# RETHINKING MATHEMATICS CLASSROOM PARTICIPATION: STUDENT AND TEACHER PERSPECTIVES

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*Participation in mathematics classrooms has received considerable attention in previous research. Scholars have emphasized researchers' and teachers' perspectives on what it means to participate. I draw on sociocultural theories of learning to explore both students' and a teacher's perspectives on participation. I describe a participatory research study where a Spanish immersion third-grade teacher and I collaborated to elicit students' perspectives on mathematics class participation. Data generation included multi-method focus groups with the students, and an interview with the teacher. Drawing on social semiotics as an analytical framework, findings suggest that there were two connotations of participation in this classroom: While the teacher's connotation characterized participation mainly as quantifiable, observable student talk attributable to individual children, students' connotation characterized participation mainly as qualifiable, amorphous, diverse and focused on the social. I argue that developing mathematics teaching that is inclusive of diverse ways of participating involves learning about students' perspectives on participation.*

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Research on participation in mathematics classrooms has primarily studied the role of the teacher in eliciting student talk. Few studies have focused on how students actually participate, starting with what they have to say about their own participation (Dallimore, Hertenstein, & Platt, 2004). The tendency to overlook students' perspectives in favor of teachers' and researchers' perspectives is particularly marked in studies involving elementary school children (Groundwater-Smith, Dockett, & Bottrell, 2014). This study addresses this issue by considering both students' and a teacher's perspectives. Learning about insiders' (teacher and students) meanings associated with participation was a first step for the teacher to support this class to become receptive of mathematical ideas that emerged in unanticipated ways.

The purpose of this study was to question taken for granted ideas about participation in mathematics classrooms, whose perspectives we acknowledge, and whose we overlook. I report on an exploration of students' and a teacher's participation-related perspectives, in the context of a participatory research study in a third-grade Spanish immersion mathematics classroom. I ask the following research question: What does it mean to participate in a mathematics classroom according to students and to the teacher? I argue that developing mathematics teaching that is inclusive of diverse ways of participating involves learning about students' perspectives on participation. Grounding research and teaching efforts on students' perspectives challenges the imposition of adult-generated visions of what it means to participate, and it helps conceptualizing participation in ways that are consistent with and inclusive of students' classroom experiences.

## Literature Review

Participation is nearly equated with student talk in mathematics education research. Many studies use the terms participation and student talk interchangeably (For a few examples see

Otten, S., Candela, A. G., de Araujo, Z., Haines, C., & Munter, C. (2019). *Proceedings of the forty-first annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. St Louis, MO: University of Missouri.

Brown, 2017; Franke et al., 2015; Jansen, 2006). For example, when studying students' participation in mathematics classrooms Jansen (2006) focused on students "talking about mathematics" (p. 412). Not surprisingly, previous research has characterized the teacher's role regarding participation mainly in terms of eliciting student talk. Specifically, teachers strive to uniformly distribute talk time among students, disrupting the tendency to attend to mathematical ideas uttered by a few dominant students. As Webb et al. (2014) put it, "Teachers can set ground rules and guidelines for desired participation, promoting greater student talk" (p. 81). These norms influence student talk by signaling to students the desirable ways to add to discussions.

Little is known about how teachers become aware of and draw on students' multiple ways of participating in mathematical activity. In this study, I consider the teacher's role not only in eliciting predetermined forms of student talk but also in learning about unanticipated ways of participating. As a first step toward challenging preconceived notions about participation, I focus on students' perspectives on participation and raising the teacher's perspective to awareness.

## Theoretical Framework

I draw on sociocultural theory to define participation as an evolving social experience of engaging in meaningful shared activity, that combines doing, talking, thinking, feeling, and belonging (Rogoff et al., 2003; Vygotsky, 1978; Wenger, 1998). Participation is a situated phenomenon in which the individual and the social interact as members of a bounded social community, such as a classroom, coordinate the pursuit of a shared enterprise. It is situated because the context influences both the activities that are considered meaningful and the ways of becoming part of an activity (Thomas, Whybrow, & Scharber, 2012). Participation involves an interaction between the individual and the social because, rather than being a static set of practices, members of a community permanently negotiate what it means to participate (Wenger, 1998). As the community develops over time, the activities in which members engage and how they participate in these activities evolve, too. Different members may introduce novel activities or ways of engaging in activity. When an individual's ways of participating are legitimized and influence how others participate, the member experiences a sense of belonging.

