# THE MAKING OF A MEANING MAKER: AN ENGLISH LEARNER'S PARTICIPATION IN MATHEMATICS

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*This paper focuses on meaning making as a process that can transform English learners' participation in mathematics. Using selected video transcripts from a one year long project in a fourth grade bilingual classroom, the paper documents the development of participation along a continuum of meaning making, from preparing students to transform their participation to creating meaning eliciting tasks to showcasing students in meaning making interactions. Findings suggest that the problem of participation in mathematics by English learners—and other students as well—is a problem rooted in the absence of meaning making practices in mathematics classrooms.*

Keywords: Meaning Making; Participation; English Learners; Elementary School Education

## Purpose

The purpose of this paper is to contribute an understanding of English learners' participation in mathematical discussions as a deliberate meaning-making process that is initiated by the teacher, interpreted by an English learner, and reinterpreted by peers. The paper documents the development of meaning making practices with a focus on an English learner's participation in a Latino classroom. The focus on this student serves to illustrate the intricacies of meaning making and how it transforms and is transformed by participants. Through this analysis, the paper highlights the importance of re-envisioning student participation in mathematics not as an individual act but rather as a continuum of meaning making moments. Along this continuum, participation emerges as a meaning-oriented, other-oriented process.

## Theoretical Foundation

The issue of who participates in mathematics has been explored from an equity perspective (Gutiérrez, 2010; Khisty & Chval, 2002), a status and domination perspective (Cohen & Lotan, 1995, Pierson Bishop, 2012, JRME), a racial perspective (Martin, 2007; Stinson, 2010), and a sociocultural perspective (Moschkovich, 2002), among others. This paper focuses on a meaning-making perspective to understand English learners' participation in mathematics. I view meaning making as foundational to student participation in mathematics. The critical need for bringing meaning making into teaching and learning mathematics has been highlighted in research (Schoenfeld, 1991). A view of participation as rooted in meaning making affords a critique of participation as individual and behavioristic and shifts our attention to participation as a continuum of various forms of participation, none of which can stand alone in a significant manner. As Sfard (1998) explains her metaphor of learning as participation, "[f]rom a lone entrepreneur, the learner turns into an integral part of a team" (p. 6).

I start this theoretical foundation with a definition of meaning making as "the translation of one sign into another system of signs" (Jakobson, 1985, p. 251). By translation I refer to the interpretive and continual process of recreating signs (e.g., 9 is also 5 and 4), reconstructing images (e.g., the area of an irregular shape is also the sum of the areas of regular shapes), social representations (Gorgorió & de Abreu, 2009) (e.g., an English learner can solve problem *a* but not problem *b*), and task adaptations (e.g., 272 divided by 8 can be transformed into an open ended task). The expression of meaning is only possible through signs (Radford, Schubring, & Seeger, 2011). However, signs alone refer to objects that are meaningless (e.g., a 9 remains as a 9, or an English learner can remain as someone who can only solve problem *a*) unless participants translate them along a continuum of possible meanings (Otte, 2011). The active translations and interpretations of signs—meaning making—characterize rich participation in mathematics. For example, the number 9 is a sign that, by itself, has no meaning. It requires a student's

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interpretation as “1 less than 10,” or as “5+4,” or as “3 × 3,” etc. An open-ended task in this framework is a powerful sign in that it invites multiple interpretations from students. A teacher who uses open-ended tasks is primarily interested in the meaning that students will make.

## Methods (Participants, Context, Data Collection, Analysis)

Data collection consisted of video taping of the problem of the day in a bilingual Latino fourth grade classroom, four times a week, for an entire school year. At the time of the data collection, the teacher was in her first year of practice. At the beginning of the project, the problem of the day consisted of low-level mathematics tasks, often copied from the school’s adopted textbook. However, she was interested in increasing student participation but did not know how to make it happen. Students, including Sam the English learner who is the focus of this paper, came to her classroom with a history of traditional mathematics instruction from the previous three years. Students were used to the Initiation-Response-Evaluation pattern of participation (Mehan, 1985) found in most U.S. classrooms. For example, Sam would only participate when called on by the teacher, and his ideas would not travel outside the teacher-student interaction. Another form of data collection consisted of reflection and co-planning sessions with the teacher, usually at the end of the school day, and on weekends. The problem of the day used in this analysis was developed during one of these reflection and co-planning sessions.

To analyze data, I selected interactions from video recordings produced at the beginning of the school year, when students were showing resistance to the teacher’s new plan for participation. I also selected interactions toward the end of the school year to illustrate how students were relearning new ways of participation. I transcribed these selected videos. Then I applied the ideas from the theoretical foundation to document how participation emerged as a continuum of meaning making.

