



Communicating Mathematically: English Language Learners in the Mathematics Classroom

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Abstract

This article explores the essential role of communication and language in learning mathematics. Implications for English language learners taught primarily by English-speaking teachers are highlighted. In this paper (and their related book), the authors advocate regular use of pedagogical strategies such as "help English learners talk-to-learn during mathematics lessons" and "provide mathematical and organizational representations."

Discussion And Reflection Enhancement (DARE) Pre-Reading questions:

1. Think of when you were communicating in a foreign language to get directions to a place or to learn something unfamiliar. What was confusing and what helped you understand?
2. Think of a time when you learned specialized vocabulary associated with a new sport or hobby. What did you do to be able to develop meaning for, and to recall the new words? Did you learn the concept or the word first?
3. What do you believe are necessary components/attributes of effective mathematics lessons that are taught in English to students who are still in the process of learning English?
4. Have you purposefully added a new instructional technique to your practice to the point where it became routine? What process worked for you, from the time that you decided to expand your practice to the time when you could almost automatically use the technique? What types of support were helpful?

"DARE" Post-Reading questions appear at the end of the article. This article (without DARE questions) originally appeared in Fall 2007 *Noticias de TODOS*.

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“The ability to read, write, listen, think, and communicate about problems will develop and deepen students’ understanding of mathematics.”

— Communication Standard, NCTM (2000)

One essential aspect of *participation* in a high-level mathematics lesson is written and oral communication, including requirements for students to explain their mathematical thinking. The Communication Standard from NCTM (2000) states that instructional programs from PreK-12 should enable students to organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; analyze the mathematical thinking and strategies of others; and use the language of mathematics to analyze and express mathematical ideas precisely.

These recommendations have profound implications for the pedagogical strategies used by teachers of English learners (ELs) as well as for the achievement of all their students. These multiple abilities and higher expectations of mathematics learning present a particular difficulty for second language learners who are taught by traditional methods that depend on considerable teacher talk and relatively passive student involvement. *It is evident that use of language is essential for mathematics learning, and mathematical activities provide opportunities to extend language skills.*

The authors [of this paper and of Coggins et al., 2007] aimed to address the critical issue

of the level of mathematics learning by the growing numbers of ELs in American classrooms. Based on experience as professional development designers and providers, as college instructors, as researchers and writers, and as classroom teachers, we knew that the responsibility to seek and implement strategies for ensuring each student’s development of communication skills and mathematical ideas ultimately falls upon the classroom teacher.

A major purpose of the book was to provide teachers a context for focused conversations about expectations and possibilities for all learners. The accessible writing style and examples used, along with specific information and guidance related to several practical teaching strategies and a lesson map, are intended to spark reflections on current teaching practices. The hope is to inspire teachers purposefully to adopt effective strategies for teaching mathematics. *We believe that the recommended strategies are more than just good teaching practices — they are essential to the education of ELs.* We envision the use of our book in pre-service courses, in collaborative inquiry teams, and as a vehicle for school-wide or grade level implementation of effective strategies for teaching ELs.

Each chapter includes several components: mathematics teaching examples, each focused on a specific mathematics problem; a discussion of the use of the chapter’s focus strategy in the teaching example; an overview of the research or theoretical basis for each chapter topic; specific teaching tips; further discussion of the focus strategy, and practice/discussion questions.

An extensive lesson-planning map is provided not as a template, but tool for teachers to think about the myriad of planning aspects that are part of an excellent lesson.

Samples of the chapter components are included in relation to the seven chapters listed below. For the sake of coherence, examples related to communication and language have been selected.

Developing Conversational Language: Help ELs Talk-to-Learn During Mathematics Lessons – Teaching Tips – Tips include suggestions to include brief Think-Pair-Share sessions on focused discussion topics and suggestions of sentence starters that can expand ELs’ participation in discussions.

