PRESERVICE SECONDARY SCHOOL MATHEMATICS TEACHERS' PERCEPTIONS TOWARD STUDENTS WITH DISABILITIES: A PRELIMINARY INVESTIGATION

PERCEPCIONES DE FUTUROS DOCENTES MATEMÁTICOS DE SECUNDARIA HACIA ESTUDIANTES CON DISCAPACIDADES: UNA INVESTIGACIÓN PRELIMINAR

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Better understanding preservice teachers' current perceptions toward students with disabilities will allow mathematics educators to create specific strategies for helping students to develop perceptions promoting inclusive classroom environments. To access these perceptions, we developed an online survey that asks respondents about their knowledge of disabilities, their experiences with people with disabilities, and decisions they would make based on classroom scenarios that involve students with disabilities. We gave this survey to 14 preservice secondary school teachers (PSTs). Key findings include five PSTs presented an inclusive perception toward students with disabilities, seven PSTs presented an ambiguous perception and the perceptions of two PSTs remained unknown. All but the latter two PSTs provided at least some evidence of their willingness to fully include students with disabilities in their mathematics classrooms.

Keywords: Equity, Inclusion and Diversity; Students with Disabilities; Teacher Beliefs; Preservice Teacher Education.

Purpose of the Study

History reflects a progression through four views about the participation of students with disabilities in classrooms: exclusion, segregation, integration, and inclusion (Sónia, 2012). Currently, the goal is classrooms with an inclusive environment for students (Radd et al., 2021), which means that students with and without disabilities are considered contributing members in the learning process. This requirement is what makes inclusion different from integration, as integration—the current norm—is satisfied merely by the presence of students with disabilities in the classroom without regard to the nature of their participation. Mathematics teachers, in their role as instructional leaders, affect the movement from integration to inclusion in their classrooms. Specifically, teachers' perceptions toward students with disabilities can affect, either positively or negatively, the creation of an inclusive environment in their mathematics classrooms. Better understanding teachers' perceptions is essential to being able to support them in making the transition from integration to inclusion, and being able to support preservice teachers to develop an inclusive perception at the beginning of their career will accelerate the change process. To move toward this understanding, our preliminary investigation used a classroom-scenario-based online survey to access preservice secondary school mathematics teachers' perceptions toward students with disabilities.

Kosko, K. W., Caniglia, J., Courtney, S., Zolfaghari, M., & Morris, G. A., (2024). *Proceedings of the forty-sixth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Kent State University.

Theoretical Framework

Papadakis & Kalogiannakis (2020) defined teacher perceptions as "[t]he thoughts or mental images [that] teachers have about their professional activities and their students, which are shaped by their background knowledge and life experiences and influence their professional behavior" (p. 339). Following their definition, we use the phrase *mathematics teachers' perceptions toward students with disabilities* to mean "the thoughts or mental images that influence teachers' interactions toward students with disabilities" and assume that these perceptions are formed from teachers' background knowledge about disability and life experiences with people having a disability. The same definition applies to preservice teachers with respect to their future students.

To have a better understanding of teachers' perceptions toward students with disabilities, it is first important to understand their perceptions toward disabilities. This is why our framework (see Figure 1) addresses both types of perceptions. Perceptions toward disabilities focus on two things: (1) the medical, social, and revolutionary models of disability described in Tan et al. (2019; see Figure 2 below) as a way to categorize the conceptualizations teachers have of disability, and (2) which health conditions teachers recognize as disabilities. Our conceptualization of teachers' perceptions toward students with disabilities focuses on teachers' practice in the classroom around (1) their considerations toward students with disabilities in comparison to students without disabilities, and (2) their application of fairness, justice, equity, and human rights from the perspective of disability.