## Results

Results are intended to illustrate the arduous process of making meaning makers. Years of being denied opportunities to participate in meaning making result in this arduous process of reminding, convincing, and preparing students to participate as meaning makers. Results illustrate moments of tension as students learned to transition from older ways into new ways. An important meditational tool in this evolution of participation was the transformation of mathematical tasks and the roles, norms for participation, and expectations that these tasks required.

### Preparing Students to Transform their Participation

At the beginning of the school year, students were used to working in mathematics individually. The prevalent participation pattern was between individual students and the teacher, with the rest of the group acting as passive spectators. How comfortable students were in this participation structure became apparent as the teacher introduced the new norms of participation. These new norms met students’ strong resistance. Their reaction evokes Sherin, Louis, and Mendez’s (2000) comment about how hard it is to make students participate in mathematical discussions. Students were initially participating *for* the teacher, as evidenced by the kinds of questions they were asking the teacher:

“Ms. R, do we take out our math journal?”
“Do we need to copy that?”

Students were also challenging the new rules of participation with expressions of resistance:

“What does this have to do with math?”
“Ms. R, why are we doing all this? Can you explain it to me?”
“Ms. R, are we learning anything here?”

In the midst of these complaints, the teacher and I also noted that students were noticing something about the tasks. For example, when the teacher was explaining the new rules of participation, hearing the teacher say “problem of the day,” three students suggested:

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"Why can't there be a problem of the week? Or the month?"
"Yeah, like a really, really hard good question."
"Yeah. That would be good."

**Translating the Mathematical Task**

In our initial conversations, the teacher and I had a clear goal: We wanted students to participate by responding to each other's contributions instead of responding only to the teacher. We were confident that strong, open-ended mathematical tasks—or as students suggested, "like a really, really hard good question"—could be our ally in achieving our goal. The problem I use in this paper was originally conceived as a single version that the teacher and I translated into two related versions. One version was a measurement division problem; the other was a partitive division (see Table 1).

**Table 1: Measurement and Partitive Division Tasks**

| Measurement Division (size of group known; number of groups unknown) | Partitive Division (size of groups unknown; number of groups known) |
|---|---|
| 1. Ortega Elementary has 272 students. For the fire drill, students were placed in rows of 34 students. How many rows did they form? | 2. Sanchez Elementary has 272 students. For the fire drill, students were placed in 8 rows. How many students were in each row? |

We split the group in half and each group received one of these two problems. On the back of their problem, we included a discussion question: Explain which school has a better fire drill, Ortega or Sanchez. The teacher instructed students to save this question for a final discussion. One student, however, could not resist the curiosity of reading the question, and he exclaimed:

*Rolando:* "But this doesn't make any sense!"
*Teacher:* (touches Rolando on the shoulder): "But it'll make sense whenever you hear what the other problem (points to other group) is about."
*Rolando:* "Oh!"

Rolando was not finding meaning in the question. For him, the question was a sign disconnected from other signs, therefore lacking meaning. The teacher, however, reminded Rolando that meaning was about to emerge as soon as all participants translated this question along a continuum of ideas. The teacher's reply to Rolando is consistent with a view of meaning as other-oriented (Dominguez, López Leiva, & Khisty, 2012), and it may be difficult to emerge in the sole act of Rolando reading the question.

**Making an English Learner a Meaning Maker**

The teacher asked each group to read their version of the problem to the other group to establish a common understanding that they had been working on different problems. Some students claimed that the problems were the same, only that the words were different. The teacher helped students with this initial translation of each other's signs (the problem) by emphasizing that one problem was asking for the number of groups, whereas the other was asking for the number of student in each group. But the important part of this interaction came next, when Sam, an English learner, raised his hand to participate, in English. What follows is the process of the teacher and peers collectively making Sam a meaning maker.

*Sam:* "Ms. Ramos, I did a picture of eight, eight…"
*Teacher:* "Can you stand up and show what you did?"
(Sam stands up, holding his notebook high up for the other group to see) (See Figure 1.)
*Teacher:* "Can you explain it to them?"
*Sam:* "I put 8 rows, 8, 8 lines, and I did it like this, it's the, it's the, it's the rows, and then I put 34 in each row, the number, and then I knew that 34 × 8 is 272."
*Teacher:* "OK, go ahead and show them what you did (signals to go to the other group's table) 'cause I don't think they can see that when you are standing way over here."

