CHAPTER 1

The Power of Humanizing Mathematics Education

This chapter presents a few examples of the powerful impact that humanized mathematics classrooms can have on students with disabilities. These are a few of many possible paths that teachers can take to better connect and engage their students in mathematics. If there is a "magic ingredient" across these examples, it is the practice of humanizing the work of teaching and learning as part of a belonging, fun, creative, mutually respectful, and inclusive set of interactions.

REFLECTIONS ON ENGAGING STRUGGLING STUDENTS

We invite you to reflect about your own practice. Recall a time when a student, who typically struggles in mathematics, was very excited to engage in mathematics. How did you feel? What kind of things did you do that were similar or different from your usual method? What would it take for this to become a regular occurrence with all types of students?

Prospective Teachers at Work as Observed by Paulo Tan

I often notice the power of humanizing mathematics education for students with disabilities in my own work as a field supervisor for university-based teacher education programs. I spend considerable amounts of time in classrooms, supporting prospective teachers in developing their mathematics practices. Often times, I notice that teachers of mathematics rely on teacher-centered instructional practices; that is, mathematics is taught directly through teacher modeling and guidance, and students are mostly listening, at times responding, but in general, mathematics procedures and knowledge are passed on to students from the teacher. You could think of this as the mathematics "for" students instead of mathematics "of." In turn, I wouldn't classify teacher-centered instruction as humanizing because students are not encouraged to draw from their own knowledge, their experiences, or their expertise. Instead, students are told what to learn and how. The mathematics content and procedures are disconnected from who they are and their interests as humans. As a

result, students are passively going through the motions of following the prescribed procedures. With this in mind, this is why I work with prospective teachers to humanize their mathematics classrooms. As they begin to do so, the mathematics classroom goes from being sterile and stale to one filled with excitement and deep, meaningful engagement in problem-solving. Students excitedly share mathematics ideas with the teacher and their peers and become immersed in learning mathematics. This difference is particularly noticeable for students with disabilities.

Students are told what to learn and how. As a result, students are passively going through the motions of following the prescribed procedures.

I recently observed a ninth-grade class, in which Ms. Haley, a prospective teacher doing her practicum, had begun humanizing her mathematics practices. The impact of this was remarkable! Whenever students are deeply engaged in mathematics, teachers of mathematics experience "the buzz" in their classrooms. That day, I certainly sensed this buzz as students were excitedly sharing their ideas about a mathematics problem with one another and were eager to learn from their peers. One of Ms. Haley's students was so excited and engaged in the mathematics activity that he even stayed after the end of the class to share his ideas with the teacher. In the end, Ms. Haley had to respectfully stop him short and nudge him as he was going to be late for his next class! Students had been working in small groups on solving the Rowboat problem (see below), which is an accessible yet rich mathematics problem posed by Ms. Haley. The student that stayed after class was one of several students in that class with a disability. Prior to this observation, I had noticed that Ms. Haley employed mostly teacher-centered instruction; that is, there were few opportunities for students to be creative and deeply engage with the mathematics, which negatively impacted the disabled students.

THE ROWBOAT PROBLEM

> Two adults and two children need to cross a river in a rowboat. Can you determine how to get everyone across, and how many crossings are needed, given the following information? All adults weigh the same. Each child weighs half as much as an adult. The boat can only carry the weight of one adult. The boat must have someone in it to row it!
>
> (The University of Cambridge, NRICH program, https://nrich.maths.org/11175.)

Later that day, I observed another class where I noticed similar student excitement and engagement as found in Ms. Haley's class. This was an eighth-grade class with about 25 students, including several with disability labels. Previously, I had encouraged the prospective teacher, Ms. Heejin, to provide more opportunities for students to draw on their own thinking and reasoning rather than having the teacher provide the mathematics knowledge. Ms. Heejin concurred and proceeded to develop a lesson exploring the Pythagorean theorem with the central question of "What is the relationship of the three sides of a right triangle?" using square-shape chewy candies (see fig. 1.1).

