of not knowing once I began to fully adopt a multidimensional lens on teaching and learning; see Figure 14.

In this visual, you might notice a reflection on a notion that both Ms. B and Mr. JR shared with me: "there is so much more than just math that I have to teach."

Figure 14: Shifting foci, doing what I cannot do yet to learn.

Individual transformation compels action

In light of the aforementioned individual transformation, one action is clear: presence. I assume an ethical responsibility for the current state of algebra education—and a responsibility to push back against a (perceived) culture of failure (Figure 15).

Figure 15: Making sense of experience: asking questions and identifying core issues.

I am responsible for being present in school settings, being present with students and teachers, and for being involved in the transformation of teaching and learning experiences. Moreover, beyond my presence as an individual, I am unveiling a more nuanced sense of my responsibility to take action toward understanding and addressing oppressive structures in the system of schooling. For example, by stopping to ask who makes the policy decisions, I can help to humanize the education system as a structure set up by a group of people with particular goals and intentions. How might a particular system of testing and accountability be perpetuating a fear-based, failure-oriented culture around the nature of school algebra? What is my role as a mathematics educator in shaping and directing this culture?

To begin to address these and related questions, I am working toward enacting new models of research-practice partnerships that center on participatory design (cf. [28]). These models begin from and center on the voices of teachers, students, and community members to ground our understandings of both the issues and challenges faced in school algebra, as well as the visions for collective change. I'm also learning to see how many of the issues Ms. B and Mr. JR identified in the landscape of high school algebra in this district may require a multiplicity of lenses: from a micro lens on an individual or relationship, to a macro or systems lens on the structures of schooling.

Summary of reflections

In this subsection, I've shared a self-reflection on how a heart-centered lens is shaping my work as a scholar. Video 5 below captures some of the expressive forms of journaling that supported this shift. This method of expression allowed me to uncover some of the aspects of my work and identity as a mathematics education researcher that were shifting. This process invited a personal excavation of how my training in mathematics education has further systematized the maintenance of dominant forms of discourse around cognition and instruction.

Video 5. Narrative Process, available at <https://youtu.be/VWD8cNTVTlw>, last accessed on January 21, 2021.

From a heart-centered lens, by seeking to better understand the contexts and culture of school algebra from the perspectives and experiences of students and teachers in school classrooms, I was beginning the work of individual transformation in shaping my research agenda and scholarly activity in mathematics education that might more directly contribute to and shape this culture in a way that is responsive and receptive to those experiences. This shifted lens has also invited me to ask new questions about how the political and social landscape of the current time and place have an impact on my work as a scholar.

6. Discussion and Conclusion

6.1. *Seeing Through a Heart-Centered Stance*

Seeing through a heart-centered stance on receptivity to relatedness and multidimensionality of experience has led me to new realizations about the nature of teaching and learning school algebra, and individual transformations regarding how I understand student outcomes in school algebra. I have learned from Mr. JR and his students the importance of teacher-student relationships and contextualized learning opportunities that link students' diverse experiences and language practices with content. I have learned from Ms. B. the great potential of socio-emotional learning such as mindfulness practices in school algebra classroom spaces as an important component of effective instruction, especially for students, like Ms. B's, who report having high levels

of stress. Broader than these two classroom spaces, I can now see how the seemingly poor performance outcomes of 9th grade students' Algebra Regents test scores (the mandated statewide measuring stick of teacher effectiveness and student learning) in one urban district are related to much broader social realities (poverty, learning multiple languages, policy decisions) that also manifest in classroom spaces.

As a researcher and interested community member, I'm showing up in classroom spaces with new understandings of how some students may experience schooling with high levels of stress, how other students may be negotiating between multiple language practices, and how teachers can design and adapt algebra instruction to meet their students' diverse needs and contexts.

I am also asking new kinds of questions. How are the educational outcomes in this urban district related to broader systems of power such as social inequities in this particular city? How might research-practice partnerships be tailored to systematically address some of these issues, and students' opportunities to learn? How might student voice be centered in curricular and instructional decision making? How might teachers and community members support students' experiences in school algebra that are related to their out of school contexts, diverse language practices, and that address their social, cognitive, emotional, and embodied experiences in school algebra classrooms? What new kinds of tools and practices might be needed to work on behalf of high school algebra students? These questions guide my ongoing investigations into school algebra in urban places, and further shed light on the need for a heart-centered stance to guide me on this journey. I do not have all the answers; the answers will be co-created together with the communities that I partner with.

Building new relationships from a receptive, non-judgmental stance

A heart-centered caring stance has guided me to develop a stance of non-judgmental awareness and open presence to others' experience, aimed at building a connection of human relatedness in the spaces and places of school algebra. Others interested in adopting a heart-centered caring stance might approach new (or existing) relationships from a place of curiosity, with an intention to "see a multidimensionality of experience" across cognitive, embodied, emotional, and social perspectives.