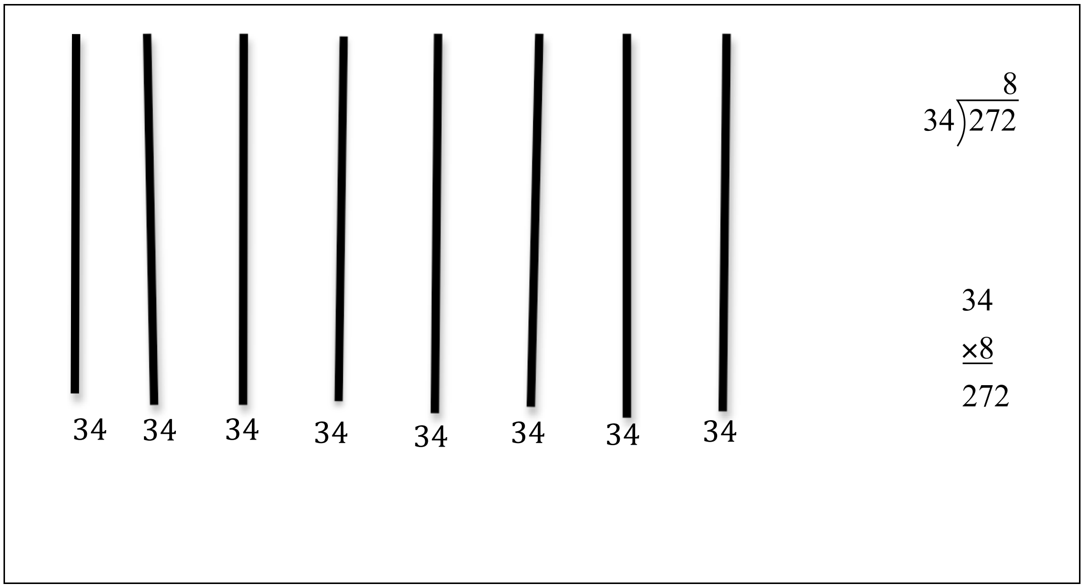


**Figure 1: Sam's strategy**

When the teacher asked Sam to stand up, she is translating Sam as capable of explaining his strategy to others. By asking Sam to explain his strategy, she is establishing the conditions for the creation of a continuum of meanings, as meaning depends on others to grow. Sam takes up the teacher's translation of him, but his standing up and showing his work has not yet created a continuum of meanings. The teacher seems to be interested in seeing this continuum, as she asks Sam to explain what he did to his audience. In the act of explaining, Sam may find the possibility of refining his translation of the problem (his strategy) for himself and for others. Although Sam accepts the teacher's new translation of him as a capable explainer, he performs this new role from where he is standing distance. The teacher wants to ensure that everyone hears Sam's translation, so she asks Sam to approach the group. Here, the teacher is interested in Sam's audience and their ability to interpret Sam's translation. The teacher is establishing the conditions for making every student a participant in the process of making meaning. She picked Sam as the carrier of a sign to be translated first by him and then to be interpreted by his peers. In the following section, Sam will encounter multiple interpretations of his work as he interacts with peers. The continuum of meanings at this point begins to take shape.

### Students Interpret an English Learner's Strategy

Sam walks toward the other group. At the same time that he starts walking, Joel, the same student who, in the beginning of the year, was questioning the new way of participating in mathematics, initiates a student-student interaction focused on Sam's mathematical strategy.

*Joel:* "What was that for?" (pointing to Sam's drawing)
*Sam:* "The rows!" (points to his 8 rows)
*Joel:* "Why did you need it? Why did you do that?"
*Sam:* "So I can show my strategies. So, some people do believe me. Like this!" (points to Joel's strategy, who drew 8 circles on his notebook instead of 8 lines like Sam did) (See Figure 2)
*Joel:* "Oh, Oh, every line means a row?"
*Sam:* "Yeah!" (turns palm of his hand up, as if indicating the obviousness of his meaning)
*Joel:* "Oh!"
*Student:* "Duh, dude!" (teasing Joel)
(Sam walks around the table, holding his notebook by his chest so peers can see).

