

Strengthen STEM in the Middle

With schools focusing more on STEM subjects, educators nationwide are working to understand how to best prepare students for the world through math and science education. Students entering middle school math and science classrooms are being introduced to challenging concepts, and teachers are tasked with finding the best ways to instruct them. In order to find out how those classrooms operate today, the National Science Foundation funded its fifth National Survey of Science and Mathematics Education, which asked middle-level teachers across the country how they are faring.

The 2012 survey was designed to provide up-to-date information and to identify trends in the areas of teacher background and experience, curriculum and instruction, and the availability and use of instructional resources. A combined total of over 2,000 middle-level science and mathematics teachers in schools across the United States participated in the survey.

Preparing Teachers

It turns out that one of the biggest challenges for math and science instruction at the middle level is teacher preparation. The vast majority of middle school science teachers do not have a degree in the science discipline they teach. Even though life science teachers most often hold a degree in the field or have taken more advanced courses, nearly two-thirds of those teaching Earth science haven't taken any college Earth science courses beyond the introductory level. Additionally, only a quarter of middle-level math teachers have a degree in mathematics, and only another 10 percent have degrees in mathematics education.

As a consequence, teachers' confidence in their own abilities to teach these courses varies. Roughly half of middle school science teachers feel very well prepared to teach topics in chemistry and life science. However, very few (only 6 percent) feel prepared to teach engineering concepts. Most math teachers are comfortable with subjects such as algebraic think-

ing and geometry, but less so with discrete mathematics.

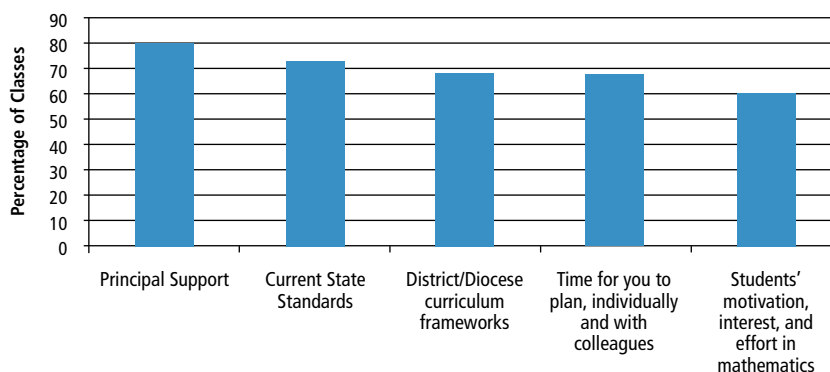
The report also indicates that teachers hold inconsistent beliefs about what effective instruction should look like. Most math and science teachers agree that classes should provide opportunities for sharing thinking and reasoning, and should conclude with a summary of key ideas addressed. However, many teachers believe in practices that research has shown to be ineffective for math and science instruction. For example, most teachers support defining new vocabulary at the start of teaching new concepts and using hands-on laboratory activities to reinforce concepts already presented and explained, rather than as opportunities for students to construct understanding.

Improving Teaching

In light of these facts, the report makes several recommendations concerning teacher effectiveness. Underlying many school reform efforts is the notion that classroom teachers are in the best position to know their students' needs and interests, and therefore should be the ones to make decisions about tailoring instruction to a particular group of students. Fortunately, many math and science teachers are likely to perceive themselves as having strong control over pedagogical decisions, such as determining the amount of homework to be assigned, selecting teaching techniques, and choosing criteria for grading student performance, according to the report. On the other hand, many teachers perceive themselves as having less control in determining course goals and objectives, selecting what content and skills to teach, and selecting textbooks and programs.

The report also highlights the significance of professional development, and how it can help math and science teachers to improve instruction and make well-informed decisions in their classrooms. As a whole, both math and science teachers at the middle-level participate heavily in professional development. Over 80 percent of science teachers and 89 percent of math teachers report participating in profes-

Factors Promoting Effective Instruction in Middle School Mathematics Classes



The full report, including data on elementary instruction, can be accessed at horizon-research.com/2012nssme.

sional development related to their subject areas in the past three years. However, less than a third of math teachers and only a quarter of science teachers spend more than 35 hours on professional development related specifically to *teaching* their subjects.

The emerging consensus about effective professional development suggests that teachers need opportunities to work with colleagues who face similar challenges, including other teachers from their schools and those who have similar teaching assignments. Other recommendations include engaging teachers in investigations, both to learn disciplinary content and to experience inquiry-oriented learning; to examine student work and other classroom artifacts for evidence of what students do and do not understand; and to apply what they have learned in their classrooms and subsequently discuss how it went.

The Principal Is Key

Although professional development and teacher preparation are substantial factors in improving instruction, the report shows that principals in fact have a major impact on teaching. When asked which factors promote effective instruction in their classes, 77 percent of middle-level science teachers and 80 percent of math teachers cited principal support.

Principals are uniquely positioned to guide instruction in their schools. Ensuring that teachers are participating in content-specific and pedagogically relevant professional development can help ensure that best practices are being used in math and science classrooms. Bringing these skills and tools back to the classroom can also make teachers feel more prepared, and empower them to make the best instructional decisions for their students. With support from their principal, math and science teachers can ensure that students are getting the best STEM education possible. ■

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