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Using Concrete Situations to Introduce Content

Brian Bottge, Ed.D. • March 2008

Topic: How to Organize Your Teaching
Practice: Abstract-Concrete Connections

Highlights

- Concrete representations are more than just manipulatives.
- Students need mental models to understand complex ideas.
- Students need a firm foundation in concrete experiences before they move to the abstract.
- Sophisticated concepts can be learned from hands-on and real-life problem solving.

About the Interviewee

Dr. Brian Bottge is the William T. Bryan Endowed Chair in the Department of Special Education and Rehabilitation Counseling at the University of Kentucky and Professor Emeritus at the University of Wisconsin–Madison. Prior to his university positions, Dr. Bottge taught students with learning disabilities and behavioral disorders in elementary and middle schools for 10 years. He later became a district-wide assessment coordinator. His interest in becoming a special educator developed during his service as a Peace Corps volunteer in Iran. Dr. Bottge has used his extensive classroom experience to build a theoretical model for guiding the development of curricula to improve the mathematics achievement of low-achieving adolescents. Based on his research using a method called Enhanced Anchored Instruction, Dr. Bottge has earned an international reputation for translating theory into classroom practice. Recently, Dr. Bottge served on the Expert Panel at the National Center for Technology Innovation and helped to prepare the Practice Guide for Teachers on Organizing Instruction and Study to Improve Learning.

Full Transcript

My name is Brian Bottge. I am Endowed Chair and Professor at the University of Kentucky in the Department of Special Education and Rehabilitation Counseling.

When we think of concrete representations, a lot of times we think about math because math teachers use—in elementary grades—Cuisenaire rods and so forth. But concrete representations can be used in other areas as well, such as computer simulations now, for example, but also simulations, group activities in social studies and history. So, concrete representations are very important and can be used across a number of content areas.

In our research just recently, we've used fraction strips where we say to the students—and these were 8th grade students—we give each student four long paper strips and we say that those strips are representative of candy bars, so take one strip and say, "You have to divide your strip into two pieces, and how would you do that?" So they fold the strip in half and they label the first crease 1/2 and the second crease 2/2. And then they go on and they say, "Okay, take your second strip and divide that into four. Pretend that you have to give a piece to each of four friends. How would you do that?" So they fold the paper strip in half and then they fold it again and label the creases 1/4th, 2/4ths, 3/4ths, and 4/4ths, and they do the same for 8ths and they do the same for 16ths. And then, at the end of this exercise, the teacher asked the students, "What did you notice about the size of the denominator as we folded the strips?" And what they will say, of course, is that even though the number—16, for example, on 16ths—is very large, the actual size, the quantity of the candy bar that they are receiving, is very small. So, you can use those fraction strips to represent equivalent fractions, adding, subtracting fractions.

One of the primary reasons for using concrete representations is to help students build mental models or pictures of what it is they're learning. For example, with the fraction strips, they are learning that if you divide a fraction strip into four pieces, well, those are fourths. Obviously, we can't use concrete representations all the time and that eventually we are going to have to move to the abstract so that students don't think that fractions are only used with candy bars, are only used with linear measurement.

So, we will have to eventually move from the concrete to the abstract. But I guess the point is, is that many students need to have a firm foundation in the concrete before they move to the abstract. One of the ways we've tried to connect the concrete to the abstract, both in computer simulation and in actual hands-on, is with one of the Adventures of Jasper Woodbury called "Kim's Komet," that—these are 10- to 12-minute video scenarios where the students try to figure out how to help the people in the video solve their math problem. Kim's Komet is one of the problems that I really like because it teaches pre-algebraic concepts such as line of best fit, function, variables, formulas, graphing—those types of skills.

So, the object of this particular problem is for the students to help Kim figure out where on a ramp to release her car to be able to be going a certain speed at the end of the ramp to negotiate several tricks, five different tricks. And students time their cars, figure out rate, graph the rates, and then, based on their graph, they are able to predict where they should release the car to navigate each of the tricks. The speeds for navigating the tricks aren't given to the students until the end and so, the day of the "grand pentathlon," as it's called, is very exciting for students because they use their own cars that they've built and they release them at certain heights on the ramp where they think their car will navigate the trick at the end of the ramp. The students learn a lot about pretty sophisticated math concepts.

I want to emphasize that this project isn't just fun for the kids. It isn't just motivating for the kids. They also learn a lot about variables. They learn about measurement error; they learn about reliability. They learn how to figure out the relationship between distance, time. They're able to predict—using their graphs—speeds, how to label x-axis, y-axis, and what that means. So there are a lot of concepts that are packed into this teaching unit that are not taught individually. They are taught in a meaningful way much like you would encounter them in real life.