

# Chapter 9

## Student Agency and Counter-Narratives in Diverse Multilingual Mathematics Classrooms: Challenging Deficit Perspectives

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### 9.1 Introduction

With increased global migration, many mathematics classrooms now serve students who are also learning the dominant language of instruction. The forms of participation in mathematics classroom activity of emergent<sup>1</sup> bilinguals or multilinguals have often been examined from deficit perspectives (see, for instance, Orr, 1987) that focused on the obstacles for vocabulary, oral fluency, and comprehension in the new

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<sup>1</sup>We use the term “emergent” bilingual or multilingual to highlight that English learners are not only learning English but also becoming bilingual/multilingual along a continuum of different types of bilinguals (see Fig. 1 in Valdes, 2005).

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language rather than the resources they bring to learn mathematics<sup>2</sup> (see Cuevas, 1983, 1984; Moschkovich, 2000, 2002; Spanos & Crandall, 1990 for criticisms). Recent studies focused on language learning and engagement in mathematics classroom activity from sociocultural perspectives have examined the construction of mathematical knowledge in social context, focusing not only on the challenges that emergent multilinguals face in the classroom, but also on the strengths of their linguistic resources (Adler, 1998; Brenner, 1994; Khisty, 1995, 2002; Moschkovich, 1999, 2002; Powell & Frankenstein, 1997; Rosebery, Warren, & Conant, 1992). Such work, which this chapter builds on, provides counter-narratives to deficit perspectives and offers what we argue is a more productive frame for understanding issues of mathematics teaching and learning in multilingual classrooms.

Deficit perspectives arise from and are fed by broader sociopolitical contexts that often position emergent multilinguals learning the language of instruction as lacking in cognitive resources necessary for competence (Healy & Powell, 2013; Morgan, 2006; O'Halloran, 2004). Deficit perspectives also derive from existing literature on language learning and development framed with a monolingual bias, obscuring not only competence in children's native languages, but also how children can productively draw on native and emergent languages to support communication in the language of instruction (Gort, 2006; Moschkovich, 2002). This bias is problematic not only because it assumes the monolingual student as the norm (Moschkovich, 2010), but also because it distorts the reality of emergent multilinguals' learning trajectories (Gort, 2006). Emergent bilinguals have a variety of unique linguistic resources at their disposal that they utilize productively to learn in their second language. When bilingual learners are treated as if they were imperfect monolinguals, these competencies are ignored, downplayed, or disallowed in educational environments structured around policies based on a monolingual bias (Gort, 2005). For example, an adolescent who is developing bilingual competence in English will typically use reading comprehension strategies developed for reading in her first language to understand a text in English. In contrast, when using a monolingual bias, such students are treated as if they are learning to read from scratch.

Research that illuminates the ways in which multilingual learners positively utilize available resources, both linguistic and otherwise, during mathematical activity is greatly needed (Bialystok, 2001; Gutierrez, Sengupta-Irving, & Dieckmann, 2010; Moschkovich, 2002, 2010). Such work begins to illuminate the productive use of resources that educators could strategically build on during instruction.

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<sup>2</sup>It is important to acknowledge that some students are learning not a second language but their third or *n*th language. For example, in some schools in the United States there are African and Haitian students who already speak two languages (French and a mother tongue) and are now learning mathematics in English, their third language. It is critical that these students be recognized in the literature, especially since they provide evidence that multilingual students have already demonstrated that they are capable of functioning effectively in more than one language and that some of the difficulties they encounter in school mathematics—taught in a new language of instruction they are yet to master—result not from deficient cognitive resources but from sociopolitical context of instructional practices.

In this chapter, we focus on one particular resource: multilingual learners' agency in positioning themselves and one another with competence in ways that initiate, support, or further productive mathematics classroom interactions.