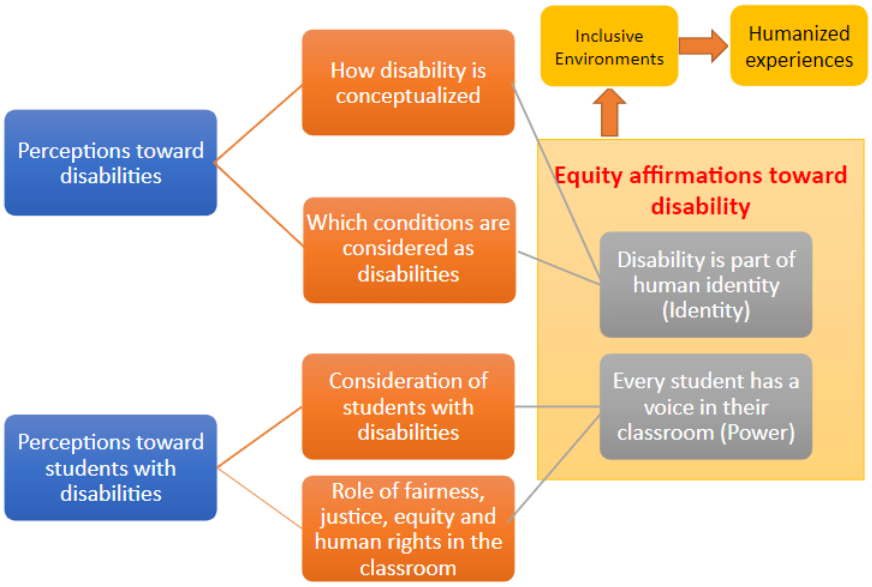

Figure 1: Conceptualization of Teachers' Perceptions toward Disabilities and Students with Disabilities (adapted from Romero Castro & Van Zoest, 2023)

We consider that teachers' perceptions toward disabilities or toward students with disabilities can be identified as inclusive if they promote inclusive environments in classrooms. Otherwise,

they are identified as non-inclusive. The right side of Figure 1 illustrates two equity affirmations toward disability that promote inclusive environments and increase the possibility that students will have humanized experiences in their mathematics classrooms. We take the perspective that (1) in order to have an inclusive perception toward disability teachers need to embrace the fact that *disability can be part of human identity,* and (2) to have an inclusive perception toward students with disabilities they need to hold that *every student has a voice in the classroom* (for more details, see Romero Castro & Van Zoest, 2023). These two facts are considered affirmations of equity toward disability, and they are related to Gutiérrez's (2012) two dimensions of the critical axis of equity: identity and power. Particularly, alignment of these equity affirmations with the critical axis of equity is the necessary condition for inclusion toward disability, whereas the relationship between teaching practice and the dimensions in the dominant axis of equity—access and achievement—is a sufficient condition for integration (Romero Castro, 2023). This can be explained by considering that the active participation of students with and without disabilities in the learning process (which requires students' identities to be considered) is what makes an environment inclusive rather than integrative. On the other hand, access and achievement will guarantee that students are present for all classroom activities, which satisfies the definition of integration.

Methods

An anonymous classroom-scenario-based online survey was designed to assess the current perceptions of mathematics teachers. We gave this survey to 14 preservice teachers (PSTs) at the end of a secondary mathematics methods course at a mid-western U.S. university. Before accessing the survey, the PSTs were asked to accept the conditions of a consent form appearing on the first screen of the survey link; all 14 people enrolled in the course accepted. The survey was created using the software Qualtrics (2020) and has three components. The first component assessed which conditions PSTs considered as disabilities. Although other studies have asked preservice teachers to explain their concept of disability (e.g., Mason & Connor, 2022), for our purposes, it seemed more useful to draw on the existing legal documents in the United States that require the integration/inclusion of students with disabilities that belong to certain categories. Specifically, we drew on the categorization of disabilities from the Individuals with Disabilities Education Act of 2004 (as cited in Radd et al., 2021). The PSTs were provided with a list of 12 health conditions and asked to indicate whether each was or was not a disability, or if they were "unsure." The health conditions listed were cerebral palsy, blindness, hearing impairment, leprosy, panic disorder, autism, sleep-wake disorder, Tourette syndrome, spinal cord injury, Down syndrome, oppositional defiant disorder (ODD), and depression; leprosy and sleep-wake disorder are the only conditions on this list that are not considered disabilities in IDEA. For each of the conditions in the list, teachers were also asked to identify whether they have the condition, they have met someone inside/outside the school with the condition, or they have not had exposure to the condition. They also were provided with the opportunity to enter other disabilities and describe their exposure to them. Babik and Gardner (2021) established that exposure since childhood to people with disabilities is one of the factors that positively affect perceptions toward them.

The survey's second component asked the PSTs to describe the nature of their experiences with people with disabilities. There are two questions related to this: one focused on their

interactions in their educational career (with teachers, school staff, classmates) and the other focused on their interactions with people outside of school. In each of these two questions, PSTs may choose if they have had only good experiences, at least one complicated experience, or no related experience in the respective environment. If they choose the second option, then they are encouraged to describe why it was complicated. In addition, they were asked to determine whether they felt "totally," "enough" or "not" prepared to be the teacher of a student with a disability. All these questions help to understand PSTs' backgrounds, which inform their conceptualization of disability and their perceptions toward students with disabilities in the classroom (see Figure 1).

