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Video

FULL DETAILS AND TRANSCRIPT

What Algebra Teachers Need to Know

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Topic: National Math Panel: Major Topics of School Algebra

Practice: Topics of Algebra

Highlights

- Improving teachers knowledge of algebra content
- Most important aspects of algebra to emphasize in instruction
- Helping students understand the connections among algebra topics
- Examples of the relationships among topics
- How learning the connections among topics helps students integrate previous knowledge with current learning

About the Interviewee

Hung-Hsi Wu is a differential geometer by profession. He has authored research papers and research monographs, as well as three graduate level textbooks in mathematics in Chinese. In 1992, he was moved by what he witnessed in the mathematics education reform and was determined to initiate change in mathematics education. After 1996, he started to participate in the education process full-time, first as a critic and then as a member of various state and national committees. He probably played a role in changing the practices of professional development in California as well as the attitude of textbook

publishers toward textbook writing. His latest project is the improvement of the professional development of teachers, both pre-service and in-service. He has been engaged in in-service work since 2000, and starting with 2006, he has begun working on the pre-service professional development of high school teachers. Wu has written extensively on mathematics education, and his articles can be accessed from his homepage: <http://math.berkeley.edu/~wu>.

Full Transcript

I am Hung-Hsi Wu. I am Professor of Mathematics at the University of California at Berkeley, and I was on the National Mathematics Panel. On that panel, I was in two task groups. One is the task group on conceptual understanding and skills, and the other one is on teachers.

I think, if I may say so, at the moment, the main problem with our teachers in algebra, what's holding them back, really, is a deep enough understanding of the subject matter so that they can tell their students correct information. That's important. And second, they know what are the most important aspects of algebra to focus the students' attention on exactly those things. Unfortunately, I think our education system has not gotten to the point where we actually teach our teachers what they really need to know in order to function effectively in the classroom. It's a matter of failure of content knowledge. For example, the fluency in the use of symbols being so fundamental and so important, I don't think this piece of knowledge is at present known to most teachers. We simply have not taught our teachers what they really need to know.

The second point about, our teachers don't quite know what to emphasize in the teaching of algebra. For example, it is supposed to be a very big deal to factor trinomials. Well, of course standardized tests are full of questions about $x^2-x+6=$ a product of what linear factors, and this is a big deal. Now, teachers ought to be taught that it's not a big deal. It's a very minor topic. It's something that yes, students ought to have some practice with it, but ultimately, it's not that important because why? Because when students get to learn the quadratic formula—using the quadratic formula—you don't need to know anything. Plug the numbers in and out comes the factorization. So, it's good to spend a little time, get students some practice about learning how to factor a trinomial. It is important on some occasions.

Why is it important for teachers to emphasize the connection among topics in mathematics? Having established connections among topics makes it easier for students to learn, to retain. Also, it makes a deeper impression on them. For example, factoring trinomials, this is not an isolated topic. Given any polynomial, the fundamental theorem of algebra tells you, no matter what the polynomial is—polynomial of degree five, for example—you can always write it as a product of five linear polynomials. So, it gives you a trinomial, which is degree two, you will know automatically it must be factorable into a product of two linear polynomial, first of all. So, conceptually, you have a framework to receive this skill.

Moreover, then you will also learn the quadratic formula. Now, quadratic formula is a basic skill that people

should learn. But if you learn it and at the same time once you learn it, you look back and say "Oh, the thing I learned way back that made me tremble about factorizing trinomials is a consequence of quadratic formula. Oh, that's a useful skill for me to learn." It gives you more incentive to learn the quadratic formula. At the same time, it makes you look back and say "Now, I understand this factoring of trinomial, what this is all about." So, this is the function of connections. It will make you integrate these disparate pieces of knowledge you have gained, you have learned before, into one whole. And you begin to see the whole thing, you feel much better about it.

Mathematics is really quite simple. You don't need to know 1000 things. I, myself, I know three or four important things, and once I know them well enough, I know how to make deductions from them. That's plenty good enough. And I would rather have our teachers know that there are a few key things they must know. Once they know that, of course, they have to learn how to teach their students well. They themselves must learn how to make deduction, make logical deductions they can reason, they can do that. Limit themselves to a few key concepts, few key skills, they teach those well, and they would be a very successful teacher.