Practice theories of identity and learning offer researchers ways to highlight the individual agency of emergent multilinguals' interactions in mathematical activity, allowing for the emergence of analytical counter-narratives that challenge deficit perspectives. Holland, Lachicotte, Skinner, and Cain's (2001) figured worlds-based theory of identity considers both the sociopolitical forces that shape the positional identities made available to particular persons and the role of individual agency that can accept, reject, or alter such positions. Figured worlds are "socially produced, culturally constituted activities" (1998, pp. 40–41) where people come to conceptually (cognitively) and materially/procedurally produce (perform) new self-understandings (identities). Identity making is defined as "producing, from the cultural resources available to them, understandings of themselves" (2001, p. 4). For example, Holland et al. (2001) describe the figured world of the caste system in Nepal, where actions are interpreted from the perspective of a narrative that includes such rules as persons from a lower caste cannot enter the homes of persons from a higher caste. Thus a woman from a high caste who enters the home of another woman from a high caste is interpreted as being appropriate, while a woman from a lower caste who engages in the same act is interpreted as inappropriate. Such "characters" and "story lines" in particular figured worlds enable and constrain possible acts. Yet, even these constraints are still subject to agentive acts. Holland et al. (2001) describe, for instance, an encounter with a woman from a lower caste who was invited to enter the researcher's (accorded a higher caste status) apartment for an interview. As the researcher walked down to greet her, the low-caste woman instead scaled the outside of the building to the second floor balcony for the interview as a way to participate in the interview without entering the researcher's building. This act, profoundly shaped by how the narrative of caste positioned the woman, was nonetheless an agentive act; no other community members climbed walls to reach second stories of buildings.

A framework centered on human agency within dominant sociopolitical narratives and discourses is a potentially useful way to examine how emergent multilinguals might utilize the resources available to them in creative and competent ways as they navigate interactions during mathematical activity. In the remainder of this chapter, we draw on these ideas to examine several vignettes that highlight creative and productive uses of emergent multilinguals' available resources. In doing so, we hope to offer counter-narratives that both challenge deficit perspectives and offer a promising approach to move forward research in the teaching and learning of mathematics in linguistically heterogeneous classrooms that capture the full range of students' competencies. The vignettes are drawn from a variety of mathematics classroom contexts: Spanish-dominant emergent bilinguals from different states in the United States, and multilinguals in Sweden using various languages, most commonly Arabic and Swedish. The vignettes show students as creative users of linguistic resources in ways that serve a variety of functions in mathematical activity.

## 9.2 Vignettes of Counter-Narratives in the Experiences of Emergent Bilinguals in Mathematical Classrooms

The three vignettes in this section draw from a variety of mathematics classroom contexts. Vignette 1 focuses on how a Spanish-dominant bilingual fifth grader in the Southeastern United States negotiated mathematical ideas and her position as an English language learner as she collaborated with an English proficient peer. Vignette 2 focuses on multilingual students in Sweden who successfully re-directed their teacher's planned lesson toward Swedish counting words, an aspect of mathematical language they were developing. Vignette 3, set in the Northeastern United States classroom, evidences students' use of linguistic and representational resources to interpret open-ended problems in combinatorics.

### 9.2.1 Vignette 1: Mispronunciation as Wordplay

Based on a fifth grade mathematics classroom in the Southeastern United States, this first vignette highlights the ways in which language learners can positively alter potentially negative positionings of their struggles to simultaneously learn both mathematics and the language of instruction. The vignette focuses on a dyad collaboratively solving a mathematics word problem. As they take turns reading the problem aloud, one student, an English language learner, struggles with the pronunciation of particular words, in particular "cello." The student follows her own mispronunciation of the word "cello" with immediate subsequent wordplay. In doing so, she repositions her error as creative play. Her partner takes up this alternate, positive positioning and the two students move forward into problem solving.

Fifth graders Amanda and Roger collaborated on a worksheet with several mathematics word problems on the topic of sets. Amanda, an English language learner, agrees to read the second problem that included finding the set of students who play violin, the set of students who play the cello, and the set of students who play both. While reading, Amanda repeatedly gets stuck on the pronunciation of the word "cello," alternating the correct pronunciation "CHE-loh" with the incorrect pronunciations "CHAY-loh" and "SELL-oh."