The third component of the survey positioned the PSTs in two classroom scenarios and asked them to respond to mathematical contributions from students with disabilities during a classroom discussion. The first scenario involves Sam, a student with cerebral palsy who, after working individually on a geometric problem the teacher provided in class, publicly gives an incorrect answer. The second scenario involves Chris, a student with a mathematical learning disability who, after working with a group on an algebraic problem the teacher provided in class, shared the group's correct answer. As described in Romero Castro & Van Zoest (2023), each scenario is followed by a series of three questions, with each question having three to four choices and the option to write one's own response if it is not captured by one of the options. Question 1, "What first comes to your mind?" is intended to access the extent to which teachers embrace the complex nature of disabilities as being part of students' human identities (Figure 1: Equity Affirmation #1). For this question, they are asked to write their response before selecting the choice that best fits their response. Question 2, "What would you do next?" is intended to access the extent to which students with and without disabilities have a voice in the classroom (Figure 1: Equity Affirmation #2). The response to Question 1 informs the response choices for Question 2. Question 3, "Why did you choose that response?" is designed to access their justifications for their answer in Question 2 through a view of the student's identity.

For the analysis stage, responses to Question 1 were aligned to the models of disability's conceptualization described in Tan and colleagues (2019). Figure 2 shows a brief description of each model and example choices for Question 1 to illustrate how the response options in the survey support identifying a respondent's model based on their choices.

Model of disability	Description (Tan et al., 2019)	Example Response Choices for Question 1
Revolutionary	considers disability as part of a person's humanity and not something to be fixed "posits that mathematics belongs to all students, assuming that all learners, without distinction, are creative thinkers and doers in their multifaceted everyday experience of mathematics" (p. 39)	(Scenario 1) I need to figure out what Sam is thinking because there are multiple ways they could have gotten that wrong answer. (Scenario 2) I need to figure out what Sam is thinking because there are some reasoning ways they could have answered.
Social	"points to the deficiencies within the environment that contributes to the construction of the disability or impairment" (p. 37) "addressing disability issues becomes more a matter of social change rather than individual fixing or even curing or correcting biological or	(Scenario 1) Maybe this problem is too hard for Sam, so I should modify it to support Sam to get the right answer. (Scenario 2) I wish I knew more about Chris's mathematical learning disabilities so I would know how to help Chris more effectively.

	functional impairments" (p. 39)	
Medical	"locates the deficit, impairments, or disability solely on the individual" (p. 34) "the mathematics learning environment and socially acceptable classroom rules, expectations, and circumscribed ways of knowing and doing mathematics are thought of as adequate and are unquestioned" (p. 36)	(Scenario 1) That's a common answer, even a normal student might come up it because everyone comes to the class with their own conceptions or misconceptions. (Scenario 2) It feels risky to have Chris present the solutions because their mathematical learning disabilities prevent Chris from making sense of it.

Figure 2: Models of Disability and Their Manifestation in for Survey Response Choices

Based on the first equity affirmation we mentioned—*disability can be part of human identity*, the revolutionary model reflects an inclusive perception toward disability whereas the medical and social models reflect a non-inclusive perception. The analysis for the responses to the first question was set up to determine the respondent's perception toward disability in the following way:

- Inclusive when the revolutionary model is shown across both the written and selected responses to both scenarios.
- Non-inclusive when the medical or social models are shown across both the written and selected options respond to both scenarios.
- Ambiguous when the responses vary within or across scenarios.

Responses to Question 2 and Question 3 were analyzed to determine whether PSTs would consider people with disabilities for participating in class, from which it is possible to infer their perceptions toward students with disabilities (see Figure 1) in the following way:

- Inclusive when there is consistent evidence the respondent considered students with disabilities for class participation.
- Non-inclusive when there is consistent evidence the respondent would not consider students with disabilities for class participation.
- Ambiguous when there is inconsistent evidence about the respondent's consideration of students with disabilities for class participation.
- Unknown when there is no response to Questions 2 and 3 for both scenarios.

The survey responses were imported and organized into a Microsoft Excel spreadsheet by respondent number to support the analysis process.