This conceptualization has implications regarding the role of the teacher. What counts as participation varies from classroom to classroom (Anderson, 1998). Even within each classroom, teachers' and students' meanings of what counts as participation may differ (Mafra Goulart & Roth, 2006). Teachers may decide to focus on helping students participate a certain way. Although this approach has the potential of helping students expand the ways in which they participate, it can also exclude children whose preferred ways of participating are overlooked. In contrast, when the classroom allows multiple ways of participating to influence activity, the community expands the ways in which students make sense of ideas and more students experience a sense of belonging in mathematical activity (Dallimore et al., 2004). In this study, I consider the role of the teacher expanding her own conceptualization of participation by learning about students' ways of participating.

## Methodology

### Participatory Research

Participatory research seeks to challenge power hierarchies, including the positioning of the researcher as an expert that comes to the site to execute a predetermined agenda (Fals-Borda, 1987). Participatory approaches do not regard the researcher as the producer of knowledge and the researched as the object of analysis and the recipient of knowledge. Instead, participatory

researchers move from working *on* or *for* participants to working *with* them (Hansen, Ramstead, Richer, Smith, & Stratton, 2001). Accordingly, participatory research is based on the needs of the community and it focuses on the process of working together to gain understandings and initiate transformations of particular situations. In this study, the issue of participation emerged during my prolonged collaboration with the teacher, as we both became aware and were puzzled by students' differential participation. The teacher and I collaborated in making sense of the ideas about participation that coexisted in this classroom.

**Sites and Participants**

Located in the Midwest of the United States, this school offered a Spanish language immersion program. Instruction was in Spanish all school day (including mathematics class), except for one hour taught in English. There were 21 students in this third-grade classroom: 15 female students (one Latina, one Asian American, two African American, 11 White) and six male students (two Latino, one African American, three White). All students seemed comfortable sustaining conversations, as well as following directions and discussions in Spanish. The teacher, Señora Abad (all names are pseudonyms) was a Spanish-English bilingual Latina, with four years of teaching experience, all in this school.

Consistent with principles of participatory research, I position myself as a research-participant in this study. I am a Latino Spanish native speaker. I was a teacher for 7 years. As part of my involvement with this classroom, I visited the school for three years, collaborating with Señora Abad on my research. I observed this specific third-grade and supported students during small group work throughout the school year.

**Data Sources**

I conducted multi-methods focus groups with students to discuss participation in general and in math class specifically. I conducted six focus groups with three or four students in each group. Consistent with tenets from participatory research, the structure of these focus groups was flexible: First, I reiterated that participation was voluntary and that students could choose whether to join a focus group or not. I communicated to all students that I would share their responses with the teacher. Second, students chose their own groups, in an attempt to help the children feel comfortable sharing their ideas. Third, students could choose to leave the group at any moment and join another group later. Fourth, students could choose to speak in English or in Spanish at any point. Fifth, students had the option of choosing among multiple methods to share their ideas.

I initially asked students to think about what it means to participate and how they participated in math class. Each student individually decided whether to draw or write about these ideas, or to think and then share during the conversation. Paper and markers were available. Then, each student could decide whether to share the ideas with the rest of the group or not. All students shared their drawings and writings and explained what they represented. I asked follow-up questions to clarify points or to ask for specific examples. In all groups, students frequently addressed each other, adding to what others said or proposing alternative ideas. Each focus group was about 30-minutes long. I audio recorded and transcribed each group and I collected students' sheets.

I also conducted an interview with the teacher. This 45-minute semi-structured interview took place after all the focus groups, and the teacher and I discussed her ideas about participation in her mathematics class. I audio recorded and transcribed the interview.

**Analytical Framework**

Principles from social semiotics (Halliday, 1978; van Leeuwen, 2005) resonate with this

study's focus on a shift away from overvaluing predetermined ways of participating. Social semiotics argues that when individuals communicate, in addition to externalizing personal understandings, they also intend to achieve effects in their community (Morgan, 2006), which is consistent with sociocultural theory's considerations of participation as involving a sense of social involvement. Social semiotics challenges the assumption that pre-given, static meanings reside in specific semiotic resources. Acknowledging the influence of social contexts and interactions in meaning making processes, social semiotics contends that specific practices have different meanings in different contexts, and the culturally situated meanings of those practices can be the focus of social semiotics analyses (van Leeuwen, 2005). In this study, I focus on the meanings and practices associated with participation in this mathematics classroom.

