Language, Culture, and Equity in Secondary School Mathematics Classrooms

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Language, culture, and equity are crucially important issues in mathematics classrooms. This article begins with the assumption that educators both value and are committed to creating conditions of equity in mathematics classrooms. To do this, teachers need to know their students and their students’ communities. However, knowing and learning about students’ practices outside of school can be a challenge for teachers who teach students from communities outside their own. An important beginning step is recognizing that although students from different communities may participate in classroom activities in different ways, these differences are not deficits. Another important step is learning to see more than the obstacles that students from nondominant communities face: all students bring resources from their experiences to the task of reasoning mathematically.

This article tackles three related issues in turn: (a) the needs of bilingual students and English learners in secondary school mathematics classrooms; (b) learning to use language for mathematical purposes; and (c) connections among language, culture, and equity. Rather than providing a quick recipe for addressing issues of equity connected to language and culture in mathematics classrooms, this article presents suggestions and ways of thinking that are grounded in currently available research.
1. How do I address the needs of bilingual students and English learners in my classroom?

It is difficult to make generalizations about the instructional needs of all students who are bilingual or English learners. Specific information about students’ previous instructional experiences in mathematics is crucial for understanding how bilingual learners communicate in mathematics classrooms. Classroom instruction should be informed by knowledge of students’ experiences with mathematics instruction, language history, and educational background. In addition to knowing the details of students’ experiences, research suggests that high-quality instruction for English learners that supports students’ achievement has two general characteristics: (a) a view of language as a resource, rather than a deficiency, and (b) an emphasis on academic achievement, not only on learning English [5].

2. When and why do bilingual mathematics students switch from one language to another? Does switching languages affect or reflect mathematical reasoning?

Strong evidence suggests that, in general, bilingualism does not affect mathematical reasoning [10]. Bilingual students sometimes use two languages in the classroom, and we may wonder whether this practice might be significant to learning mathematics.

Bilinguals sometimes switch languages when carrying out arithmetic computations. Adult bilinguals may have a preferred language for carrying out arithmetic computation, usually the language of their original arithmetic instruction. Reported differences in calculation times between adult monolinguals and bilinguals are minuscule [10]. Furthermore, some evidence suggests that switching languages for arithmetic computation may not affect the quality of conceptual reasoning. This language switching can be swift, highly automatic, and facilitate rather than inhibit solving word problems in the second language, as long as the student’s language proficiency is sufficient for understanding the text of the word problem. Research suggests that classroom instruction should allow bilingual students to choose the language they prefer for arithmetic computation [10]. Classroom practices should also provide students the opportunity to understand the text of word problems before they attempt to solve them [11].

The practice of using two languages during one conversation or in one sentence is called code switching. Research does not support a view of code switching as a linguistic deficit [13]. In fact, the opposite is true. Although code switching has an improvised quality, it is a complex, rule-governed, and systematic language practice reflecting a speaker’s understanding of his or her community’s linguistic norms. The most significant reason for a bilingual student’s language choice is the language ability and choice of the person addressing the student. We should not assume that bilingual students switch into their first language because they are missing English vocabulary or cannot recall a word.

We should also avoid using code switching as evidence of a deficiency in students’ mathematical reasoning. Research has shown that code switching can provide resources for communicating mathematically [8]. For example, students sometimes code switch as they describe a mathematical situation, explain a concept, justify an answer, elaborate on an explanation, or repeat a statement.

3. I have often heard that “mathematical discourse” and “academic language” are important for English learners. Does that mean that I should focus on teaching mathematical vocabulary?

Although it is crucial that students who are learning English have opportunities to communicate mathematically, this is not primarily a matter of learning vocabulary. Students are also learning to describe patterns, make generalizations, and use representations to support their claims. As a start, mathematical discourse involves the mathematics register—the meanings, words, structures, and so on, that are appropriate when language is used for mathematical purposes. Learning to communicate mathematically involves, in part, sorting out differences in meanings of words and phrases that are used in both mathematical and everyday settings [9]. For example, the word set and the phrase any number have different meanings in everyday and mathematical settings. The word set can be used in the phrase “Please set the table” at home and in the phrase “Find all the elements in this set” in a mathematics classroom. The phrase any numbers is regularly used to mean “all numbers” in mathematics classrooms [12].

