DOINGWHATWORKS

Presentation

FULL DETAILS AND TRANSCRIPT

School Algebra Topics

November 2008

Topic: National Math Panel: Major Topics of School Algebra

Practice: Topics of Algebra

Highlights

- Implications of modifications in state algebra standards for district topic coverage
- Process district uses to review alignment of current algebra courses with recommendations of National Math Panel about the topics of school algebra
- How National Math Panel developed recommendations for topics of school algebra
- Overview of topics of school algebra: symbols and expressions; linear equations; quadratic equations; functions; algebra of polynomials; combinatorics and finite probability
- Importance of making connections across topics
- Research about types of practice for learning algebra including value of worked out examples and practice with translating problem statements

Full Transcript

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Welcome to the overview on school algebra topics.

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“The state board of education wants to make modifications in algebra content standards and assessments so they will line up better with the National Mathematics Panel’s recommendations. We need to make sure we’re ready for this change.”

With those words, district math supervisor Kim Brackett opened a day-long in-service for middle and high school mathematics department staff.

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Ms. Brackett reviewed the school algebra topics that have been recommended by the Panel. She then challenged school teams to figure out how well the district was doing in terms of topic coverage and where they needed to improve.

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Using the topics associated with Quadratic Equations, Ms. Brackett demonstrated how school teams should structure their reviews. She showed them a table with topics recommended by the Math Panel listed in the first column and in the second column, whether or not that topic is covered in the current state standards.

In the last three columns, teams are instructed to identify in which math courses the various topics are addressed.

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Ms. Brackett reminded teams that a topic is “addressed” in a course only if students are expected to become proficient in the skills associated with the topic.

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The teams were given time to confer and consult their objectives, pacing charts, and textbooks. After getting a show of hands, Ms. Brackett completed the table, mapping how each school was addressing

quadratic equations.

They found that two of the topics are not currently addressed in state standards and that there was a lot of variation within the district in terms of coverage. One topic in particular was not well addressed in district courses.

Ms. Bracket repeated this process with her team, reviewing each of the other school mathematics topics recommended by the National Math Panel.

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Let's take a look at the specific topics identified by the Math Panel Report.

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To develop the list of recommended school algebra topics, the National Math Panel reviewed state standards, the National Assessment of Educational Progress algebra objectives, the American Diploma Project benchmarks, and the Singapore mathematics curriculum.

The panel of mathematicians and mathematics educators applied their combined professional judgment to those findings to determine a final set of recommended topics.

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The National Math Panel identified six primary topic headings. The headings are:

Symbols and Expressions,

Linear Equations,

Quadratic Equations,

Functions,

Algebra of Polynomials, and

Combinatorics and Finite Probability

Each of these headings is further broken down into series of topics.

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For Symbols and Expressions, there are three important topics, including polynomial and rational

expressions, and arithmetic and finite geometric series.

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The heading of Linear Equations encompasses a number of topics dealing with solving and graphing linear equations as well as linear inequalities.

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The heading of Functions covers a number of topics such as linear, quadratic, and many other nonlinear functions. It also includes fitting simple mathematical models to data.

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Algebra of Polynomials and the joint heading of Combinatorics and Finite Probability are the last two headings identified by the National Math Panel, each containing their own lists of sub-topics.

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The research done by the National Math Panel turned up more than a list of important headings and topics.

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The panel report emphasizes the importance of making connections among the topics.

For example, the method of solution for Linear Equations is applicable to Quadratic Equations and leads to the well-known quadratic formula.

Also, completing the square connects topics in Quadratic Equations with topics under Functions and Algebra of Polynomials.

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National Math Panel task group members reviewed research about how students learn algebra. Out of this review, the report offers insights for teachers about building students' proficiency with the topics of school algebra.

A consistent theme emerging from this research is the importance of particular types of practice.

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Developing proficiency in algebra depends on cumulative practice. Students who are skilled in problem solving have developed long-term memory of basic forms of equations and the procedural steps used to solve them.

Many students however will need extensive practice to develop this ability to automatically recognize the forms of equations and word problems and how to approach them.

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For students who need practice in basic transformations of algebraic expressions, worked-out examples with explanations and procedural steps can be a powerful aid.

For example: in a homework assignment, a teacher might provide a few fully worked-out, step-by-step solutions for algebraic problems along with several similar problems for students to solve on their own.

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Proficiency in solving word problems requires a specific type of practice: the accurate translation of problems. In other words, students need practice identifying what information is relevant in a word problem and then developing the corresponding symbolic notation.

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While students need practice translating all the various types of statements in problems, research has found that they tend to have particular difficulty with translating relational statements.

Consider this example of a relational statement.

Using f for the number of feet and y for the number of yards, write an equation for the relationship between these units.

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What can we take away from this?

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In any district's mathematics program, it is important to identify the critical topics of instruction, how they support each other, and how to help students focus practice to master the topics. The National Math Panel Report provides information about the key topics of school algebra along with other suggestions for implementation.

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While Ms. Brackett was pleased with teacher response to the in-service day, it was clear that there was much work to do on the district's algebra curriculum due to changes in state standards. She could see that in some schools, there was need for more work on articulation across algebra topics and courses.

She decided that she'd need to contact the state mathematics supervisor with the results of the district review and seek advice about next steps.

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