**Connotations.** I focus on this analytical tool from social semiotics to make sense of the students' and the teacher's responses. Connotations are variations within the culturally shared meanings, values and practices of a social group. The context and the perspectives of different participants influence these variations. When the connotations that different members of a group hold about a practice are sufficiently complementary or similar, the coming together in joint activity is more likely and more inclusive than when these connotations are incompatible. For example, if a teacher's connotation of participation involved students sitting quietly and raising their hands to respond to the teacher's questions and most students shared this connotation, it would seem as if there is cohesion and ease within the group. At the same time, however, the few students whose connotations differed could potentially be ignored. In the presence of this incompatibility, elementary school children tend to conform, and adults' perspectives tend to prevail (van Leeuwen, 2005).

### Data Analysis

Consistent with the participatory methodology, the teacher and I collaborated analyzing focus group and interview responses to develop agreed-upon interpretations of the connotations of participation that coexisted in this classroom. I annotated each line of the transcripts, focusing on nuances in characterizations of what it means to participate. I attended to word choice, the use of pronouns, and expressions of emotion or intensity. Analysis of these language cues helped "link micro-analysis of texts to various forms of social analysis of practices" (Fairclough, 2013, p. 7).

I also annotated statements where students agreed, disagreed or built on others' responses to identify convergence and divergence of perspectives on participation among students. I repeated this process, refining annotations. Then, I conducted a thematic analysis to identify emerging themes in the focus groups and in the teacher interview. I shared these tentative themes with the teacher, and we analyzed excerpts of responses from the focus groups that I selected. I selected three excerpts from different focus groups that included references to the main themes that I had identified and that were representative of the entire data set. The teacher confirmed most of my interpretations and she helped me strengthened them by contextualizing some of the responses based on what she knew about the students.

## Findings

Analyses suggest that Students characterized participation mainly as qualifiable, amorphous, social and diverse. The teacher, on the other hand, characterized participation mainly as quantifiable, observable, individual student talk.

### Students' Connotation

I illustrate the interpretation of students' connotation of participation mainly as qualifiable, amorphous, diverse and focused on the social with a vignette from the second focus group I

conducted. Three students were part of this group: Stacey, Rose and Jimmy. Stacey mentioned she participated in gym class watching what the teacher did and then trying to do the same. I followed up asking how they participated in math class.

| | | |
|---|---|---|
| 1 | Author | So, I have a question for the group. How do you participate in math class? |
| 2 | Stacey | Like, what? |
| 3 | Author | You just talked about how you participate in gym, so now I'm wondering how |
| 4 | | you participate in math class. |
| 5 | Stacey | But, like, what? Like in charlas de números [number talks], or when Señora Abad |
| 6 | | is explaining something, or when we work with our table? |
| 7 | Author | Is it different? |
| 8 | Jimmy | It's different but it's the same. It's the same because sometimes what we're doing |
| 9 | | doesn't matter. Like, I love to ask questions all the time. |
| 10 | Rose | And it's different at our tables. I like participating because I feel part of the team. |
| 11 | Stacey | I like helping others because I can help everyone feel part of the team. |
| 12 | Jimmy | And also sometimes you can participate too much because you are not really |
| 13 | | helping but telling others 'this is the answer.' |
| 14 | Rose | Yeah. You have to think, and you have to listen first. |
| 15 | Jimmy | And you can say like 'I think we can try this way because I draw it here and I |
| 16 | | think it works. What do you think?' |

**Participation as qualifiable.** In all focus groups, the idea of qualifying participation emerged. That is the case in the vignette when Jimmy stated: "sometimes you can participate too much because you are not really helping but telling others 'this is the answer'" (lines 12-13), to which Rose agreed. Later in the conversation, Stacey articulated a similar idea. She was referring to a whole class discussion in math class earlier that day when the teacher mentioned it was hard for her to understand because several students were talking at the same time. Stacey stated: "sometimes, like what they were just doing is over-participating cause they shouldn't be talking, and they still were, so that's like kind of participating, but, yeah." In this case, Stacey qualifies a classroom event as involving over-participation.

**Amorphous, perceived participation.** Although students mentioned observable aspects of participation, they also described a non-observable sense of participating. In the vignette, all three students related ways of participating with something they loved or liked. Jimmy, for example, said: "I *love* asking questions all the time." Similarly, Rose said: "I like participating because I *feel* part of the team" (line 10). Rose related participation with her feeling part of the team. Stacey agreed, adding that she *liked* to "help everyone feel part of the team" (line 11).