Results & Discussion

Here we briefly discuss key findings for each of the three survey components. In the first component, cerebral palsy and blindness were the only health conditions identified by all 14 preservice teachers (PSTs) as disabilities, even though only five and nine of them, respectively, indicated past interactions with people having those disabilities. Autism and Down syndrome were identified as disabilities by 13 PSTs; one PST was unsure about Autism and said Down

syndrome was not a disability. In general, the PSTs identified legal disabilities as disabilities, or were unsure. For example, depression is legally identified as a disability (ADA, 2018) and eight PSTs identified it as such, four were unsure, and only two said that it was not a disability. Interestingly, one of the two PSTs who said depression was not a disability identified themself as having depression and the other as knowing someone who did. Eight PSTs in total identified themselves as having one of the listed health conditions: one with hearing impairment, two with panic disorder, and five with depression[4]. In addition, one PST entered that they had post-traumatic stress disorder (PTSD). Regarding interaction with others, 13 PSTs reported exposure to someone with autism, 10 for Down syndrome, and 9 for hearing loss. Interestingly, although five PSTs in the class reported having depression, eight of their classmates reported not having been exposed to anyone with depression, highlighting the invisible nature of depression as a disability. In addition to the health conditions on the list, one PST each entered that they had exposure to someone with the following: attention-deficit/hyperactivity disorder (ADHD), obsessive-compulsive disorder (OCD), multiple sclerosis, muscular dystrophy, hip dysplasia, and epileptic seizures.

For the second component, seven PSTs (50% of the sample) declared they had all good experiences interacting with people with disabilities *within* school relationships, while the other 50% declared having had at least one complicated experience. Among the reasons given by the PSTs who declared to have at least one complicated experience, the lack of preparation or knowledge about disabilities was the most common. For example, PST 10 wrote, *It was one of my first times working with a student who had a disability [autism], and I felt ill-prepared in helping them.* A different reason is illustrated by PST 6: *How the teacher thought about the student was a negative.* This PST did not identify any contact with a particular disability in the first component of the survey, but their answer implies that they could identify a teaching practice with a non-inclusive perception toward the student with a disability. PST 13 distinguished among different types of disabilities: *Sometimes, students who have disabilities can (not often) be disruptive to the class (especially those with neurodivergent ones). Disabilities that are purely physical are usually handled well by myself, classmates, and teachers*.

Similarly, six of the PSTs declared they had all good experiences interacting with people with disabilities *outside* school relationships, seven declared at least one complicated experience, and one had no experience. PSTs described complicated experiences around family issues and fluency in daily conversations. For example, PST 13 wrote: *Being friends/family with someone who has a disability can be hard. Of course, I do not downplay the dignity of that person. However, loving them takes effort on their hard days* and PST 8 expressed: *Sometimes I struggle with navigating conversations with people and worry about what I might say, so I get worried about saying the wrong thing to someone with a disability*. In the same survey component, one of the PSTs declared to feel totally prepared to be a teacher of a student with a disability, while twelve of them felt somewhat prepared and one of them not really prepared.

The results of the third survey component are organized in Table 1. We first discuss the model of disability that the PSTs' responses mapped to for each scenario and their resulting

[4] It is important to clarify that PSTs were not allowed to select more than one choice in the determination or the exposure parts. This is a design feature that we will modify in future uses of the survey so that respondents will be able to indicate both their own experience and exposure to others.

inferred perception toward disabilities. We then discuss the PSTs' consideration of students with disabilities and their inferred perceptions toward students with disabilities.

In Scenario 1, ten PSTs responses mapped to the revolutionary model, none to the social, three to the medical, and one presented as ambiguous. In Scenario 2, five mapped to the revolutionary model, three to the social, three to the revolutionary, and three presented as ambiguous. Table 1 shows that of the ten PSTs that mapped to the revolutionary model in Scenario 1, four mapped to the revolutionary model in Scenario 2, two to the social, one to the medical, and three presented as ambiguous. These differences in models across the two scenarios could be affected by the differences between the scenarios: type of disability (physical or non-physical), evaluation of the student's contribution (correct or incorrect), and type of work (individual or group). Considering the results, we conclude that four PSTs presented an inclusive perception toward disability, two PSTs presented a non-inclusive perception, and eight PSTs presented as ambiguous. The fact that only four PSTs presented an inclusive perception toward disabilities suggests that there is much work to be done to prepare teachers to promote an inclusive classroom. Furthermore, even PSTs who have an inclusive perception may need

Table 1: Analysis of preservice teachers' modeled perceptions toward disabilities and students with disabilities