Developing Academic Language: Develop Mathematics Concepts and Vocabulary for English Learners – Discussion of the lesson vignette–The discussion of this lesson on comparative relationships emphasizes the need to provide a positive environment replete with opportunities to use academic language: The questions, verbal and physical models, diagrams, “talk to your neighbor” directions, and partner games all lead to an increased likelihood that students will have frequent meaningful encounters with the mathematics vocabulary.

Scaffolding: Give Support for Both Mathematics and Language Learning – Theoretical basis for the strategy – “Another [scaffolding] technique, is to provide challenging tasks, with collaborative support, including considerable social interaction” (National Research Council, 2001).

The Role of Concrete Materials – Utilize Objects to Develop Mathematical Understanding for English Learners – Research. While tactile and visual learning are significant meaning-centered components of instruction, benefits include not only increased access to ideas, but also multiple ways of thinking and communicating.

Visual Learning: Provide Mathematical and

Organizational Representations as a Regular Component of Instruction Focused – Discussion of the Topic– Focus questions, such as “What are graphic organizers, advance organizers, and diagrams, and why are they important?” are included. Each visual tool is defined, discussed, and examples are given. For example, “Graphic organizers are visual structures that make it possible to organize words, ideas, information and so on to further learning goals such as understanding, communicating, and remembering.”

Questioning Strategies: Ask Questions to Foster Students’ Learning of Mathematics and English – Mathematics teaching example – The lesson vignette about Snail Races, a probability game, includes many questions from the teacher, such as “Help me label our bar graph. How can we use this chart to find out which snail won the most in our class?...How did I choose the numbers [to use to label this tally chart]? How should we use this chart?” The questions are also identified as to type of question.

Comprehensible Input: Combine Many Strategies to Develop Mathematics Concepts Through Clear and Effective Instruction – Practice and Discussion Questions - Question 1. Think about teaching a small group of intermediate-level English learners the concept of perimeter. What would you say and how would you create access to your explanation? What would the students see? How would you assess students’ learning?

The book aims to serve as a resource to those who work to further the goals of mathematics for ALL. It is intended to show the high level of mathematical learning and increased use of language that result when specific and purposeful planning occurs in designing mathematics and ELD (English language development) lessons. These strategies and components are designed to promote communication, mathematical understanding, increased skill development, and confidence for ELs.

REFERENCES

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Discussion And Reflection Enhancement (DARE) Post-Reading Questions

1. Do you believe that communicating about mathematical problems is essential to the development of a deep understanding of mathematics? Why?
2. What is necessary in order to communicate about a mathematical idea with others?
3. In the preface of the Coggins et al. (2007) book (<http://www.corwinpress.com/upm-data/19571/Preface.pdf>), the authors contend “if we teach mathematics by following commonly accepted ‘best practices,’ we may actually overlook English learners, because they have very specific needs.” Identify and discuss the evidence for some of those specific needs.
4. Name a strategy or topic listed in this *TEEM* article that you think warrants further consideration for teachers. Examples of strategies are: Help ELLs Talk-to-Learn during mathematics lessons; utilize objects; provide mathematical and organizational representations; and ask questions. Outline what you will do to use your identified strategy purposefully in an instructional context in the next few weeks. Arrange to discuss your progress with the strategy with a colleague and then identify modifications to make when you next use the strategy.
5. Reflective lesson preparation, either by a single teacher or as part of a collaborative team, is needed to address the learning needs of English learners better. For an upcoming math lesson or unit, outline how you could identify and introduce key vocabulary and develop in advance plans for exposure, sense-making, practice, repetition, reinforcement, and application.
6. In a 2007 position paper titled “Improving Student Achievement by Leading *Effective and Collaborative Teams* of Mathematics Teachers” (<http://mathedleadership.org/docs/PositionPapers/NCSMPositionPaper1.pdf>), the NCSM states that effective collaborative teams of mathematics teachers meet to “[s]hare teaching strategies and analysis of the effectiveness of those strategies” and to engage in reflective discussions about observations of teacher practice. How could you become part of a collaborative team that focuses on effective instructional strategies for English language learners?

“DARE to Reach ALL Students!”

