DOINGWHATWORKS

AUDIO
6:05 min

Full Details and Transcript

Designing Worthwhile Problems

Philip Ogbuehi, Ph.D. & Patricia Herzig

September 2011

Topic IMPROVING MATHEMATICAL PROBLEM SOLVING IN GRADES 4 THROUGH 8

Practice PREPARE PROBLEMS

Highlights

- Patricia Herzig introduces the role she and Philip Ogbuehi played on the IES panel.
- Dr. Ogbuehi discusses why context is critical to learning mathematics and how applying skills in a problem-solving context refines and reinforces mathematics skills.
- Ms. Herzig offers an example of how a teacher could integrate problem solving in a mathematics lesson, using the example of a seventh-grade lesson on the means-extreme property.
- Both describe the importance of selecting problems with contexts familiar to students, with attention to explicit identification of vocabulary that might be confusing to students.
- Dr. Ogbuehi notes that the point is not to make the problem less challenging mathematically but to allow students to focus on the mathematics rather than being sidetracked.

» Ms. Herzig explains nonroutine problems and talks about why it is important for teachers to use both routine and nonroutine problems. She gives an example of a problem that might be routine for some students and nonroutine for others, depending on prior knowledge.

About the Interviewees

Patricia Herzig, M.S., is a national math consultant in Virginia, New Jersey, and Oregon. She was a classroom teacher for 20 years in Ohio and Washington, and she has taught mathematics in kindergarten through 12th grade. Since 2001, Ms. Herzig has played a leadership role as a math specialist for Highline and Bremerton school districts in the state of Washington. She helped write the *Mathematics Grade Level Expectations* for this state, and she has been active in writing and scoring performance items on the Washington Assessment for Student Learning.

Philip Ogbuehi, Ph.D., is a mathematics specialist with the pre-K–12 mathematics program in the Los Angeles Unified School District, where he designs and facilitates professional development as well as curriculum and assessment development. Dr. Ogbuehi taught eighth-grade algebra and seventh-grade pre-algebra in middle school for seven years and led the Mathematics, Engineering, and Science Achievement program at his school site. Dr. Ogbuehi's research has focused on evaluating innovative strategies for teaching algebra concepts, largely with regard to students' perceptions of classrooms as learning environments, attitudes toward mathematics, and conceptual development. His research has been presented locally and internationally, and also has been published. Dr. Ogbuehi was selected as a content review panel member for the 2007 Mathematics Primary Adoption by the California Department of Education.

Full Transcript

Philip Ogbuehi 00:04 My name is Philip Ogbuehi. I am a pre-K–12 mathematics specialist with Los Angeles Unified School District.

Patricia Herzig 00:12 Hello, my name is Patricia Herzig, and I am a math consultant and I work with various school districts helping their teachers and students with math. Philip and I were the two practitioners on the Problem Solving Guide panel. We both have advice for teachers who will be using the Practice Guide and some concepts we would like to emphasize. Philip and I agree that it's very important to incorporate problem-solving activities into whole-class instruction. One of the things that I have observed, and I am sure Philip has also, is that much of the math instruction is limited to learning and practicing new concepts, and this leaves very little time for the incorporation of problem solving.

Philip Ogbuehi 01:00 Mathematics cannot be learned and understood in isolation without being taught in context. The context will help the students to make meaning out of mathematics, and hence help them to become adept in solving problems. Applying skills in complex problem-solving situations is one of the ways in which students not only refine their skills, but reinforce and strengthen them.

Patricia Herzig 01:24 It is not difficult—with some structure—to model problem solving at the same time that you are teaching concepts. One of the things that I observed recently in a classroom—and this was a seventh-grade classroom—the teacher was teaching how to solve proportions. She was teaching it very traditionally using the means-extreme property. When the students got into the application part, where they had to read a problem and set up a proportion, they had a very difficult time doing this. This would have been an easy thing for the teacher to model using whiteboards in the classroom, reading problem situations, and having students set up for the proportions, and then being able to immediately check for understanding to see if the students actually could apply the proportional reasoning rather than just solving a proportion.

02:24 Both Philip and I believe that in today's diverse classrooms teachers really need to carefully select problems, and these problems need to include context and vocabulary that are familiar to their students. There have been studies that show that students that have

practiced with word problems involving people, places, and things they know do better on word problem tests.

Philip Ogbuehi 02:51 The question to ask is this: Is the problem given in the context—a way the student will understand? The teacher will endeavor to select a problem or write problems that are culturally relevant and responsive. Certain words in mathematics have multiple meanings, which can confuse some English learners. A word such as *table*, we use it a lot in math, but it has a different meaning than the table where we eat. Analyze the problem earlier and identify the vocabulary which will be problematic to the understanding of the math problem itself. We adjust how we teach to the needs and experiences of students by using their cultural knowledge to make learning in context more relevant and effective for them. It's not to make the problem less challenging, instead to allow students to focus on the mathematics and the problem. The teacher has to consider whether the problem is rigorous enough; whether it is routine or nonroutine; is the problem open-ended, which can have multiple entry points. By multiple entry points, we mean different solution strategies, not just one or two; which familiar or unfamiliar words are contained in the problem. By looking at all this, the teacher will know the best way to package a problem before implementing it in the classroom.

Patricia Herzig 04:23 It's very good for teachers to use nonroutine problems periodically, and the reason is because it helps children develop strategic thinking. Routine problems can be solved using methods familiar to students by replicating previously learned methods in a step-by-step fashion. A nonroutine problem, they are problems for which there is actually not a predictable, well-rehearsed approach or pathway suggested by the task.

04:57 A good example of this is that there are 20 people in a room, everybody high-fives with everybody else, how many high-fives occurred? The interesting thing is, what is a nonroutine problem for some people can be a routine problem for others. And let me give you an example of that. For a third, fourth, or fifth grader, the high-five problem would be nonroutine because they do not have the algebraic

knowledge to be able to solve it. For an algebra student, however, the high-five problem would be very routine because they have the concept of algebra enough that they would be able to solve that problem.

Philip Ogbuehi 05:41 I will use this guide with my teachers in planning professional development. We have diverse student populations in our classrooms, and we have to consider them as we plan lessons and also as we deliver problem solving in the classroom.

This project has been funded at least in part with Federal funds from the U.S. Department of Education under contract number ED-PEP-11-C-0068. The content of this publication does not necessarily reflect the views or policies of the U.S. Department of Education nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.