PST #	Model of disability reflected (Q1)		Perception toward disabilities	Participation of students with disabilities (Q2 & Q3)		Perception toward students with disabilities
	Scenario 1	Scenario 2		Scenario 1	Scenario 2	
4	Rev	Rev	Inclusive	Yes	Yes	Inclusive
7	Rev	Rev	Inclusive	Yes	Yes	Inclusive
11	Rev	Rev	Inclusive	Yes	Yes	Inclusive
13	Rev	Rev	Inclusive	Yes	Yes	Inclusive
5	Rev	Med/Rev	Ambiguous	Yes	Yes	Inclusive
10	Rev	Med/Rev	Ambiguous	Yes	Missing	Ambiguous
2	Rev	Med/Rev	Ambiguous	Yes	Missing	Ambiguous
12	Rev	Med	Ambiguous	Yes	Missing	Ambiguous
14	Med/Rev	Med	Ambiguous	Yes	Missing	Ambiguous
9	Rev	Soc	Ambiguous	Yes	Missing	Ambiguous
3	Rev	Soc	Ambiguous	Yes	Missing	Ambiguous
6	Med	Rev	Ambiguous	Missing	Yes	Ambiguous
1	Med	Soc	Non-inclusive	Missing	Missing	Unknown
8	Med	Med	Non-inclusive	Missing	Missing	Unknown

additional opportunities to better understand disabilities. For example, PST 13 wrote in the blank box for Question 1 in Scenario 1: *The first thing that comes to my mind, without even reading the numbers yet, relates [to Sam's] perspective to the problem. Without solving and analyzing the error, I would wonder if Sam's experience with wheelchairs informs the solution*. Since

Scenario 1 does not mention anything about Sam's experience with wheelchairs, PST 13 may have assumed that Sam uses a wheelchair because he has cerebral palsy. The reality is that above 50%-60% of children with cerebral palsy can walk independently (CDC, 2023).

Five PSTs' responses to the second and third questions provided evidence that they would consider further participation of the students with disabilities in the scenarios, and thus they were inferred to have an inclusive perception toward students with disabilities. Seven PSTs' responses to one of the scenarios provided evidence that they would consider further participation, but because they were missing responses to Questions 2 and 3 for the other scenario, they were coded Ambiguous. Two PSTs' perceptions toward students with disabilities remain unknown because they did not provide any responses to Questions 2 and 3. It is interesting to note that these two were the same PSTs who had non-inclusive perceptions toward disabilities.

To illustrate, for Scenario 1, nine PSTs chose *Ask Sam to explain their result* (seven of them *to better understand the root of [their] misconception* and two *to give other students a chance to notice whether they share Sam's argument*), and one PST chose *Ask someone else who had the same answer to share their thinking* to *promote discussion in the classroom.* PST 14 chose to create their own response: *Have Sam take me through step by step so I can understand their thinking and build from it*, and their reason behind their response was: *Sam is a person with a disability. He is more than the disability.* All these PSTs were willing to include Sam in the conversation and seemed to value Sam's contributions. For Scenario 2, five PSTs chose *Ask Chris to give their reasoning for their answer* (four of them *to promote discussion in the class* and one *to deepen Chris's mathematical reasoning*). In addition, PST 11 wrote: *I would first ask Chris to explain their reasoning and then solicit help from the group if he struggled* and chose as their reason *to deepen Chris's mathematical reasoning.* Four of these six (PSTs 4, 7, 11, and 13) demonstrated an inclusive perception both toward disabilities and toward students with disabilities. PST 5 demonstrated an inclusive perception towards students with disabilities and an ambiguous perception toward disabilities because they had one response that seems to reflect a medical model of disability. The fact that there was more missing data for Scenario 2, where the student was identified as having a mathematical learning disability, raises the question of whether PST 13 was correct in assuming that PSTs are more comfortable responding to students who have physical disabilities. However, Scenario 1 involved a student's own contribution and Scenario 2 involved a student representing their group's answer, which could also be a reason for the difference.

Conclusion

This preliminary investigation provides a glimpse into preservice secondary school mathematics teachers' perceptions toward disabilities and toward students with disabilities. Our results suggest that PSTs have a fair amount of experience with people with disabilities, and much of it has been positive. Furthermore, all but two PSTs provided at least some evidence of their willingness to fully include students with disabilities in their mathematics classrooms. Despite these encouraging signs, there is much work to be done to support teachers in achieving the goal of creating an inclusive environment in their mathematics classrooms. Better understanding PSTs' current perceptions toward students with disabilities will help teacher educators create specific strategies for helping them to develop perceptions promoting inclusive classroom environments from the beginning of their careers.

Having only two scenarios for PSTs to respond to meant that we could not clearly identify which aspects of the scenarios were responsible for the differences in the models of disability their responses reflected and inconsistencies between their consideration of students with disabilities as contributors of mathematics. Expanding the survey to additional scenarios would allow us to better identify nuances in their responses (e.g., physical vs. intellectual disability, individual vs. group work, accuracy of the contribution).

Acknowledgments

This report is based upon work supported by the National Science Foundation under Grant No. DRL-1720613. Any opinions, findings, conclusions, or recommendations expressed in this report are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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