**Multiple ways.** In all focus groups, students mentioned diverse ways of participating. In the vignette, for example, when I asked how students participated in math class, Stacey helped the group consider diversity of participation within math class. Specifically, she focused on diverse ways of participating related to types of activities, including number talks, teacher explanations, and small group work (lines 5-6). Group members added other ways of participating that involved student talk, such as telling the answer to a problem (line 13), and some ways that did not necessarily involve student talk, such as thinking, listening, and drawing (lines 14-15). Additional ways of participating that students mentioned in other focus groups included watching, writing, reading, and using specific materials (e.g. rulers and base ten blocks).

Students' comments did not seem to favor one way of participating over others or to subordinate one way of participating as ancillary to others. For example, students did not mention listening or observing as ways of participating that would ultimately facilitate student talk. Instead, students mentioned these ways of participating as alternative and complementary.

Two ways of participating were salient in all focus groups. One way was helping. In the vignette, Stacey introduced this idea when she mentioned she liked helping others (line 11), and Jimmy and Rose expanded on this by characterizing ways to help and ways that are "not really helping" (line 12). Another salient way of participating that emerged in focus groups was asking questions. Although asking questions involves student talk, it is not a kind of talk where students explain an idea or justify a response. This kind of talk elicits others' ideas and expresses curiosity, confusion, or the need for help. In the vignette, Jimmy offered an example of this way of participating when he said he loved asking questions all the time (line 9) when referring to ways of participating that may occur regardless of the type of mathematical activity.

**Relating the individual and the social.** Students' connotation of participation tended to consider the interaction between the individual and the social. In the vignette, students mentioned individual preferences related to participation. Students, however, related their individual participation preferences with social interactions. For example, Jimmy mentioned he loved asking questions (line 9) when he was explaining that his awareness of the context of the activity influenced how he participated. Similarly, when Rose mentioned her liking feeling part of the team (line 10), she was simultaneously recognizing the sense of membership to a social group as an aspect of her participation. When Stacey stated she liked helping (line 11), she signaled her involvement with those who she helped as part of this way of participating. Finally, students' characterization of participation as qualifiable implied that what the teacher did or how some students participated influenced others' participation. That is the case when Jimmy said "you can participate too much" by telling others the answer to a problem (line 12).

**The Teacher's Connotation**

The following vignette illustrates the interpretation of Señora Abad's connotation of participation mainly as quantifiable, observable student talk attributable to individual students. This vignette is part of Señora Abad's response when I asked her what she did to help students participate in math class. Giving an example of the strategies she used, she mentioned the cup where she had popsicle sticks, with the name of one student written on each stick. She mentioned she would randomly draw one stick and call on the student whose name was written on that stick to answer a question or share an idea. Señora Abad shared that besides helping her avoid calling the same student multiple times, this strategy signaled to students everybody needed to be ready.

1 I use them [the popsicles] because then they [the students] know anybody can participate. Not
2 only those who always raise their hand. It doesn't always work because they can pass if they
3 don't want to participate, and then I draw another name. But I would like to see everybody
4 participating [in math class]. And there are different forms of participating, it doesn't have to
5 be the same for everyone, but [I'd like to see] everyone participating. Because sometimes
6 some [students] don't participate. I know that sometimes Daniel is going to be doing
7 something else and then he won't be able to say anything when I ask him a question. Or Emi.
8 She doesn't like going to the board and telling us about her strategies. So, it's difficult.

**Absence or presence of participation.** Señora Abad seemed to characterize participation in

terms of a binary: at any given moment, a student either is or is not participating. In this excerpt, this presence or absence of participation refers to whether students shared an idea or answered a question when the teacher called on them. In line 1, she talked about how when she told students she would use the sticks "then they [the students] know anybody can participate." Not everybody would actually participate, but since she randomly selected the name of the student who would participate, all students needed to be prepared. She reinforced the notion of presence or absence of participation when she said that when she called on students, they could pass "if they don't want to participate" (lines 2-3). According to this characterization, students could choose between participation and non-participation. If a student accepted Señora Abad's invitation and contributed an idea, that student chose to participate. In contrast, the student could decline and, therefore, choose to not participate. Señora Abad made this contrast more explicit when she stated: "sometimes some [students] don't participate" (line 6). This comment also suggests that for Señora Abad the status of participating or not participating was not static and changed over time. The use of the sticks strategy relates to the teacher's desire "to see everybody participating" (lines 3-4). This statement further supports the interpretation of Señora Abad's characterization of participation in terms of some students falling into the participating side of the binary and others falling into the non-participating side.

