DOINGWHATWORKS

Video
FULL DETAILS AND TRANSCRIPT

Visual Representations

Bradley Witzel, Ph.D. • September 2009

Topic: Response to Intervention in Elementary-Middle Math
Practice: Intentional Teaching

Highlights

- Concrete-representation-abstract (CRA) sequence of instruction
- Defining how to set up a CRA sequence that is a leveled and aligned approach
- Example of adding fractions using the CRA sequence
- Types of visualizations, including number lines and strip diagrams

About the Interviewee

Bradley Witzel, Ph.D., is an experienced and award-winning teacher and professor of education for students with exceptionalities or at-risk concerns. He has worked as a classroom teacher and paraeducator in inclusive and self-contained settings with a focus on math and science instruction. He has taught geometry, algebra, pre-algebra, personal finance, and chemistry, as well as history, English, and mechanics. Dr. Witzel received his B.S. in psychology from James Madison University and his M.Ed. and Ph.D. in special education from the University of Florida. He currently serves as associate professor, coordinator of the special education programs, and assistant department chair of Curriculum and Instruction at Winthrop University, in Rock Hill, South Carolina. At the university level, Dr. Witzel has taught

undergraduate and graduate courses in special and general education methods as well as a variety of other courses, from transition to behavior support. His research focus is on mathematics and motivation strategies for students who learn at different rates and in different ways. Dr. Witzel has written several research and practitioner articles, books, and book chapters on mathematics education and interventions, and has provided professional development to teachers and administrators in several states and school districts. He has recently coauthored the Institute of Education Sciences RtI Math Guide and served as a reviewer of the final report from the National Math Panel. Additionally, he has a series of math interventions available through Pearson publishing and an RtI with math book through Corwin Press.

Full Transcript

Hi, I am Dr. Brad Witzel at Winthrop University, and I was a member of the panel for the IES [Institute of Education Sciences] Practice Guide on RtI [Response to Intervention] in Mathematics. Visualizations have blossomed as a research piece for struggling students in mathematics. Now, one type of visualization is the concrete to representation to abstract sequence of instruction. It's called CRA. The concrete part of it is a physical manipulation. The R is a pictorial representation of that physical manipulation. The most important part to CRA is not those two; it's the A, abstract. It is the sequence of steps I am trying to teach the students to learn. In fact, to set up a CRA sequence of instruction, I actually devise it all based on the abstract. Let's say that I have a five-step problem abstractly; that doesn't mean I teach concrete differently. It means my concrete must present a five-step sequence. It means the R, the picture, must present the five-step sequence. So I'm giving students a kind of a scaffolded leveled approach to learning a sequence of instruction.

If we're trying to teach fractions with unlike denominators, I should have a concrete visual that the students are interacting with. So, if I'm doing 1/2 + 1/3, they should be able to manipulate the 1/2 and 1/3 to figure out those multiples. That would be the concrete part of it, and they'd follow the same, they follow one series of steps. The pictorial part, they're actually drawing out the same concrete ideas, and again following the same sequence of steps. Finally, at the abstract level they're doing it with the numbers written in Arabic symbols, and they're doing again the same sequence of steps.

The beauty to CRA is not because it just takes students in different direction. In fact, the students through CRA only learn one thing, and that's important. A lot of times you get concrete objects, the students learn one thing and by the abstract they're learning something different. We don't want that. So CRA is one big way of doing visualizations.

For concrete to representation to abstract sequence of instruction, there might be some confusion out there as far as "Well, how long do I do each level?" And actually, that one is easier than usual than most of my answers: you do it until the student is proficient at that level. So I would do a concrete instruction until the student shows that they can accurately go through the steps. Then we go to a pictorial form. And it's funny,

the students go, “Well, can I have these concrete things back?” And I work with a lot of high school students who, a lot of teacher go, “Well, they don’t need concrete.” Absolutely they do, and they’ll say, “Can I have those back?” “Well, actually no, you are good at this now; let’s do a pictorial form of it.” And once they are again proficient at the pictorial level, then we go to the abstract level. The goal of CRA is to get to the abstract level, but you want to make sure by the time they get there, that they’re ready to succeed at that level.

There are many visualizations in mathematics that are possible. One are number lines. The use of number lines is not just for teaching counting, and counting back, and counting on. The use of number lines can be used all over mathematics, from teaching arrays to teaching vectors later on. We can use number lines for simple integers, we can use it for fractions and locating fractions on a number line, we can use it for decimals. There are a lot of different uses for that kind of visualization there. Another possible one is strip diagrams. Strip diagrams are very useful for word problems. A strip diagram could help you show a missing addend or another type of word problem, but typically there is a schema that’s attached to it, or a learning process that’s attached to using a strip diagram with a word problem. Now the good news is, in the IES Practice Guide on RTI Math, there are lots of examples to peruse. And that way you can go through them, and really look through the details and how to use them. They even have explanations of how to use each one of them.

Developed 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.