Immediately, Amanda turns to word play to make light of her mispronunciation, creating humorous rhymes and joking:

*[in sing-songy, dramatic voice]* che-LO::H! che-LO::H! Or jell-o! *[giggles]*  
You see what I just did that? Che-lo:::h? *[mimicking Spanish accented form of saying hello]*

(continued)

Instead of responding to her mispronunciations, Roger, an English proficient peer, responds to her word play by smiling and giggling, which is positioned positively. Directly after her wordplay, Amanda resumes working on the problem by stating, “Okay. So eight play cello and eight play both. Your turn.” Roger pulls the worksheet closer to him and takes up Amanda’s solution by stating, “Eight play both.” Amanda follows by stating, “And eight play cello, or jell-o.” Both students smile and move on to the third problem on the worksheet.

Language learners like Amanda are likely to show errors in pronunciation (Brown, 1973). The social positioning of these errors, however, is constructed in interaction by the speaker and his or her audience (Holland et al., 2001). Typically, a speaker who makes a pronunciation error is positioned as lacking competence. Here, Amanda drew on other linguistic and cultural resources—her knowledge of rhyme, humor, popular culture, and even accented speech—to position her pronunciation of the word “cello” not as lack of competence, but as creative wordplay. This bid in positioning is taken up by her student partner Roger, who joins Amanda in enjoying the word play and also subsequently takes up her mathematical ideas. Such subsequent uptake of her ideas provides further evidence that the mispronunciation did not downgrade her perceived academic competence. Rather, Amanda is positioned with both social and intellectual authority. This is further highlighted at the end of her turn solving the problem, where she concluded, “And eight play cello, or jell-o.” Her concluding statement was both mathematically correct and socially sophisticated and, importantly, was taken up by Roger as such. Although the resources that Amanda used are not mathematical by themselves, they provided her with access to participation in the mathematical activity as well as a position of intellectual authority in the dyad.

Research on cooperative groups made up of culturally heterogeneous students suggests that minority students’, including language learners, opportunities for engagement in mathematical activity are constrained by the negative ways in which their ideas and identities are positioned in interaction (Kurth, Anderson, & Palinscar, 2002; Langer-Osuna, 2011). This vignette offers a counter-example, where a language learner successfully navigated social dynamics in ways that “saved face” (Goffman, 1967/2005) and supported continued productive engagement. This counter-example points to the fruitfulness of research that examines the interactional strategies that language learners utilize, such as humor and play, to negotiate mathematical ideas and positional identities during collaborative student-led problem solving.

## 9.2.2 *Vignette 2: Teenagers and Counting Words*

Based on a first grade mathematics classroom in a suburb of Stockholm, this second vignette illustrates the ways in which first grade second language and mathematics learners were able to shift the direction of their teacher's planned mathematics lesson to one of their own choosing. Further, the direction of their choosing was one that addressed mathematical language. The vignette highlights important shifts in power relations, where students shaped classroom discussions around their learning needs.

Students Amina and Liljana ask their teacher, Ms. Anna, whether everybody has to become “cheeky” when they become teenagers. After a few minutes of interaction with the girls and the rest of the class, the teacher acknowledges that many of her students do not understand the connection between the age range of being a “teenager,” and the ending of the counting words between 13 and 19.<sup>3</sup>

Ms. Anna then poses the question, “How old are they then? How old are you when you are a teenager? What is a teenager?”

Ms. Anna changed the direction of the mathematical discussion based on the girls' interests in teenagers, a change that the students initiated. Here we see student agency in their collective ability to take up positions that suit them (Burr, 2003; Foucault, 1982). After this re-direction, students and teachers discussed the counting words from 11 to 19, for about 45 min, rather than the originally planned topic. Liljana's and Amina's out-of-school identities and experiences were thus legitimized and valued as part of the mathematical learning experience.

Another example occurred moments later in the same lesson, when one of the boys, Tony, decided to pick up a pointer to point to all the -teen words (thirteen, fourteen, ... nineteen) written on the whiteboard, positioning himself as teacher-like:

Tony: There it says -teen, there it says -teen, /.../there it says -teen, it says -teen the whole row.

<sup>3</sup>This is not the case for all languages. In some languages, the word **teenager** is related to the counting words for **thirteen**, **fourteen**, ..., **nineteen**. In Swedish, teenager is **tonåring** and the counting words from 13 to 19 are **tretton**, **fjorton**, ..., and **nitton**. This example works in English and Swedish (as well as in some other languages) but not, for example, in Spanish, Arabic, Japanese, or Korean.

