

**The Massachusetts Mathematics Institute
For Elementary School Teachers
August 4-8 & 11-15, 2003**

The Massachusetts Mathematics Institute (MMI) is an intensive professional development program for elementary-school teachers. It is designed to give participants a deep understanding of mathematics content, set in the context of elementary-school instructional practice. There are no prerequisites—even the most math-challenged and/or math-phobic individuals will achieve a high level of comfort and proficiency with mathematics.

This institute will lead the way to a statewide program, the ultimate goal of which is to raise our students' mathematics proficiency to the level of their best international peers. To achieve that we need teachers who understand and feel confident with mathematics—and whose knowledge and enthusiasm will infect their own students and fellow teachers. MMI graduates will form the vanguard of this new breed of teacher.

MMI is not tied to any specific elementary-school curriculum. Today's math curricula—especially the new NCTM-inspired curricula—put increasing mathematical demands on teachers. The institute will provide them with the content knowledge necessary to meet those demands and teach effectively with whatever curricula their schools use.

The institute is modelled on Phase 1 (25%) of the Vermont Mathematics Initiative (VMI), a successful 3-year master's program with 144 elementary teachers currently participating or graduated. Phase 1 is a complete program in its own right, but Phases 2-4 will also be offered subsequently if there is sufficient interest. VMI course materials and syllabi will be used throughout.

The value of this approach is clearly articulated on the VMI web page: "...participants begin to view themselves as mathematicians, to view mathematics as part of their lives, and to see the world around them in a mathematical light. These transformations take place, in part, through a curriculum that is deep in mathematics content, and the impact of these transformations in the teachers' classrooms and schools is far-reaching." See http://www.emba.uvm.edu/~gross/vmi_summary.html.

MMI will be held on 10 weekdays, August 4-8 & 11-15, followed by 3 two-day sessions (Friday-Saturday) during the fall and classroom coaching at participants' schools. Classes will be held at EMC Corporation's new facility in Hopkinton. Teachers will receive a stipend of \$100/day, PDPs will be earned, and graduate credit from Worcester State College is being arranged (each of the three courses will earn 3 credits for a tuition of \$180).

Elementary teachers should recognize that this is a unique and valuable opportunity to dramatically improve their understanding and teaching of mathematics—in a program designed specifically for them based on four years of successful experience in the VMI. Those who accept this challenge will provide the leadership we need to raise math achievement in all classrooms.

To express interest or obtain further information, teachers should contact their principals or math coordinators, and send a note to math-institute@fortmann.org.

Course descriptions

The institute comprises three courses. All are designed specifically for elementary teachers who seek to increase their level of understanding of mathematics and strengthen their mathematics instruction. The first two will take place in the summer session with the third taught in the fall.

Course 1: *Mathematics as a Second Language*

This course lays the groundwork for all the courses that follow. Its theme is understanding algebra and arithmetic through language. The objective is to provide a solid conceptual understanding of the operations of arithmetic, as well as the interrelationships among arithmetic, algebra, and geometry. Topics include arithmetic vs. algebra; solving equations; place value and the history of counting; inverse processes; the geometry of multiplication; the binomial theorem and Pascal's triangle; the many faces of division; rational vs. irrational numbers, and the one-dimensional geometry of numbers. All topics are taught in the context of the mathematics curriculum in the elementary grades.

Course 2: *Functions and Algebra*

This course builds upon the prior course *Mathematics as a Second Language*. Participants will obtain a deep understanding of the concepts of variable and function, utilize functions in problem solving, appreciate the pervasiveness of the function idea in the mathematics curriculum as well as everyday life, and engage in problem-solving activities that relate directly to the elementary mathematics classroom. Topics include functions, graphs, inverse functions, linear functions, the algebra and geometry of straight lines, and solving linear equations.

Course 3: *Number Theory*

This course introduces the branch of mathematics known as number theory, in which one studies properties of integers with respect to the operations of multiplication and division. Emphasis is placed on how number theory is taught in the elementary grades, with particular attention to student learning of number theory in these grades. Topics include the division algorithm, properties of prime and composite numbers, the sieve of Eratosthenes as a way of understanding distributions of primes and composites, the infinitude of primes, the fundamental theorem of arithmetic, properties of the greatest common factor and methods of computing the greatest common factor including the Euclidean algorithm, properties of least common multiples, use of base ten and expanded notation, writing numbers and computing in different bases, and arithmetic progressions.