*Jennie:* "Wait, don't go so fast! Wait, why did you put 34 in each row? The way you put that."
*Sam:* "Because it says right there in the question, that there's 34 students in one row." Jennifer: "Oh."
*Liz:* "Ah, hey! Wait! How did you know that 34x8 is 272?"
*Sam:* "Because I did this and then I did this." (points to his division, then to his multiplication, and finally to his drawing)

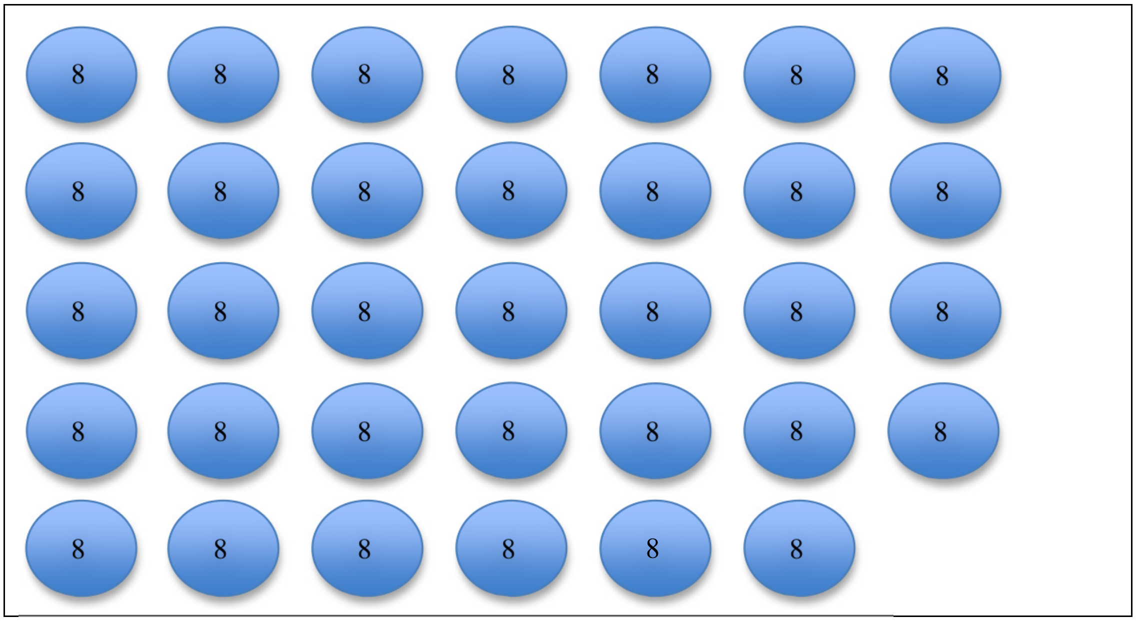


**Figure 2: Joel's strategy**

In this interaction, peers are translating Sam as a meaning maker. First, Joel demonstrates interest in Sam's strategy. Sam responds by placing his strategy (his own translation) along his peer's strategy (Joel's own translation), thus establishing a student-generated continuum of meanings. Sam's strategy in itself reflects his sensitivity to this emerging continuum of meanings, as he represented his strategy in different ways. For example, his response to Joel, "So, some people do believe me" is consistent with the multimodality of his strategy, which includes iconic representations (8 vertical lines representing 8 rows) and also symbolic representations (multiplication and division). Sam has in other words recreated signs for multiple interpreters (so some people would believe him) and has maintained these translations of signs meaningfully connected.

At this point in the interaction, Sam does not need the teacher's prompts any more. Instead, he shows his strategy to peers spontaneously. At the same time, peers continue asking him questions, in what exemplifies the rarest form of whole group discussion in mathematics, one in which students themselves mediate and control their own participation. The teacher was sitting in one corner of the room, enjoying the unfolding of this discussion. It is important to note that Jennie's question is a request for an explanation (*why*) and Liz's question is a request for a justification (*how did you know*). The caliber of these questions, and the fact that they are the building blocks in a discussion for learning mathematics (NCTM, 2000) demonstrate that as a whole, Sam's peers have helped the teacher to effectively construct an English learner as a meaning maker. And in this collective act, all participants constructed themselves as meaning makers as well.

## Discussion: The Making of Meaning Makers

Teachers, students, tasks, and instructional strategies, all contribute to make different kinds of meaning makers. Prior to the interaction reported in this paper, particularly at the beginning of the school year, students were making meaning for and by themselves, sharing it occasionally with the teacher. As one student frankly put it,

*Josh:* "But this is the first time we've done it in groups. We've always doing it by ourselves."

Similarly, when the teacher asked whether all students had found a group to be in, two students replied:

*Mandy:* "No! Not all of us."
*Joel:* "It's more like, per person."

I chose the case of Sam, an English learner, for several reasons. First, Sam illustrates how status in classrooms can shape who gets to participate (Cohen & Lotan, 1995). Second, when tasks offer students the possibility of making meaning in multiple ways, students like Sam can be motivated to share with others their understandings and strategies. Third, the fact that the teacher selected Sam as the representative of his group, was a powerful instructional strategy that served to achieve multiple goals: sharing meanings, creating a continuum of ideas, and translating low status students as active and capable participants in the process of making mathematical meaning.

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