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MAKING SENSE of the MATH Common-Core Math Standards Put New Focus on English-Learners

Language demands heightened

By [Anthony Rebora](#)

When he began working the Common Core State Standards into his instruction three years ago, New York City middle school mathematics teacher Silvestre Arcos noticed that his English-language-learner students were showing less progress on unit assessments than his other students.

"It wasn't necessarily because they didn't have the numeracy skills," recalled Mr. Arcos, who is now a math instructional coach and the 7th grade lead teacher at KIPP Washington Heights Middle School, a charter school in New York. Rather, they were struggling with the linguistic demands of his new curriculum, which was oriented heavily toward word problems and explication of solutions.

To address the issue, Mr. Arcos began incorporating strategies that are typically the province of language arts teachers into his math lessons. Especially when working with his English-learners, he provided detailed instruction in close reading, sentence annotation, and writing fluency.

He also redoubled his efforts to ensure that his lessons had specific language objectives—to help students grasp important terminology, for example—as well as content objectives, a practice he had learned in graduate school.

To help his English-learners adapt to the aims of the new standards, said Mr. Arcos, "it was important for us to develop their language skills."

Mr. Arcos' recognition that the new math standards may require greater attention to the needs of English-language learners is not uncommon among educators who work with such students. Particularly in the **Standards for Mathematical Practice** that preface and inform the grade-level objectives, the common core emphasizes the importance of explaining solutions and relationships, constructing arguments, and critiquing the reasoning of others. While such expectations are proving difficult for many students, educators say, they pose unique challenges for those not fully proficient in English.

In that light, experts in math instruction for English-learners tend to view schools' adoption of the common core in math with a mixture of hope and apprehension.

On the one hand, the standards are "pushing math teachers to think about the language we use ... [and] support English-learners at different levels," said Anita Bright, an assistant professor in the graduate school of education at Portland State University, in Oregon, who specializes in multilingual education.

In addition, the common core's emphasis on verbal expression and reasoning in math are widely seen as beneficial to English-learners. "The more language you use in the math classes, the more [ELL] students are going to learn, both in math and language," said Judit N. Moschkovich, a professor of mathematics education at the University of California, Santa Cruz.



Teacher Silvestre Arcos works with 6th graders at KIPP Washington Heights Middle School in New York. To help English-learners, Mr. Arcos integrates language development into his math lessons.

—Mark Abramson for Education Week

What concerns experts, however, is that many teachers might not have the curricular resources or training needed to address language development in connection with math instruction.

"Language hasn't traditionally played much of a role in the training of math teachers," said Mark Driscoll, a managing project director with the Education Development Center, a Waltham, Mass.-based nonprofit that provides professional development and other services to help schools support diverse-needs learners. "In my experience, many teachers lack the guidance and tools to foster communication of mathematical reasoning [with] English-learners."

Despite the growing enrollment of non-native English speakers in U.S. schools, "many math teachers have had limited professional development in what they might do to tailor instruction to ELLs," said Ms. Bright.

Under the common core, they will need "better access to supportive structures so that they are well-equipped to meet the needs of these and other marginalized students," she said.



Math teacher Silvestre Arcos conducts a class at KIPP Washington Heights Middle School in New York City. To help English-learners adapt to the common core, Mr. Arcos has integrated language arts strategies into his math lessons. —Mark Abramson for Education Week

Opportunities for Expression

If math teachers need to become more attuned to students' language needs, however, they also have to be careful not to regard their struggles with English as a "sign of deficiency," said Ms. Moschkovich.

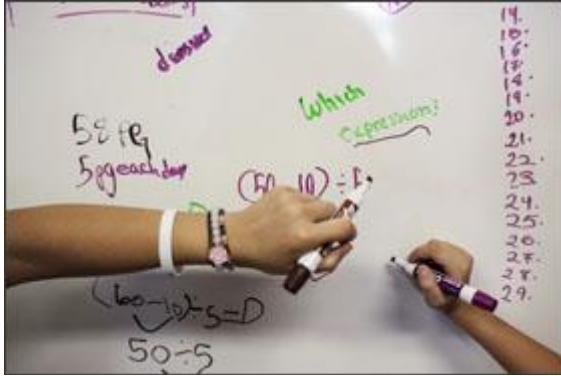
"Deficit models are really easy to fall into," particularly for inexperienced teachers, she said. "Just because a student has an accent or uses imperfect language doesn't mean he doesn't or can't understand the mathematics."

Rather than being discounted or assigned remedial computation worksheets, she said, English-learners should be given a range of opportunities to use their own words to delve into mathematical problems and concepts, including in peer-to-peer and whole-class discussions and writing activities. The teacher's job, she said, is to "look for the mathematical sense" in the students' verbal expressions and then "build on that."

As Ms. Moschkovich puts it in a [published paper on language and the common core in math](#), "By learning to recognize how [English-learners] express mathematical ideas as they are learning English, teachers can maintain a focus on mathematical reasoning as well as on language development."