After about 45 min another boy, Melvin, initiated a change of topic once again, asking:

Melvin: But ... this thing about **ton**,<sup>4</sup> two tons, three tons ... what is that? It is like ... [pointing at a desk] This weighs a ton!

Ms. Anna shifted yet again in the mathematical discussion, based on Melvin's question. The shift provided the opportunity for the students to get involved and tell their stories about heavy tables and elephants. The open nature of the classroom discussion determined students' possible ways of acting (Cotton & Hardy, 2004). In this classroom, students were very well disciplined into a mainstream school mathematics discourse where the teacher was the one with the "right" answers. Yet, in this discussion, Ms. Anna supported students' agency, as when Melvin changed the focus from ton as a counting word to ton as a measuring unit. Students' language and out-of-school experiences were supported when the teacher and students engaged in discussion that bridged mathematics and (Swedish) language issues. These young students positioned themselves as active mathematics learners by coordinating their interests in both linguistic and mathematics knowledge.

### 9.2.3 *Vignette 3: Open-Ended Tasks*

This final vignette is based on data from a larger study of Spanish-dominant, emergent multilingual third graders in a poor urban community in the Northeastern United States (Vazquez, 2009). The study investigates how students use their linguistic resources to develop mathematical and heuristic ideas as they solve a series of open-ended combinatorial tasks. The vignette below illustrates the work of a group of students who received mathematics instruction in Spanish and English. In the classroom, the students were allowed to use either language and tended to move fluidly between English and Spanish. To analyze these data, Vazquez and Powell focus particularly on the discursive interactions as students within a group justified and attempted to persuade each other of their understandings and resolutions.

To understand the students' oral and inscriptive mathematical interactions and representations, they use the analytic lens of agency and cognitive elasticity. Agency is understood as individuals' intentional, self-initiated action directed toward accomplishing an explicit or implicit goal. In the context of the third vignette, students enact agency when they author their own procedures and heuristics to resolve mathematical tasks or aspects of them or when they pose their own questions upon which to work. This conceptualization highlights students' interdependent, independent, and autonomous mathematical performances through student-to-student discourse. As Powell (2004) notes, "understanding agency is particularly important since both failure and success can be located within the same set of social, economic, and

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<sup>4</sup>Note that In Swedish **teen**-ager is **ton**-åring, and **ton** is **ton**, as in the measuring unit. This works in Swedish but not in English or other languages.

school conditions that usually is described as only producing failure” (p. 42). Examining how students exercise agency in their use of linguistic resources as they interact jointly to meet challenges of a mathematical task can provide counter-narratives to deficit perspectives. By cognitive elasticity, we refer to students’ ability to coordinate discursively between abstract and concrete representations. Discursive manifestations of cognitive elasticity can occur orally, inscriptively, or gesturally and provide evidence of emergent multilinguals’ use of their linguistic resources.

In the excerpt below, a group of emergent multilingual students, whose mathematics class was in English, work together to understand and resolve this open-ended combinatorial task:

Stephen has a white shirt, a blue and a yellow. He has a blue pair of jeans and a white pair of jeans. How many different combinations can he do?

The analytic goal is to understand how students enacted agency and cognitive elasticity to mobilize their linguistic resources to understand and develop solutions to combinatorial mathematics problems. In the vignette, a group of three students discuss their understanding and solution of the task presented above:

Ciara: We can’t use the yellow shirt because you don’t have pants that go with it. Because it says that also has a pair of blue jeans and white jeans and has no yellow pants, so we can’t use yellow shirt

Parnieri: The color doesn’t matter!

Kayla: You can put blue, white, yellow and blue, and white and yellow. Three of each is six. Six ways to combine!

Ciara: How?

Kayla: See [pointing to Ciara’s diagram] white with yellow, yellow and blue, and blue and white, yellow and white, and blue and white (...) all colors of with each pants, each group.

Ciara: One, two, three, four, five, six ... we have six ways to combine.