Learning to use the mathematics register, in particular, and learning to communicate mathematically in general, involve much more than learning the multiple meanings of words. They entail learning to participate in valued discourse practices, such as being precise and brief, abstracting, generalizing, and striving for certainty and logical coherence. Mathematical communication often involves talking and writing about imagined things—such as infinity, zero, infinite lines, or lines that never meet—as well as visualizing imaginary shapes, objects, and relationships. Students learn to participate in these practices not by learning vocabulary but by making conjectures, presenting explanations, and constructing arguments.

In sum, although vocabulary instruction is important, it is not sufficient for supporting mathematical communication. Furthermore, vocabulary drill and practice are not the most effective instructional practices for learning vocabulary. Instead, research has demonstrated that vocabulary learning occurs most successfully through instructional environments that (a) are language rich, (b) actively involve students in using language, (c) require that students both understand spo-
ken or written words and express that understanding orally and in writing, and (d) require students to use words in multiple ways over extended periods [1]. To develop written and oral communication skills, students need to participate in negotiating meaning for mathematical situations and in mathematical practices that require output from students [10].

4. What classroom practices does research suggest promote equity?

Research provides examples of how teachers can create conditions for equity [2, 4]. One example is using discussion-based formats to promote equity by providing opportunities for students to see themselves as mathematics learners. Another example is using complex instruction strategies that offer a rich set of group-worthy mathematics tasks for students to tackle together. These approaches have been shown to minimize status differences among students and promote group accountability [4].

Another research-based approach to promoting equity is the use of “culturally relevant pedagogy” [6]. To enact this method, teachers need to know, use, and capitalize on students’ prior knowledge and view students’ home cultures as resources rather than barriers. Teachers are also asked to provide students with “a way to maintain their cultural integrity while succeeding academically” [6, p. 476].

One approach to culturally relevant mathematics instruction identifies three criteria to consider for practices in the mathematics classroom: (a) cultural content, (b) social organization, and (c) cognitive resources [3]. Examining materials and instructional techniques for their cultural content reveals whether mathematical activities used in the classroom relate to mathematical activities in the local community. Similarly, a classroom where the social organization includes a variety of roles, responsibilities, and communication styles is more likely to support students’ productive participation. Lastly, classrooms that use the cognitive resources that students bring from home—including language and a variety of ways of thinking used in their communities to solve problems—make the most of students’ knowledge and experiences [11]. Other cognitive resources relevant to mathematics instruction include local systems for collecting and interpreting data and specialized local maps. Teachers’ ability to recognize and appreciate students’ cognitive resources ultimately influences how they interpret students’ talk and activity in the classroom.

Final Remarks

I close with a few words of caution. First, this article has addressed only one aspect of equity—access—as it relates to mathematical discussions in the class-

room. Another crucial aspect of equity is providing students opportunities to use mathematics to expose and confront inequitable situations in their lives, which is sometimes called critical mathematics (see [4] for a review of critical-mathematics approaches and examples). Second, we cannot assume that any community or cultural group is uniform or that all members of any community participate in a uniform set of shared practices. Therefore, assumptions that all members of a particular group share an integrated view of their culture should be replaced with approaches to culture that take into account multiple perspectives, experiences, and access to practices. Furthermore, we should not treat cultural practices as individual traits but instead consider how each student has had access to many different cultural practices. Tapping into students’ prior knowledge or experiences does not create an automatic understanding of the underlying sociocultural practices (e.g., values, beliefs, and experiences acquired as a member of a given community) that influence how students construct knowledge [11]. Instead, research suggests that teachers consider the complexity of what constitutes comfortable and productive participation for learners, as well as the multiple communication practices that students may have experienced both at home and in school.

REFERENCES


