

**American Mathematical Society
Committee on Education Meeting
October 29-30, 2010
Washington DC**

Summary Report

The Committee discussed a number of issues related to mathematics education. Guests of the Committee included representatives from the National Science Foundation, U.S. Department of Education, Council of Graduate Schools, Carnegie Foundation for the Advancement of Teaching, The College Board and Achieve. The meeting was well attended, with 60 participants, including 25 chairs and representatives of mathematical sciences department.

Update on NSF Support of Graduate Education

James Lightbourne (Director, NSF Division of Graduate Education) gave an overview of National Science Foundation programs that support graduate students and graduate education in the mathematical sciences. Specifically, the Division of Mathematical Sciences supports a wide range of projects including research grants, focused research groups and workforce programs that support students. In FY 2010, some 250 graduate students received financial support, mostly through research grants.

Lightbourne gave more specific information about the NSF's Graduate Research Fellowship Program (GRFP) including statistical information about applications and awards. The program has grown substantially and will likely continue to do so overall. However, GRFP awards are given in a particular field of study based on proposal pressure and applications from the mathematical sciences are lower than most. Consequently, the number of awards in the mathematical sciences is small. There was some discussion about why this is so and how the number of applications from the mathematical sciences could be increased.

CGS Graduate Education Initiative

Nathan Bell (Director Research and Policy Analysis, Council of Graduate Schools) spoke specifically about some of the Council of Graduate Schools' (CGS) projects, publications and initiatives. The Ph.D. Completion Project is a seven year, grant-funded project whose purpose is to determine completion/attrition rates and how they vary by field and demographics; to pilot interventions to help improve completion rates at selected institutions; to work with graduate schools to encourage Ph.D. completion with special emphasis on women and minorities. This project has been ongoing since 2004 and a report on outcomes is due in 2011.

The Master's Completion Project was launched in April 2009 and seeks to collect and analyze data about completion and attrition rates in STEM master's programs. There was an initial exploratory study, which garnered little useful information. However, a new 27-month project has been launched through funding by the Sloan Foundation and will seek to delve further into the issues surrounding the completion of master's degrees.

Bell also talked about *The Path Forward*, a report developed in cooperation with the Commission on the Future of Graduate Education -- a joint effort of CGS and the Educational Testing Service (ETS). The report, released in April 2010, outlines the role of graduate education in producing a highly skilled workforce and how it impacts U.S. innovation and competitiveness.

Projections for Workforce Trends and Education Requirements of STEM Jobs Through 2018

Nicole Smith (Senior Economist, Center on Education and the Workforce, Georgetown University) presented findings of the research conducted by the Georgetown University Center on Education and the Workforce on the demand for STEM and graduate education in the coming years. They found that 63

percent of all employment by 2018 will require postsecondary education. This represents a substantial increase in the number of postsecondary degrees that America's colleges and universities will need to confer. Research suggests that we will fall short by 3 million postsecondary degrees – meeting this demand will be a huge challenge for the U.S.

Research specific to STEM education found that shortages continue despite increasing enrollment and graduation rates. STEM occupations are set to grow from 6.8 million to 8 million total jobs by 2018 and 92 percent of those jobs will require some kind of postsecondary education and training.

The Common Core State Standards in Mathematics

William McCallum (Director, Institute for Mathematics and Education, University of Arizona) explained that the Common Core State Standards were produced through an initiative led by the Council of Chief State School Officers (CCSSO) and the National Governors Association (NGA) to develop and adopt a core set of academic standards in mathematics and English language arts. The year-long Standards project is complete and, to date, 41 states and the District of Columbia have adopted the Standards.

McCallum (a member of the mathematics work group for the standards) described the two types of mathematics standards contained in the document: those for mathematical practice and those for mathematical content. He also discussed the purpose of standards, the design principles and constraints, overarching standards, and other related projects that are currently underway.

STEM Initiatives at the U.S. Department of Education

Pat Johnson (U.S. Department of Education) talked about mathematics initiatives at the U.S. Department of Education including the Mathematics and Science Partnership (MSP) program, which is designed to strengthen teacher's content knowledge through partnerships between high-need school districts and higher education STEM faculty.

Johnson described the characteristics of the MSP program, as well as levels of participation and funding. She also discussed the models used for providing professional development for teachers and how gains were measured in teacher content knowledge and student achievement levels. She summarized the department's findings related to the importance of partnerships and evaluation designs.

Johnson also talked about the Department's "21st Century Community Learning Centers" STEM initiative, which supports the creation of community learning centers that provide academic enrichment opportunities during non-school hours. She also reported on the recently released President's Committee of Advisors on Science & Technology (PCAST) K-12 STEM Education Report, which makes specific recommendations on how to better prepare our nation's K-12 students in STEM subjects.

The Implications for Higher Ed of the Common Assessments

Laura McGiffert Slover (Vice President, Content and Policy Research, Achieve, Inc.) briefed attendees on the Common Core State Standards Initiative, specifically about the goals, parameters, process and timeline of developing the final Standards. She reiterated what Bill McCallum reported on earlier in the program regarding the design and organization of the mathematical standards, giving examples of mathematical content at different grade levels and in different mathematical subject areas.

