

# Tool helps minority students improve math word problem solving by boosting reading skills

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Students rarely study math and reading at the same time, and it's not often considered that a student needs to excel at one to be successful with the other. But reading plays a vital role in math as students are presented increasingly difficult word problems throughout their schooling. A University of Kansas professor has developed and verified the effectiveness of an intervention that helps minority students at risk of math difficulties to better solve word problems by boosting both their reading and math abilities.

Minority students, especially those from low-income backgrounds, face many challenges in education. If they are learning English as a second language or struggling with reading, the task of solving word problems becomes even more difficult. Michael Orosco, associate professor of [special education](#), co-authored a study in which an intervention to help minority students at risk of [math](#) difficulties was tested and validated. Co-authored with Jennifer Kong of the University of California-Riverside, it was published in the journal *Learning Disability Quarterly*, and the study's dedicated strategy has been cited by the U.S. Department of Education as an effective evidence-based practice.

"We haven't done a lot of word problem research with English language learners. We've applied it more to a general population," Orosco said.

"With English language learners you can have a trifecta of issues: Students may need help with math, as well as reading and language."

The study implemented an intervention called Dynamic Strategic Math with a cohort of minority, low-income students in third grade at risk for math difficulties. A replication study, it showed that all eight students' ability to solve word problems improved after the intervention and the improvements were maintained in follow-up assessments.

Students are presented with increasingly difficult word problems in math as they advance through the grade levels. But curriculum often doesn't stop and ask if students understand the terms and concepts they are reading in such problems. If they don't, the obstacles to solving the problems only increase. Orosco offered the following example of a word problem.

"Thomas bought a new pair of skis for \$350. He put \$110 down and received a student discount of \$30. His mother gave him half of the balance for his birthday. How much does he owe? Please explain your answer."

The problem is composed entirely of words and figures, but if a student is not familiar with ideas such as to "put down" money, a "student discount" or "balance," their chances of correctly solving the problem are slim. That is not even to mention the very real possibility that many students from poor backgrounds would have no experience at all with skiing, which only adds more confusion.

"For third-, fourth- and fifth-graders living in poverty, it can be very difficult for them to understand these concepts, but they're going to have to understand them at some point, as word problems are a critical building block for thinking about algebra," Orosco said. "This strategy comes more from the reading comprehension side more than the math side. It helps them create a mental model, verbalize the problem and have guided practice."

The strategy, known as DSM, helps students improve at word problems by teaching them to understand the concept of a question, relevant and irrelevant information, encouraging students to draw a picture to represent the problem, identifying the numbers in a problem, setting up an equation and checking their answer. It teaches those steps in phases first covering necessary concepts and vocabulary, then problem-solving strategies and finally cooperative learning in which students collaborate on word problems with their peers. The study showed all students who received the intervention improved in their ability to solve word problems and maintained the improvement in subsequent trials.

The findings are relevant given the increased emphasis placed on word problems in mathematics curriculum. And [minority students](#) have historically been overrepresented in special education classes. By helping students early, many could avoid being unnecessarily labeled with a math learning disability.

In future work, Orosco said he hopes to adapt DSM so it can be used in many different settings across the country. Given cultural and linguistically diverse differences from region to region, an approach that works in one setting may not automatically work in another, Orosco said. He also hopes to expand DSM to a professional development stage, in which training is developed to help teachers across the country deliver the intervention to help their students improve their word problem solving ability.

"We struggle with teaching math in this country. Teachers have told me, 'We love teaching math, but when it comes to word problems, our students just don't get it,'" Orosco said. "I not only want [students](#) to get the right answer, I want to improve their problem-solving. With this strategy, they're building reading and math skills, but they're also thinking through language about how they can approach solving problems and improving their critical thinking skills."

Provided by University of Kansas

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