The Language of Mathematics
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Abstract
Some research on content-based instruction has focused on the language of mathematics. Students whose primary language is not the language of instruction have unique needs. Educators have to specially design activities and teaching strategies to incorporate into the mathematics program in order for all students to have the opportunity to develop their mathematics potential, regardless of a lack of proficiency in the language of instruction. Language minority students are inexperienced with or lack an understanding of mathematical terminology. Language minority students expressed difficulty in mastering the basic concepts of mathematics. Instruction plays a major role in that it emphasizes language activities that are incorporated into mathematical lessons and curricula. This requires development in teacher training, curriculum, materials, assessment, and most importantly, cooperation between content and language educators. At Gunston Middle School, about mid-year I found that language minority students expressed difficulty in mastering basic concepts in mathematics.

Introduction
This is my fifth year of teaching 8th grade mathematics. This is my first year of teaching at Gunston Middle School in Arlington, Virginia. Gunston Middle is an extremely diverse school. Schools across the United States are challenged to meet the needs of an increasingly diverse population. I discovered that my communication style was so different from that of my students. I became more aware of my personal identity and more appreciative of the diverse cultural backgrounds of my students. At Gunston Middle within the first month I found that language minority students expressed difficulty in mastering basic concepts in mathematics. I found that many students were not progressing and were not able to complete tasks without my assistance. I was frustrated and my students were even more frustrated. I raised the question, "How do I meet the needs of this population?"

I then began to do some research on teaching mathematics to language minority students. I realized in my research that there was a call for a reform in mathematics instruction. It was necessary to assure that students have access to math content. This reform calls for modifications in the curricula and in the delivery of instruction.
Background

In today's society, students are not prepared for mathematics by the time they reach middle school. Language minority students expressed difficulty in mastering the basic concepts of mathematics. Educators have to specially design activities and teaching strategies to incorporate into the mathematics program in order for all students to have the opportunity to develop their mathematics potential regardless of a lack of proficiency in the language of instruction. Instruction plays a major role in that it emphasizes language activities that are incorporated into mathematical lessons and curricula. This requires development in teacher training, curriculum, materials, assessment, and most importantly, cooperation between content and language educators.

Look at the following word problem in a language which you might not have little or no familiarity and think about some questions that focus on factors involved in problem solving:

*Sam et Mike sont freres. Sam est l’aîne. Les deux vont au lycée qui se trouve a moins de cinq kilometers de leur maison a Paris. Bien qu’il y ait une difference d’age de trios ans entre les deux freres, leurs niveaux scolaires ne sont separees que par deux annees. Sam est en quatrieme. En quelle classe est Mike?*

Were you able to comprehend the problem? What are the language difficulties in this problem? What are some math difficulties in this problem? What are some extra-linguistics features that could cause difficulty in solving this problem?

Now take a look at the English version of the problem:

*Sam and Mike are brothers. Sam is older. The two go to a school, which is found less than five kilometers from their home in Paris. Although there is a difference in age of three years between the two brothers, their grade levels are only two years apart. Sam is in the fourth grade. What class is Mike in?*

Simply knowing the language of instruction and required math skills may not be sufficient for solving problems. Cultural issues may be present as well. In the word problem that was presented, one needs to know that the French counts the grade levels in secondary school from 6th (youngest) to 1st (oldest). We as teachers need to be aware that not all students have the same background knowledge. This word problem was an example which suggests the desirability of instruction that is sensitive to the linguistic and cultural needs of language minority students. Students whose primary language is not the language of instruction have unique needs. Within academic context, the basic proficiency is inadequate because language minority students are inexperienced with or lack an understanding of the terminology particular to a content area. Instruction that
emphasizes language activities should be incorporated into mathematics lessons and curricula.

Teacher Training

Training workshops for staff development for math teachers can provide an opportunity to consider language objectives and increase communication in their classes. The training should provide learning techniques into each lesson and employ extensive collaborative learning experiences to practice and demonstrate understanding of mathematics objectives. One important aspect of these training workshops is the joint participation of content and language educators, which provide opportunities for cooperative activities that combine the expertise of both disciplines. These workshops provide teachers with the background for integrating language and content and provide opportunities for application through the curricula. During the workshops, techniques should be presented through discovery learning, hands-on and problem-solving activities, cooperative learning and group work, and peer tutoring.

Curricula and Materials

Before you devise a mathematics curriculum, the following questions need to be considered:

“Why are these students unsuccessful in our present math courses?”

“What is the most efficient way for students with limited amounts of time in school to learn what their classmates already know?”

“How can math teachers be expected to teach language?”

“How should students’ understanding of math be assessed?”

Teachers need to be trained how to increase communication in class. They need appropriate materials for developing their lessons and activities. Teachers should attend workshops where they can learn to modify existing materials for their particular needs. Multiple learning strategies are necessary to reach both those students who show understanding of objectives after just a few activities and those who may need continued reinforcement.

Assessment

Teachers need to find different ways to describe and assess students’ learning in mathematics. The techniques should allow teachers to assess growth in language skills within the context of daily mathematics instruction. Instruction for language minority students has moved in the direction of teaching language and content area skills, assessment has incorporated a variety of measures that reflect the types of tasks that students are asked to perform in math classes or in real-life settings. Teachers have to develop changes in assessments, which are especially important for language minority students. The function of
assessments methods is to measure the growth or progress toward meeting established goals and standards. The NCTM Curriculum and Evaluation Standards (1989) propose changes in the methods and processes of student assessment:

1. Student assessment should be an integral part of instruction.
2. Multiple assessment methods should be used.
3. Mathematical knowledge and its connections should be assessed.
4. Teachers provide ongoing assessments in the classroom, allowing teachers to revise instruction as needed.

Assessments include:

Spot Checks: While students work with manipulatives or in solving problems, the teacher can circulate around the classroom to see how the students are doing.

Checklists: The teacher can use a checklist to assess class work. By using a checklist weekly and retaining the checklists, growth can be observed over time.

Anecdotal Records: The teacher can use an anecdotal record sheet to record observations during or immediately following a lesson, to record information about a student over time, and determines patterns of development. Teachers should document notes or phrases that can be recorded on individual student sheets.

Portfolios: A portfolio is a collection of samples of students work in a variety of the teacher may establish a set of items to be placed in the portfolio, and allow the student to select others. Samples might include problem solving activities, projects, a math journal, homework assignment from each quarter, a test, and other items which indicate the student’s work.

Cooperation between Content and Language Educators

Content teachers need to be able to implement strategies for increasing teacher-student and student-student interaction in the classroom. Teachers need to emphasize communication of mathematical concepts. Cooperation between content and language teachers can benefit the language minority students. Language teachers can provide insights into linguistic and cultural problems and offer activities for overcoming problems that content teachers might have, whereas content teachers can offer objectives for the language teachers that would reinforce the content to the students. Between the cooperation of the teachers, students will develop greater language proficiency and concept mastery.
Reflections

Throughout my research, I came to a better understanding of my students’ perceptions of mathematics. I too considered myself to be a student. I wanted to learn ways that would improve interest in mathematics. Teachers must be sensitive to perceptions and awareness of cultural differences. As the year is coming to the end of the road, I can say that I am more knowledgeable about cultural learning styles. After implementing some of these strategies, my students became more successful in mathematics. This study proved that cultural backgrounds are very important in today’s educational society.

References


