

# What impact does teacher content knowledge have on instruction?

Researcher's Best Ideas to Discover About

Mathematics teachers with deep content knowledge are able to teach rich mathematical content to all students.

Teachers need a deep understanding of the mathematics they teach—concepts, practices, principles, representations, and applications—to support effective instruction. A teacher's conceptual understanding of mathematics affects classroom instruction directly and positively. Content knowledge influences the decisions teachers make about classroom instruction.

Differences in teaching styles between teachers with a rich background in mathematics and those without are very evident. When teachers possess explicit and well-integrated content knowledge, they feel free to teach dynamically with many representations of the same concept, and they encourage student comments and questions. Teachers with more limited content knowledge may depend too heavily on textbooks for explanations of mathematical principles. This often results in controlled classroom environments in which students work individually at their seats, with mathematics portrayed as a set of static facts and procedures.

A close examination of mathematics teaching styles has revealed that teachers with less content knowledge emphasize algorithms and procedures more often. Although teachers with deeper content knowledge teach these same skills, they also engage their students in forming a conceptual understanding of mathematics. When students understand the concepts behind mathematics, they can use mathematics more successfully and demonstrate higher achievement on assessments.

Teachers should be familiar with common misunderstandings students have about mathematical concepts, such as confusing the least common multiple with the greatest common factor. Teachers' own mathematics knowledge should be deep enough to help anticipate these misunderstandings.

Teachers should use their knowledge of mathematics to clarify concepts during instruction and to recognize students' valid alternative problem-solving methods and solutions.

## Implications to Think About

Secondary teachers of mathematics should have degrees in mathematics and be state certified, licensed, or both. All mathematics teachers should have a deep understanding of mathematics content. NCLB addresses this concern with its requirement that all teachers be "highly qualified." Additional teacher preparation courses should focus on the most effective pedagogical methods for building mathematical concepts in children, such as teaching with mathematical and technological tools, allowing students to work collaboratively to solve problems, representing mathematics concepts in various ways, and linking mathematics to other content areas.

Mathematics teachers with deep content knowledge are able to teach rich mathematical content to all students and analyze student work for evidence of conceptual misunderstandings. Content knowledge allows mathematics teachers to:

- Present topics in a real-life context
- Model content in a word-problem format so students will become accustomed to the way mathematics is commonly encountered in the real world
- Link mathematics to other content areas
- Relate learning mathematics to an understanding of technology, personal and social perspectives, historical issues, and cultural values

Skilled mathematics teachers use their knowledge to help students attain a deep understanding of mathematical concepts through activities with manipulatives and other mathematical tools. They encourage the strategic use of technology, such as calculators and computers, so that students can spend more time working on higher-order problems. They also encourage students to participate in mathematical games. Such teachers give students the opportunity to use mathematics to answer real questions, and they develop students' abilities to both estimate and evaluate the rationality of answers. These opportunities for sense making are essential for deep understanding.

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