Slover also discussed Achieve's efforts to develop *High School Math Pathways* that reorganize the high school Common Core Standards into course sequences that ensure student completion of college and career readiness standards by the end of three courses, preparing them for a variety of optional fourth courses. *Accelerated Pathways* are two additional pathways that accelerate the curriculum and require a faster pace, both of which prepare students for Precalculus in their junior year and Calculus in their senior year of high school.

Slover went on to discuss the Partnership for Assessment of Readiness for College and Careers (PARCC) Consortium, a partnership of states, which is committed to increasing the rates at which students graduate from high school prepared for college and successful careers. States in the Partnership will adopt an assessment system anchored in the Common Core State Standards whereby students take parts of the assessment at critical times during the school year, close to when specific material is learned, in order to more precisely assess their performance and keep them on track.

Creating Evidence-based Pathways To and Through a First Credit-Bearing College Math Course

Uri Treisman (Director, The Charles A. Dana Center, University of Texas at Austin) and Bernadine Chuck Fong (Senior Partner, Carnegie Foundation for the Advancement of Teaching) spoke to the group about *Statway: A Pathway To and Through Statistics* -- an initiative designed to help community college students who place below college-level mathematics to complete the necessary developmental mathematics and a college-level statistics course within one academic year.

Treisman and Fong provided an overview of Statway and talked about this experimental program's student learning goals and outcomes. The first implementation of the program is set for Fall 2011.

The Vermont Mathematics Initiative: A Model for Improved Mathematics Instruction and Higher Student Achievement

Ken Gross (University of Vermont) discussed the Vermont Mathematics Initiative (VMI), which provides professional development opportunities for teachers at the elementary school level. Strong content knowledge is at the core of the program, giving teachers a solid foundation in mathematics to ensure a high quality mathematics education for their students.

The VMI has two components: Phase I is the Master's Degree program which is designed to train teachers to build capacity in school districts; Phase II is the District Implementation component which uses a district's Phase I trained teachers to reach all K-8 teachers in the district. The Master's Degree program is three years long consisting of 12 courses for 36 credits. In its 12th year, this program has graduated 327 teachers in over 90 percent of the school districts in Vermont.

Gross summarized statistical information about the efficacy of the VMI program and gave examples of mathematical problems and how students approach solving them after being taught by teachers before, during and after participation in the VMI program.

Mathematics and Music

David Wright (Washington University in St. Louis) described a course in mathematics he developed that uses music to help students understand relationships between mathematics and music; build on their musical knowledge and creativity; heighten their ability for abstract reasoning and computation; blend their artistic and analytical skills; and utilize interactive tools, such as the computer and synthesizer, to enhance their musical creativity. The course is designed for all levels of mathematics education, but Wright is currently teaching it as a freshman course.

Wright presented the group with numerous audio samples highlighting the mathematical concepts behind musical compositions and discussed what they represent and how they are perceived by the listener.

Interactions between Teachers and Mathematicians: A Model for Professional Development

William McCallum (Director, Institute for Mathematics and Education, University of Arizona) gave a presentation on professional development and why it is important for teachers, especially now. The workshop, held in March 2010 at the Institute for Mathematics & Education (IM&E) at the University of Arizona, produced pamphlets to guide instructors teaching calculus.

This workshop utilized pairs of mathematicians and teachers or mathematics educators and teachers working together to develop six pamphlets on: 1) Limits; 2) Rate of Change; 3) Fundamental Theorem of Calculus; 4) Use of Symbols; 5) Problem Solving; and 6) AP-IB to College Transition. What they found was that the interaction among these groups of people was actually more valuable than the pamphlets that were produced. McCallum shared comments from workshop participants that highlighted their positive experiences working in these groups. He then led a discussion among meeting attendees on suggestions of other ways to reach similar outcomes.

Discussion on Graduate Education

Eric Friedlander (University of Southern California) led a discussion on graduate education and what the AMS could do to aid and support graduate students. Several ideas were discussed including creating student chapters, possibly adding student Board members, providing guidance on how to secure a job after graduation and generally giving more support to grad students on issues of importance to them.

COE Activities at New Orleans, LA Joint Mathematics Meetings, January 2011

The AMS Committee on Education will host a panel discussion at the Joint Meetings in New Orleans, LA in January 2011 entitled “Teaching Elementary Math is not Elementary: How Mathematicians Can Help, and Why?” Panelists will include Hyman Bass (University of Michigan), Ken Gross (University of Vermont), Johnette Roberts (City of Baker School System) and Kristin Umland (University of New Mexico). The panel discussion will be held on Sunday, January 9th from 8:30 am to 10:00 am.

Date of Next Meeting

The committee chose October 28-29, 2011 as the date for the next meeting of the AMS Committee on Education. The meeting will be held in Washington, DC.