

DOINGWHATWORKS



Presentation

FULL DETAILS AND TRANSCRIPT

Multiple Pathways to School Algebra

November 2008

Topic: National Math Panel: Major Topics of School Algebra

Practice: Multiple Paths

Highlights

- A math supervisor's assessment of where the topics of school algebra are being addressed in a district's curriculum
- Expectation that all students can be successful in learning algebra
- Importance of preparation in the critical foundations of algebra
- Different configurations of mathematics courses can be effective as long as all the major topics of algebra are covered
- Instructional options for supporting struggling students
- Teacher recognition of student misconceptions in algebra problem solving
- Common errors in solving algebra problems

Full Transcript

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Welcome to the overview on multiple pathways to school algebra.

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Here are a few tips before we get started...

Use the slide titles in the “outline” to jump to a specific section.

Click on the “script” tab to follow along with the narration.

Use the controls at the bottom to easily stop and start the presentation.

And show or hide the navigation using the windows icon.

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District math supervisor Kim Brackett recently asked mathematics teachers to identify where the topics of school algebra were discussed in the curriculum. What she got was a whole new perspective on how algebra is being taught in her district’s middle and high schools.

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She learned from her teachers that the algebra sequence in some high schools was much more rigorous than in others. In some cases, there were articulation problems, so that students moving from Algebra I in one middle school might be required to repeat the same topics when they reached high school.

She also found that some of the algebra topics recommended by the National Mathematics Panel were not being addressed in the district’s math courses.

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Ms. Brackett believes proficiency in algebra is the best way to secure future education and career options for all students.

This is why working on the district-wide progression of school algebra topics is now her number one priority—a task that requires attention to content coverage, text materials, alignment of instruction and assessments, and professional development.

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These changes will require a unified perspective on the part of district and school leaders. They will need to share a common belief about the position of algebra in the education of all students.

To find out more and get support, Ms. Brackett consults with the state supervisor of mathematics, who shares the major tenets and implications of the National Mathematics Panel Report, especially those having to do with state mathematics standards.

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The National Mathematics Advisory Panel provides expert judgment about the content of school algebra, suggests implementation considerations for practitioners, and reviews research about the learning of algebra.

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The Report speaks to high expectations for students, clarifies course configuration options, emphasizes the importance of pre-algebra preparation, and provides information teachers need about diagnosing common student errors.

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One of the fundamental elements of successful algebra instruction is high expectations. Teachers must believe that all students can be successful in learning algebra.

All secondary students must be given the opportunity to master all the topics typically included in Algebra I and Algebra II.

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This does not mean that all math programs need to be identical. The Panel notes that different configurations of mathematics courses can be employed effectively.

School algebra is traditionally organized into two single-subject courses, Algebra I and Algebra II. In other schools, the content of school algebra is interwoven with geometry, statistics, and other mathematical topics in integrated mathematics courses.

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There is no basis in research for one particular configuration of topics over another. The important point is that all recommended topics of school algebra are addressed.

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It is vital that the structure and implementation of algebra course offerings should allow for differentiated instruction.

Teachers cannot assume that all students in a grade level have the same degree of preparation in the principles of arithmetic that are critical for learning algebra. They must be able to respond flexibly to the different levels and abilities.

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Those students who are not ready for algebra will require additional instruction and more practice to develop critical foundations of algebra, including number sense and proficiency with fractions.

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Students who are mathematically gifted and who readily grasp algebra concepts should have the opportunity to work at an accelerated pace, mastering school algebra topics at a faster rate and moving on to study advanced topics of mathematics.

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Students who are enrolled in an algebra course and struggling need options for support, including opportunities for intensive instruction in the principles of arithmetic that are fundamental to grasping algebra concepts.

Support can take many forms:

- Refreshers of arithmetic concepts learned previously, practice with algebra terms, and connections to prior learning;
- Intense preparatory experiences in the form of summer “algebra boot camps” or algebra labs; and
- Daily remediation periods.

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Of course, in order to be this flexible, teachers need to be able to recognize students' misconceptions and errors in algebra problem solving and diagnose underlying misunderstandings.

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The Report describes some common errors in algebra problem solving that are based on underlying confusions with arithmetic principles and procedures.

Many students, for example, have not developed understanding of the syntax of algebraic expressions, including confusion about the concept of mathematical equality and whether to interpret the equal sign as an expression of relationships or a call to take particular actions.

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Further, students frequently make mistakes when dividing terms that include a coefficient and a variable and have difficulty determining the appropriate application of the commutative and distributive properties.

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Problems can occur when students over-generalize the use of particular procedures or have a misunderstanding of a procedure, such as those for transforming equations. These mistakes are sometimes referred to as "procedural bugs" or misconceptions.

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Teachers need to understand how students learn to solve equations and word problems and need to know how to recognize common sources of errors and conceptual misunderstandings.

Teachers with this type of training are better able to anticipate the types of errors students may make. Instruction that focuses on particular procedural misconceptions has been shown to reduce the frequency of student errors.

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In conclusion:

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The National Mathematics Panel Report provides more than a list of recommended school algebra topics. It clarifies course configuration options, emphasizes the importance of pre-algebra preparation, and provides information about common student errors and the clues they offer about remediation and preparation.

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Ms. Brackett's conversation with the state supervisor and her own study of the math panel report gave her insight that will guide her work on revamping the district's approach to algebra instruction.

She is much more secure in allowing district schools to continue the course configurations they have in place as long as they focus on all recommended topics of school algebra.

She will work with school mathematics leaders to review the adequacy of preparation for algebra, the current options for acceleration for mathematically gifted students, and, most urgently, how struggling students can receive immediate attention.

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To learn more about school algebra topics please explore the additional resources on the Doing What Works website.