Workshop 6
Algebra and Calculus: The Challenge

DESCRIPTION

Professor James Kaput of the University of Massachusetts, Dartmouth, studies children's understanding of algebra and calculus. Historically, these topics have presented students with significant problems, and we tend to see it as a given that children will struggle with them. Professor Kaput finds many ways of embedding algebra and calculus concepts into the curriculum much earlier in the school experience so that children are no longer asked to think about them as separate from their prior mathematics work.

PROFESSOR JAMES J. KAPUT

Chancellor professor in the Department of Mathematics at the University of Massachusetts, Dartmouth, James Kaput specializes in elementary students' development of algebraic reasoning and the development of affordable technologies for mathematics education. Dr. Kaput has recently turned his attention to the massive implementation of technology-based innovations to democratize access to powerful mathematics, especially among disadvantaged populations. He is on the editorial board of six mathematics education journals and is a founding co-editor of a new series of volumes sponsored by the Conference Board of the Mathematical Sciences on Research in Collegiate Mathematics Education.

Workshop 6 Timeline

Getting Ready

30 minutes

Sharing Ideas

In group discussions:

- Develop a group definition of the term "algebra."
- Collect the group's ideas about the purpose of calculus.
- Share your personal recollections of learning algebra or those of the people you interviewed.
- Discuss the common features of your responses.

The Painted Cube Problem

Start individually, then join with a colleague to discuss the following:

- Imagine that you have a cube that you dip into paint. *How many square surfaces are covered with paint?*
- Imagine linking another cube to this one, with two flat ends butted together. Imagine dipping this train of two cubes into paint. *How many unit square surfaces are painted this time?*
- Make a train of three cubes (end to end). *How many square surfaces are painted now?*
- Extend and explore this problem to find ways of predicting how many surfaces are painted for:
    - 10 cubes,
    - 25 cubes, and
    - 100 cubes.

We will return to this painted cube problem in the Going Further section.

Workshop 6 Timeline

Watch the Workshop Video

60 minutes

Going Further

30 minutes

Return to the Painted Cube Problem

Look at the way in which you represented the data for 10, 25, and 100 cubes.

- Share strategies and ways of thinking about this problem.
- What are the simplest ways of representing the problem?
- Have each member of the group describe what they found surprising or intriguing about the painted cube problem.
- What aspects of this problem are truly algebraic?

This problem is a classic. You may want to see what your students make of it. Even young students can find and represent the patterns of growth in this cube train.

Reflecting on Algebra and Calculus

Spend some time with your group revisiting your initial ideas about calculus and algebra.

For Next Time

Ongoing Activity

Reflective Journal

Think about how Professor Kaput defines algebra. Describe ways you may be doing algebraic work in your classroom, but have not formally identified it as such.

Homework

How do you know if your students really understand the mathematics (or science) concepts you teach? List the ways you assess their understanding and compare the "yield" in knowledge you gain from each assessment strategy.

Reminder: Sign up for a Web Buddy (see Workshop Components, p. 11).

Reading Assignment

To prepare for Workshop 7, please read the article by Herbert Ginsburg, "Young Children Doing Mathematics," which can be found in the Appendix.

For Your Information

To obtain a copy of the SimCalc computer software, go to http://www.SimCalc.umassd.edu or contact:

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