FIG. 1.1 MATERIALS THAT MS. HEEJIN USED FOR THE PYTHAGOREAN THEOREM EXPLORATION

Students with disabilities comprised a larger-than-typical proportion of the class; about 7 of the 16 students were identified as having a disability. As with most prospective teachers, Ms. Heejin had been mostly modeling the procedures used by more experienced teachers (i.e., teacher-centered methods of instruction). Moreover, in one of Ms. Heejin's university teacher education courses, she was guided to plan for disabled students by describing their deficits, needs, and how the lesson would be modified to accommodate them. However, with the Pythagorean Theorem lesson, she stepped back from this traditional method of teaching mathematics and its focus on her student's deficits and gaps in mathematics knowledge; instead she allowed her students the opportunity to explore and construct that knowledge individually and with their peers. As with Ms. Haley's class, the students in Ms. Heejin's class became excited and eager to explore mathematics. Ms. Heejin posed questions such as, "What do you notice?" and "How do you know?" so that students had a chance to think deeply about mathematics. Ms. Heejin's intentionally designed her lesson to be "low floor–high ceiling" (Boaler 2015), which broadens accessibility and draws on the mathematics of students. Several of the groups eventually came to the answers, all without the teacher directly telling them the mathematical

relationship between the three sides of a right triangle. More important, Ms. Heejin drew on the mathematics of her students.

For both Ms. Haley and Ms. Heejin, their efforts to humanize mathematics education for their entire class, which benefitted all the students , but especially disabled students, were by no means smooth and easy. Although both learned powerful learning theories in their university teacher education program, they were hesitant to implement them partly because of more traditional mathematics learning practices (i.e., direct instruction and modeling) that dominate most mathematics classrooms in the United States. On top of this, they received conflicting information about ways to engage disabled students in mathematics. On one hand, they were told to prioritize assessing their students' areas of deficits and remediating those through direct instruction, while on the other hand, I, as their field supervisor, was asking them to consider implementing more humanizing forms of practices. Nonetheless, I commend Ms. Haley and Ms. Heejin for navigating this divide[1] and for their courage to humanize mathematics for their disabled students.

Practicing Teachers at Work

Practicing teachers are also humanizing mathematics education. In an article titled "Countering Deficit Mythologies about the Potential of Students with Learning Disabilities in Mathematics,"[2] Rachel Lambert shares her experiences with Luis, a seventh-grade Latino student with learning disabilities and Luis's teacher, Ms. Marquez, who employed a humanizing mathematics curriculum during the first half of the school year, but during the second half focused on a more traditional form of mathematics to prepare students for taking the state tests. Lambert describes the difference between these two paths as striking. While Ms. Marquez treated mathematics as an exploratory discipline, Luis was engaged in classroom discussions and asked, for example, what infinity meant for the least common multiples. Ms. Marquez considered Luis to be one of her top students, excelling at conceptual thinking.

In contrast, when Ms. Marquez approached mathematics as more static during the second half of the year, Luis lost focus and interest. During this time, Ms. Marquez concentrated on direct instruction of procedures, and became less attentive to the mathematics of Luis.

Students take pride in the fact that they are working on courses like algebra and geometry.

Andrew Gael[3] another colleague, has worked with high school students with disabilities in New York for many years. Mr. Gael is a mathematics teacher who embodies the notion of presuming competence of every student in his classroom. He operates under the motto "be the

change you wish to see in the world." The power of Mr. Gael's work is clearly noticeable with disabled students in his classroom. They feel respected because Mr. Gael ensures they are working on mathematics that are worthwhile, rigorous, and challenging. Students take pride in the fact that they are working on courses like algebra and geometry rather than the rote learning on basic mathematics skills that were part of their previous mathematics experiences. His classroom includes students with various categorical disabilities such as autism spectrum disorders, Down syndrome, and speech language disorders. Mr. Gael's work is backed by research that indicates that challenging negative assumptions related to these disabilities can enhance powerful mathematics learning opportunities.[4]

