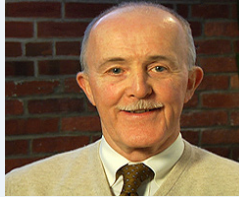




VIDEO

5:37 min

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Multiple Problem-Solving Strategies in Instruction

Mark J. Driscoll, Ph.D., September 2011

Topic IMPROVING MATHEMATICAL PROBLEM SOLVING IN GRADES 4 THROUGH 8

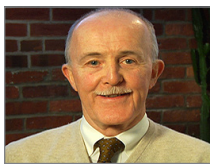
Practice PROBLEM-SOLVING INSTRUCTION


- Highlights**
- » Dr. Mark Driscoll observes that using multiple problem-solving strategies develops flexible thinking in students.
 - » He notes that strategies using visual tools often help make problems more accessible to special needs students.
 - » Dr. Driscoll explains how use of multiple strategies contributes to student learning by letting students see problems in new ways and giving students alternative approaches.
 - » He uses an example from a National Assessment of Educational Progress problem to illustrate advantages for students in having multiple strategies for solving a problem.
 - » He suggests that teachers can promote use of multiple problem-solving strategies by questioning students about their thinking and creating a culture of looking for different approaches to a problem.
 - » Dr. Driscoll explains using worked examples to illustrate more than one strategy and to encourage students to compare and contrast different approaches to a problem.


About the Interviewee


Mark Driscoll has directed a range of teacher enhancement, leadership, and materials development projects at Education Development Center. These include the MathPartners tutoring materials, the *Fostering Algebraic Thinking* book and toolkit, and the *Fostering Geometric Thinking* book and toolkit. He co-directs Fostering Mathematics Success of English Language Learners, a National Science Foundation-funded research project, as well as Mathematics Coaching Supporting English Learners, a research project funded by the Institute of Education Sciences. He received his Ph.D. in mathematics (differential geometry) from Washington University in St. Louis and taught mathematics at Logos School, an alternative high school in inner-city St. Louis. He has been co-chair of the National Council of Teachers of Mathematics (NCTM) Task Force on Reaching All Students With Mathematics and a member of the writing team for NCTM's *Assessment Standards for School Mathematics*. From 2003 to 2007, Dr. Driscoll served as editor of *Mathematics Education Leadership*, the journal of the National Council of Supervisors of Mathematics (NCSM). In 2010, he was on the development team for the What Works Clearinghouse Practice Guide on Mathematical Problem Solving. In April 2010 he received the NCSM Ross Taylor/Glenn Gilbert National Leadership Award.

Full Transcript





 **00:04** I am Mark Driscoll at Education Development Center, where I am a managing project director, and Education Development Center is also known as EDC Incorporated.


 **00:15** The value of teaching multiple problem-solving strategies to students is an opportunity to learn flexibility in problem solving. Teaching multiple strategies, there is evidence that that does produce flexible thinking in terms of the students seeing options for different strategies and then choosing according to the situation.


 **00:33** Teaching students to approach problems not just with the verbal analysis, but with a spatial analysis. Using visual tools—those strategies of using visual tools provide greater access to special needs


students in areas like ratio and proportion, which traditionally have not been accessible to a lot of middle grade students.

 **01:00** The use of multiple problem-solving strategies contributes to student learning in a couple of ways. And one way, I think, is that by a regular exposure to other students or the teacher's alternate ways to approach problems, the student can learn to see the problem and the problem types in new ways. The other way is that multiple strategies allow the student to become more analytical about problem context. So if, for example, the student's inclined to use numbers to approach geometry problems—say, similarity problems in the middle grades—that the numbers in a particular problem may be particularly difficult for the student. And so in that case, to have an alternate approach, a strategy, that's more spatially oriented based, say, on the dilation to get a similar replica of a triangle, then that student can, for the time being, ignore the difficult numbers and reason his or her way through to a solution.

 **02:15** So I think I can point to an example from the National Assessment of Educational Progress showing the advantages of multiple problem-solving strategies. Typical eighth-grade students in this country have pretty much one way to approach these proportional reasoning problems, and that is to set up a proportion and do a cross-multiplication. Setting up a cross-multiplication can be challenging and apparently is for many students. What's the alternative? If a student has another strategy in mind that's more geometric, and the student has learned that two triangles are similar if one is a dilation of the other, then you could start to look at it spatially and not worry about the cross-multiplication. The student knows dilations and says, well, it's a three dilation—it's a scale up by three. So now the question is, so what's X ? So we know that now we know it's a dilation of three, that whatever X is is going to be repeated three times in that segment there. Which means that X is going to be repeated twice in that piece of the segment, which is 40. And two even pieces into 40 means that each one has a length of 20, which tells you that X should be 20. So that's an alternative, that's a case where I think not having multiple strategies can get the students in trouble.

 **03:45** Several techniques come to mind for how teachers can promote the use of multiple problem-solving strategies. And one is to create a culture of multiple problem-solving strategies in the classroom. The second technique that comes to mind is the frequent use of questions that ask students not just what they did, but what they were thinking, so that making the thinking and the expression of thinking, again, part of the classroom culture—students talking to each other, students talking to the teacher.

 **04:24** Teachers giving the worked examples early on and emphasizing multiple strategies I think would be valuable. And to do it in a way where the students see at least two worked examples by the teacher in terms of two different strategies. Having the teacher gradually open the door and ask students, using his or her own judgment about the students, what other kinds of diagrams might help here, for example, what other strategies are there that you can think of? And to have them get those out and have the teacher then act as an agent to help them compare and contrast, which cognitive science shows is a really important contributor to learning—comparing and contrasting examples.

 **05:14** For students to be able to compare their strategy with another student's strategy and maybe a third student's strategy, the value is that they then can develop that kind of set of skills, set of strategies themselves that makes their thinking much more flexible.

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