Instructors

Herbert I. Gross, Professor of Mathematics at Bunker Hill Community College, specializes in making mathematics accessible and understandable to regular people. He is the author of three mathematics textbooks and two series of videotape courses on arithmetic and algebra, and he has given numerous in-service courses (some on educational television) to K-8 teachers. He has long been a leader in developing self-paced courses in arithmetic and algebra. While Senior Lecturer at MIT he produced 83 videotapes and 17 volumes of study guides for the distance learning course “Calculus Revisited,” used successfully by over 50,000 engineers, scientists, and technicians on six continents. He has been named national Educator of the Year (twice) and national Community College Teacher of the Year. He is also the founding President of the American Mathematics Association of Two Year Colleges (AMATYC). Prof. Gross has been an advisor to the VMI since its inception and serves as a key member of its writing team.

Thomas E. Fortmann studied mathematics and physics at Stanford, received a doctorate in Electrical Engineering from MIT, taught at the University of Newcastle, Australia, and then spent 24 years as an engineer and executive at BBN Systems & Technologies in Cambridge (the company that created the Internet). He retired in 1997 and began teaching mathematics as a volunteer in the urban schools. Recently he has worked with Mass Insight Education to launch a statewide program of math content training for teachers, and he is collaborating with Prof. Gross and others to create this institute.

Graduates of the Vermont Mathematics Initiative will act as teaching assistants and coaches.

Advisors

Kenneth I. Gross, Professor of Mathematics and Education at the University of Vermont and Founder/Director of the Vermont Mathematics Initiative (VMI), will act as an advisor to this institute. Dr. Gross is a distinguished research mathematician, educator, and academic administrator who has published over forty papers and is the editor of three books. His breadth of educational interests stretches from teaching arithmetic to math-phobic adults to advising doctoral students at the cutting edge of mathematical research. He received the Chauvenet Prize and the Lester R. Ford Award from the Mathematics Association of America, and he received both the George V. Kidder Outstanding Faculty Member Award and the University Scholar Award, the highest honors in teaching and research, respectively, at the University of Vermont. Dr. Gross is currently Special Assistant to the Commissioner of Education for Mathematics Education in Vermont.

Richard Bisk, Professor of Mathematics at Worcester State College, received his Ph.D. from Clark University. For the past eleven years, he has worked with K-12 teachers in a variety of capacities. He has presented numerous courses and workshops for teachers, conducted lessons in classrooms at all grade levels, and started an academic alliance of K-16 teachers of mathematics. He has chaired the Mathematics Department at Fitchburg State College and has been co-chair of the Massachusetts Department of Education’s Math/Science Advisory Council. Dr. Bisk has received numerous grants from the state Department of Education to conduct summer courses that focus on improving teachers’ knowledge of mathematics content and relating that knowledge to what they teach in their own classrooms. He is currently working on a project to train teachers in the use of the mathematics curriculum of Singapore.

Sponsors

EMC Corporation, headquartered in Hopkinton, is a Fortune 500 company and Massachusetts' largest technology employer. As part of its longstanding commitment to supporting local schools and improving math and science education, EMC will underwrite and host this math institute at its facility in Hopkinton.

See <http://www.emc.com>.

Mass Insight Education and Research Institute (MERI) is an independent, not-for-profit organization focused on improving student achievement in public schools. MERI conceived and proposed this math institute as a prototype for its statewide campaign to increase the math content knowledge of in-service and pre-service teachers.

See <http://www.massinsight.com/meri>.

The Engineering in Mass Collaborative (EiMC) is a unique collaboration of businesses, schools, and higher education institutions focused on meeting the Commonwealth's growing need for a workforce skilled in math, science, engineering, and technology. EiMC supports this math institute as a means of making engineering careers accessible to all students.

See <http://www.eimc.org>.