The importance of authentic care cannot be overstated. Mr. Gael and other mathematics teachers like him genuinely relate to and are personally concerned for their students. Authentically caring for disabled students is a huge part of humanizing mathematics education. Yet, this aspect of teaching is very challenging given the increasing demands that are being put on educators. There is a big difference between authentic and aesthetic care (Rector-Aranda 2018). For example, in the United States, many would agree that teachers play an important role in our society. We pay lip service to this importance by stating things such as, "Teaching is a noble profession," or "Thank you for all that you do for our kids." But we do not follow through on this aesthetic gratitude with authentic care. That is, if we truly valued teachers as we say we do, then we would, at the very least, pay them significantly more, provide them with adequate resources to enhance their work and professional learning, and treat them as true professionals. Similarly, one may often hear educators speak of caring for their students or the importance of building relationships. This sounds nice and usually comes from a place of good intentions. However, without authentic action, these words qualify as aesthetic care. In other words, authentic care and action have to go deeper. In Mr. Gael's case, aesthetic care may be that he tells others that he cares about his students as mathematics doers and thinkers. However, Mr. Gael takes his aesthetic words much further by putting them into credible action. His classroom practices reflect an authentic mode of caring through humanizing the mathematics education of his students. He is also a champion for his students.

A Journey into This Work

We close this chapter by sharing one of Paulo's experiences.

"I will forever remember Dextor, who was a tenth-grade student that I worked with as an alternative school mathematics teacher many years ago. Dextor's story represents one path of how humanized mathematics education can have powerful outcomes. Before I start describing

Dextor's situation, I want to provide a little more background into how I came to teach at an alternative high school, which will provide more context into the work that ultimately occurred with Dextor as well as how my passion developed for my current work with disabled students and mathematics education.

"I spent ten years teaching mathematics in public middle schools and high schools in Kansas before I became interested in pursuing a doctorate in mathematics education full-time. It was also around then that my two-year-old son had been diagnosed as autistic. This was a very significant event in my life. It first meant temporarily pausing my doctoral studies, but once I resumed, it also shifted my focus to understanding autism and what this meant for education, broadly, and mathematics education, particularly. During this break in my studies, I decided to move my son and me from Kansas to Indiana. While in Kansas, I was interested in a 'proven' approach to 'treat' autism known as applied behavior analysis, or ABA. I realize now that ABA can be a very dehumanizing[5] form of treatment (which ironically contradicts what this book is all about). I also now realize the problematic nature of trying to 'fix' a disability. At the time, the cost of ABA treatment was astronomical—I simply could not afford it. Unlike other states, Kansas did not financially cover any part of the ABA treatments, which meant I had to pay those costs myself. My choice to move to Indiana was motivated by the state policy that required medical insurance companies to cover the cost of ABA treatment fully. Ultimately, the move to Indiana explains how I ended up working at the alternative school with Dextor.

"During my interview with the principal and vice principal of the school, I clearly remember the question that seemed to solidify the administrators' decision to hire me. They asked me about my approach to teaching mathematics for students who were placed there—essentially students who were unsuccessful in the regular schools. My response was based on what I had learned during my short time in the mathematics education doctorate program: that teachers have not been teaching mathematics well for a very long time. My response to the interview question was that all students and especially students who have repeatedly 'failed' needed opportunities to learn mathematics that were very different from the traditional methods typically found in schools. I contended that students who are 'unsuccessful' in learning mathematics in the traditional ways have not failed. Rather, we, as mathematics educators have failed them. Our teaching methods are ineffective and meaningless to them. What I proposed—which was not revolutionary by any means and has been known for a very long time—is that

Students in this alternative school needed opportunities to engage in exploratory, creative, connected, and meaningful forms of mathematics education.

students in this alternative school needed opportunities to engage in exploratory, creative, connected, and meaningful forms of mathematics education. That mathematics needed to be 'of' instead of 'for' them. The interviewers were clearly pleased with that response: their eyes lit up, along with enthusiastic head nods and big smiles.