**Participation as observable.** Señora Abad's connotation focused on observable aspects of participation. That is the case, for example, when she expressed her wish to "*see* everybody participating [in math class]" (lines 3-4). Her characterization referred to "different *forms* of participating" (line 4), suggesting participation that takes a form. Participation seems to be embodied in specific student behaviors accessible to the teacher through direct observation. Specifically, in this vignette Señora Abad referred to participation that takes the form of hand raising and going to the board. The absence or presence of participation relates to its observable nature, in Señora Abad's connotation. According to her comments, whether students were or were not participating was something that she could see. Students' enactment of a specific form of participation would be visible to Señora Abad. Conversely, the absence of such forms would mean that there would be no participation to observe.

**Overemphasis on student talk.** Señora Abad explicitly acknowledged her perception that different students could participate in different forms when she stated that "there are different forms of participating, it doesn't have to be the same for everyone" (lines 4-5). Señora Abad, however, emphasized student talk during the interview. In several of her comments she suggested that when students talked about mathematical ideas, they participated, and when they did not talk, they did not participate. For example, in the vignette she mentioned that Daniel sometimes got distracted "and then he won't be able to *say* anything" (line 7). Similarly, she talked about Emi not liking "*telling* us about her strategies" (line 8). Talking about mathematical ideas is a form of participation that Señora Abad valued, and students could expect Señora Abad to encourage them to talk. The vignette depicts students who participated as the ones that showed willingness to talk by raising their hands (line 2), and those who did not participate as those who passed when Señora Abad called on them (lines 2-3). The strategies that Señora Abad described communicated to the class that she valued student talk, and they related her idea of absence and presence of participation to absence and presence of talk.

**Foregrounding the individual.** Señora Abad's connotation of participation tended to foreground the individual over the social. In the vignette, Señora Abad's comments suggest that she attributed participation and non-participation to individual students at any given moment. She provided the example of Daniel (lines 6-7), stating that he tended to not participate when she

asked a question. Furthermore, Señora Abad claimed that there was a reason for Daniel not to participate: his getting distracted doing something not related to the class discussion. Similarly, Señora Abad shared that Emi tended to not participate when it required explaining something in front of the class. In the vignette, Señora Abad hinted at Emi's aversion to being put on the spotlight as the reason for her non-participation.

## Discussion

In this study, I answered the question: What does it mean to participate in a mathematics classroom according to students and to the teacher? Findings suggest that there were marked differences in the students' and the teacher's perspectives. While students characterized participation mainly as qualifiable, amorphous, social and diverse, the teacher characterized participation mainly as quantifiable, observable, individual student talk. Students' connotation of participation challenges implicit definitions of student talk frequently found in the mathematics education literature. Students' connotation resonates with tenets from sociocultural theory. This suggests the need to examine the theoretical consistencies and inconsistencies in the definitions of participation that researchers implicitly or explicitly use. Methodologically, these findings suggest the need to consider not only adults' but also children's perspectives on participation.

Some aspects of this study's findings reinforce previous research on participation. Specifically, the idea of helping as part of participation that emerged during the focus groups echoes the ideas of students in other contexts (Civil & Planas, 2004; Jansen, 2006). This indicates that some students' ideas about participation may transcend context and be relevant in a variety of classrooms. Simultaneously, findings suggest the need to consider context-specific meanings of participation. For example, unlike other studies, these findings invite a reconsideration of the goal of observing equal participation, understood as the amount of student talk. Students' perspectives, especially when contrasted to the teacher's, suggest that an alternative goal may be to learn about and embrace students' different ways and rates of participation. This way, the class may consider diverse ideas and ways of becoming part of mathematical activity, instead of overemphasizing spoken ideas proposed by talkative students.

Rather than arguing against student talk or against teachers' efforts to support student talk, I argue for teachers and researchers to consider additional ways in which students engage with mathematical activity. Findings from this study suggest that teachers interested in participation may need to consider more than only observable indicators in individual students. Instead, teachers may need to consider a complex network of both social and individual, observable and perceived, quantifiable and qualifiable aspects. In turn, drawing on strategies that help students participate in practices they prefer (such as helping others or asking questions), may foster their exploration of mathematical ideas.

My intention was not to present either connotation of participation as good or bad, but to understand the nuances and contrasts between the two. Moreover, I acknowledge that using focus groups to elicit students' connotation may have favored the emergence of a composite of connotations, but there may be differences within students' connotations. Teachers awareness of their own connotation of participation and learning about their students' is a first step in transforming their practice toward becoming inclusive of diverse ways of participating.

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