THE NEED FOR WELL-QUALIFIED SCIENCE AND MATHEMATICS TEACHERS

Position: Every student must be taught sceince and mathematics by well—qualified teachers.

There is a crisis in the nation's mathematics and science classrooms – too few students are reaching internationally competitive levels and too few teachers are well armed to help them get there. In response to this crisis, all fifty states are challended to define what is means to be a "highly qualified" teacher and are called to develop programs to move all of their teachers to this level. If we are to succeed in addressing serious challenges to security, health and economic success, we need a new generation of engineers and scientists, and a citizenry knowledgeable about the science and technology that play an increasingly important role in today's political and community decisions. The mathematics and science teachers educating American's next generation represent a critical focal point for society's attention.

Well qualified mathematics and science teachers are those who:

- **Know and understand mathematics or science deeply**

Teachers of mathematics or science at the middle school or high school level should have the depth and proficiency of science or mathematics equivalent to a major in the area(s) that they teach. Elementary teachers should have a deep understanding of mathematics and science equivalent to significant college coursework. The particular content knowledge, depending on the level, might include some advanced courses that a scientist or engineer might take. However, a teacher's study of mathematics or science should focus on deep understanding of the fundamental concepts of the discipline including the meaning, development, and applications of concepts addressed in school mathematics or science well beyond the level to be taught. A teacher's education should include experience in related problem identification and solving, and applications of knowledge.

- **Understand what science or mathematics is appropriate to teach**

While knowing the subject to be taught is necessary, the well-qualified teacher is proficient in selecting appropriate content topics for particular purposes and for particular groups of students and in sequencing these topics appropriately.

- **Understand and use problem solving, experimentation, and communication of results and help students develop these capabilities**

In order to understand and use a scientific way of thinking, students need both a knowledge base of content and verified skill in creating, questioning, and solving problems using their knowledge in creative problem solving process. Without this creative problem solving ability, we limit our effectiveness in interpreting scientific or quanititative situations or extending what is already known.

- **Understand how students learn**

Content knowledge alone is insufficient to be an effective teacher. Teachers also must be able to make and implement instructional decisions based on the complexities of human learning and school culture.

- **Teach from a repertoire of effective teaching strategies**

Based on a sound knowledge of science or mathematics, human learning, school culture and the creative problem solving process, a well-qualified teacher can plan and modify instruction, adjusting to the ever-changing dynamics of the classroom and the diversity of student needs. At any time, the teacher may make a conscious choice to guide student learning using any of a number of approaches, including, but not limited to direct instruction, multi-dimensional teaching, carefully designed experiments, more open-ended student investigation or projects.

- **Commit to their own lifelong learning**

Even today's well-qualified teacher of mathematics or science lives in a rapidly changing time. Perpetual advances in mathematics and science mean that teachers must continually learn anew in their content area. As new research tells us more about teaching and how students learn, teachers must regularly expand their repertoire of teaching approaches and their knowledge of new programs in order to be well qualified tomorrow.

CSSP Conclusion: Federal and state governments must act in concert to ensure that they will develop, maintain and retain well-qualified mathematics and science teachers, guided by these recommendations from the scientific community. This requires a significant investment in teacher education courses and programs as well as in disciplinary teaching. This investment must provide strong support for research related to best practices in education policy decisions related to effectively educating new teachers and the development of ever better curriculum, materials. It entails a true partnership between the scientific and education communities.

More complete guidelines and recommendations can be found at the websites of the following professional organizations: National Science Teachers Association, National Council of Teachers of Mathematics, Mathematical Assocation of America, and the Association for Science Teacher Education.

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