"The alternative school in Indiana served students from grades 6 to 12, most of whom were diagnosed with a disability. Students understood why they were there, whether it was because they 'failed' academically or socially or just needed a different learning environment. Yet most would constantly express their desire to return to their regular home school.

"Dextor was a lighthearted, highly intelligent, and humorous tenth-grade student enrolled in geometry. He was also very motivated to return to his home school. Thus he eagerly wanted to get through all of the course credit requirements as quickly as possible. At first, I went along with his plan of action by teaching him and the rest of the class a concept from the geometry book and then assigning them practice problems. Dextor was usually the first to finish, mostly with the correct answers, and he was eager to advance without the rest of the class. I was pleased with his motivation and work ethic, so I allowed that to happen. This working arrangement progressed relatively smoothly until I realized that I had not stayed true to my commitment to teaching mathematics differently at this school. I was teaching mathematics along traditional lines.

"A few weeks into the school year, I abruptly informed the class that we would be approaching the mathematics teaching and learning in a different way than before. I began to pose geometry problems to the class to solve that had no clear solution or path to a solution, forcing them to think deeply and to work with one another. Students expressed their displeasure with this shift. Dextor led this effort by constantly saying, 'Just tell us how to do this,' 'This sucks,' or 'I'm not learning anything!' This shift was not only frustrating for the students but for me as well. I expected resistance and confusion, but I did not expect these feelings to last well into the second half of the school year. From Dextor's point of view, I was slowing down his progress, and he really did not like this new approach to learning mathematics.

"Things began to change for Dextor toward the end of the school year. He started to enjoy the process of solving open-ended problems. He came up with some novel solutions to these problems and asked me some really thought-provoking mathematics questions. He still 'got stuck' and became agitated often, but overall this different approach of mathematics education helped him to gain a deeper understanding of geometry. The positive outcomes made him really proud of himself, especially seeing, and at times being prompted to see, the powerful ways he was doing mathematics. This way of practicing and making sense of mathematics became more about him.

"Our class did not get through all of the content in the geometry textbook. Teachers and students often think that this ceremonial completion is what counts as completing the course. In fact, we were far from covering all of its content. Also, Dextor was never fully on board with this new mathematics education approach, at least not during the one school year that I worked with him. By the end of that year, he was expected to return to his home school to start his junior year, and I planned to return to my graduate studies full time. To this day, I still vividly remember Dextor and all of the successes and challenges that we experienced. In the end, I am confident that I would have never witnessed Dextor's unique ways of approaching geometry had it not been for the shift in my mathematics teaching methods. Using the traditional methods, I would have hindered the opportunities to showcase his thinking. Even if he fully engaged and we covered all the required mathematics content, much of that knowledge would not make any sense to him by the end of the school year or later.

"I taught using the traditional methods during the first eight years of my public-school teaching career, and I cannot help but lament the many students like Dextor I failed because I did not provide them with opportunities to engage with mathematics in an exploratory, belonging, creative, connected, and meaningful way."

Conclusion

The stories we shared in this chapter demonstrate the power that humanized mathematics education has for students with disabilities. Teachers are so crucial to this work. Ms. Haley, Ms. Heejin, Ms. Marquez, Mr. Gael, and our own relational work with students with disabilities in their mathematics classrooms illustrate effective paths that have been taken[6]. To reiterate: students with disabilities are mathematics doers and thinkers, mathematics belong to them, and we must resist the idea of disability as tragedy. If teachers of mathematics approach their work from these assumptions, then they will be met with much delight as we've described in this chapter. It is also important to come to this work with the understanding that there are many different ways of doing and thinking about mathematics that we do not fully understand. Mathematics, as we describe in chapter 2, is not just a set of facts and procedures. Mathematics is an ever-expanding human practice, and as such, there is so much that is still unknown. As we stated in the Preface, and it is worth stating again, the power of humanizing mathematics education lies in the opportunities that we afford students to show us how they are making sense of the discipline and how they may expand it. They are very eager and proud to do so!