Ms. Moschkovich said that many teachers make the mistake of thinking that language instruction merely means pre-teaching vocabulary words. Instead, word meanings should be explored in the context of students' work on solving problems, she said.

Experts also stress the importance of using diagrams or illustrations together with linguistic prompts as a way of drawing out English-learners' verbal understanding of math problems.



Mr. Arcos' students at KIPP Washington Heights work in pairs at a whiteboard to solve a math problem. "As their language development improved, so did their math scores," Mr. Arcos said.

—Mark Abramson for Education Week

Such visual elements can go well beyond bar graphs and number lines.

In providing coaching to math teachers who work with English-learners, for example, Mr. Driscoll of the Education Development Center said that his organization has had success in using sequences of diagrams showing the steps that fictional characters named Mario and Estella take as they work through solutions to math problems. The idea is for teachers to prompt students to try to explain the math strategies used by the characters in each frame, with the help of simple sentence starters. (For example, "In step one, Mario _____.") Throughout the process, Mr. Driscoll said, teachers are guided to bring in a variety of other common language-instruction strategies, such as revoicing terms and clarifying key vocabulary.

"We believe you can use visual representation as a bridge to academic vocabulary," Mr. Driscoll said. "It can act as a mediator between the words in a problem and the symbolic solution."

Scaffolds and Support

In a similar vein, as part of a U.S. Department of Education-funded study, the Washington-based American Institutes of Research is building "scaffolds," or instructional supports, for 6th grade Spanish-speaking English-learners to supplement an iPad-based math curriculum created by Pearson Inc.

For a lesson on fuel-efficiency rates, draft screenshots from the enhanced curriculum feature numerous visual elements. They include a "picture card" comparing the gas intake of a truck and a solar-powered car, a graphic organizer showing the relationship between rates of measurement and fuel efficiency, and a Venn diagram to sort out the key components of a word problem.

At the same time, a Teacher Notes panel provides specific activities teachers can use to help English-learners engage with the language of the lesson. One such exercise says:

"Have students work with partners to discuss the graphic organizer and fill in the sentence frames [provided]. Then have them use the word bank [provided] to fill in the summary frame." The lesson also includes Spanish translations of key terms.

The goal is to "make the content comprehensible [to ELLs] and develop language proficiency in the context of learning," said Diane August, a managing researcher at the AIR who heads the project, which is slated to be tested in four Los Angeles schools starting in January.

"The biggest challenge for teachers is that these types of scaffolds aren't [typically] part of the curriculum," added Ms. August, a former English-as-a-second-language teacher. "If teachers had a curriculum like this, it would be a lot less challenging."

Beyond specific instructional strategies and curriculum supports, experts say the new math standards may require stronger ties between math teachers and schools' ESL specialists. "ELL supports tend to be more concentrated in language arts," said Gabriela Uro, the manager for English-language-learner policy and research for the Washington-based Council of the Great City Schools. "That's where the challenge is. In the common core, the language demands are heightened [in math], so ELL supports have to go across content areas."

For Ms. Uro, that means math teachers and ESL teachers alike have to learn more about each other's craft. "Content-area folks have to take on more with regard to language development. But [ESL] teachers have to delve more into math," she said. "You might have good techniques in language arts for reading complex texts. Now that has to happen in math."

Luciana de Oliveira, an associate professor of teaching English to speakers of other languages at Teachers College, Columbia University, said she is already seeing ESL teachers take on a greater role in math classes. "I see more [ESL] teachers going into classrooms working along the mainstream math teacher, so it's co-teaching versus pulling kids out of the classroom for separate language instruction," she said.

Ms. de Oliveira, who is on the board of directors of the TESOL International Association, said teacher educators like herself are increasingly aiming to prepare ESL teachers for that kind of collaborative work with their content-area counterparts. "There's more of a focus on both language and content" in preparation programs for ESL specialists, she said. "It's a major change in the past five years—certainly attributable to the common core."

But Ms. de Oliveira acknowledged that, in practice, the melding of schools' math and ESL resources is a work in progress. "I think we're all still kind of establishing what is really needed," she said.

Making Language Visible

For his part, New York City math teacher Mr. Arcos said that his efforts to revamp his lessons to focus more on his English-learners' language needs helped improve the students' understanding as he transitioned to the common core. "As their language development improved, so did their math scores," he said.

What's more, Mr. Arcos noted, the scaffolding techniques he used to boost his English-learners' verbal and conceptual understanding of problems also proved beneficial to other students in the class, particularly those who were below grade level in reading.

Indeed, Ms. Moschkovich of UC-Santa Cruz suggests that math teachers' work with English-language learners can be an opportunity to gain a better sense of the strategies expected of them under the common core.

"What English-learners do in a math class is make language visible—that's a gift, not a disadvantage," she said. "English-learners are a window into language."

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