Seeing beyond test score data and implicit biases

Finally, I have also learned that in order to “see” the injustices of the system of schooling and the need for far greater resources to support the students in public schools, I need to be open to seeing from others’ perspectives. It is too easy to gaze (in the sense of [10]) at the test score data of urban school districts and to make assumptions about the preparedness or dedication of students (or their teachers) to succeed in a particular system of schooling. Instead, I have learned that I need to dig deeper beyond naming groups of students by numbers and percentages, and to learn new perspectives. In particular, I have learned that I need to see how the broader structures of our society may be perpetuating inequity that is manifested and borne on the shoulders of students attending under-resourced public schools (e.g., opportunities and access to affordable housing, opportunities and access to affordable health care, opportunities and access to sustained educational opportunities from young ages through adulthood, opportunities and access to higher education).

A heart-centered caring stance has guided me to explore the multidimensionality of human experience as situated in a much broader realm of social participation. By adopting a heart-centered caring stance, educators and researchers alike can be in receptive relation to another, open to others’ multidimensionality of experiences in a non-judgmental way. We need to open up spaces for transformation and for healing for those who are experiencing negative effects of an unjust system. In order to work toward transformation and change at a social level, I have found that I need to work toward individual transformation and change as well. For instance, without a heart-centered caring lens, I would not have developed and deepened my ability to see some of the ways that social structures are affecting classroom practices and experiences in school mathematics. In my example, individual transformation and change went hand in hand with my deepening understanding of experience from a multidimensional lens. It is from this new stance that I can more clearly focus on working toward improving the well-being of teachers and students in school classrooms.

6.2. Introspection and Creative Expression as Self Study

Mantras for guiding an introspective journey

For those interested in taking an introspective journey, I offer three mantras. First, remain curious and kind. Second, remain open and empathetic. Third, keep asking questions. These mantras have guided me in a journey of self-study that has led to individual transformation. These mantras continue to propel my work forward as I seek to better understand the realities of school mathematics in an urban public school district, as I seek to raise my own critical consciousness, and as I seek to change the opportunities students have to engaging in meaningful mathematics learning. Figure 16 is a visual manifestation of these mantras.

Figure 16: Mantras for guiding visual introspection: remain curious and kind, remain open and empathetic, and keep asking questions.

Creative expression and self-study

Self-study is a flexible methodological approach of making sense of one's own experience, personal transformations, or broader issues. The main self-study approach exemplified in this paper was that of creative free writing and expression through sketchnotes and visual reflections. For others interested in engaging in such a practice, I first recommend allowing the above three mantras to guide your work (i.e., remain curious and kind, remain open and empathetic, keep asking questions). Second, from this place of a curious, non-judgmental stance, allow the form of the ink to unfold on the page without expectation. Remain curious and open to what is shown. Third, develop free-writing or sketching as a regular practice. The ease of engaging in free expression will improve over time as it is practiced regularly (e.g., consider a daily five-minute practice). Sketching and synthesizing ideas can develop into a relaxing way to engage during conversations, meetings, observations of others' teaching, or lectures, as well as a nice way to start or end the day.

To move from the process and practice of engaging in free expression toward a critical self-study, start to identify the issues, aims, or questions that the expressive forms speak to. The examples of sketches in this paper were produced both in real-time and as reflections on experience. From a retrospective stance I learned that I was engaging in personal transformations to better understand my experience as it relates to others' experiences in my community schools. It was from a place of longing for connection that I experienced discomfort and unrest. I turned to self-study through creative visual expression to: (a) process that discomfort, and (b) retrospectively understand how those sketches and art work shed light on my role as a mathematics education researcher, teacher educator, and community member in advancing an agenda for change in school algebra toward critical mathematical inquiry.

Processing difficult experiences

When learning about the difficulties, fears, and traumas that teachers and students experience in school mathematics classrooms in my community, I have found it helpful to engage in practices such as sketching as an outlet for transforming those experiences into something beautiful. It is uncomfortable to learn that children in my community are living in poverty, are homeless, and are experiencing trauma. It is uncomfortable to learn that teachers such

as Ms. B and Mr. JR struggle to support the wholeness of students' needs in school mathematics classrooms, especially when confronted with the increasingly high pressures of testing and accountability that could ultimately have detrimental effects on students' livelihoods (e.g., not graduating high school). For others experiencing difficulty themselves, or for those who encounter others facing difficulties, I recommend processing that experience through an introspective free-writing exercise. In this form of "self-study," allow the pen to touch the page in a "free write."

An invitation and open questions

I close with an invitation and several open questions. I invite you to join me and conduct your own introspective journey through creative expression. How might free-writing or sketching illuminate key issues, help process difficulties, or serve as the basis for personal transformation around the teaching and learning of mathematics? I also invite you to consider how the tenets of a heart-centered caring stance—receptivity to relatedness, and multidimensionality of experience—may change your perception in the arena of mathematics teaching and learning. How might adopting non-judgmental lens toward your own and others' experience shed light on ways to deepen relationships, and undergo personal transformation? How might "seeing" the multidimensionality of experiences be a catalyst for deepening one's understandings of experiences from a new lens, and in turn be a catalyst for perusing social change?

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