The vignette shows students’ agency as well as their cognitive elasticity. The exercise of students’ agency is a hallmark of the classroom’s linguistic and collaborative atmosphere which provides space for students to be comfortable discussing and challenging each other’s ideas. Discursively, the group challenges Ciara’s idea that colors matter and, thereby, convinces her that there are six different combinations of shirts and pants Stephen can use as outfits. Inscriptively, they use their own strategic representations to solve the problem. In their discursive interactions, they reveal the importance of the interaction between members of the group that are at a high level of mathematical understanding (Fig. 9.1). This excerpt also illustrates Vygotsky’s theory of the Zone of Proximal Development (ZPD), where the assistance of a more experienced interlocutor contributes to the activity of another. With the help of the group, Ciara uses agency and cognitive elasticity to develop the diagram and represent her ideas (Fig. 9.2). She and other members of her group exhibit cognitive elasticity as they move back and forth between concrete and more abstract representational forms. The emergent multilingual students in this vignette evidenced ease in communication and construction of mathematical representations as well enactment of agency and cognitive elasticity.



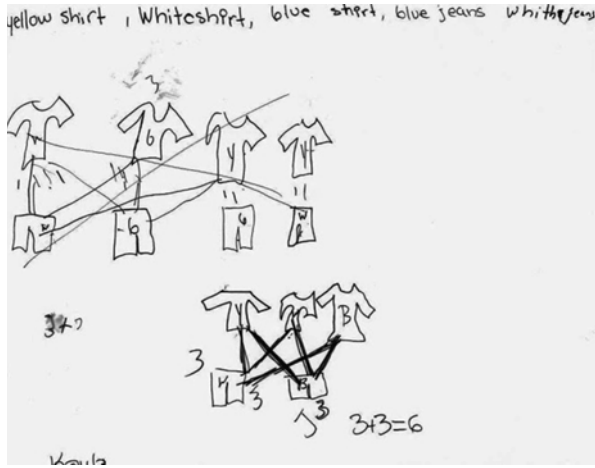


Fig. 9.1 Kayla's inscription

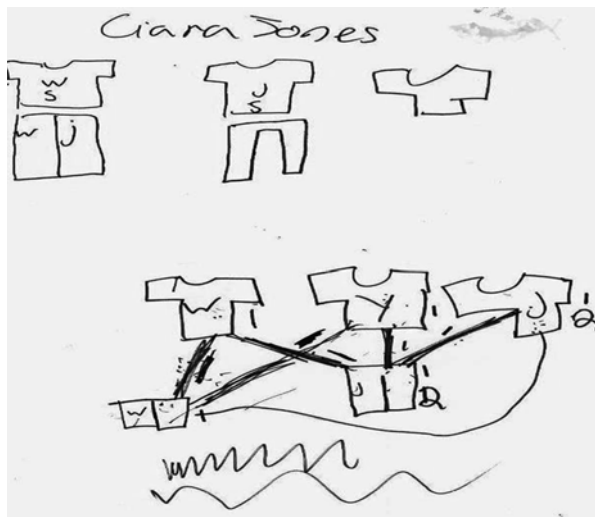


Fig. 9.2 Ciara's inscription

### 9.3 Concluding Thoughts

The purpose of this chapter is to broaden the conversation around language learners' competence in negotiating interactions in mathematics classrooms. Our three excerpts highlight how language learners draw creatively on humor, personal interests, and bilingual competencies to position themselves productively as learners, shift the nature of mathematical discussions, and engage in complex debates of mathematical ideas.

Learners draw on a variety of resources as they negotiate mathematical ideas and positional identities during classroom activity. In contrast to prevailing emphases on linguistic deficits, our vignettes show students' agentic use of resources for both mathematical and positional functions. This chapter serves as a jumping off point for further examination of the ways in which emergent bilingual and multilingual students construct productive trajectories as mathematics learners. More research is needed to understand how emergent bilingual and multilingual learners utilize linguistic and other available resources in order to successfully navigate mathematics classroom interactions. Such understandings can help researchers and educators to design classroom spaces that position all learners as capable, enabling their entry into meaningful mathematical discussions with their peers.

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