The Mathematics Educator
Volume 9, Number 1

# The MAA Historical Modules Project

Dawn L. Anderson

The Mathematical Association of America is conducting an NSF-funded, three-year project entitled Historical Modules for the Teaching and Learning of Secondary Mathematics, in association with its ongoing project, the Institute in the History of Mathematics and Its Use in Teaching (IHMT). Eighteen high school teachers from across the United States and one graduate student from the University of Georgia came to Washington from July 20 to July 31, 1998 to take a course in the history of mathematics and to work on developing modules using historical materials which will help in the teaching and learning of mathematical ideas in high school. The high school teachers were split into six writing teams of three members each, with a fourth member selected from among the college faculty at IHMT. Each writing team was responsible for one module.

During the morning hours of each of the two weeks in Washington, the participants took two courses in the history of mathematics, presented by V. Frederick Rickey and Victor J. Katz. The four one-week courses considered material which is typically part of secondary school or college mathematics courses. The courses showed that mathematics has been studied and developed all over the world throughout the centuries and is not the province of a single cultural group. A variety of pedagogical approaches were utilized, including formal lecture and small group activities. Participants were expected to prepare themselves by doing extensive readings before arrival.

The following is a description of the courses offered to the participants in the Historical Modules Project:

*History of Algebra.* This overview of algebra focused on basic trends beginning in 2000 B.C.E. with the solving of linear and quadratic equations in ancient Egypt and Babylonia and concluding with the development of group theory in the 19th century, which occurred partly in response to the failure to discover a formula for solving quintic equation. Other topics discussed include the "geometric algebra" of the Greeks; the first algebraic textbooks in Islam; the solution of "square" systems of linear equations in China and the much later struggle to understand what happens when a unique solution is not possible; the efforts to develop algebraic symbolism during the Renaissance; the solution of the cubic and quartic equation in sixteenth-century Italy; and the introduction of the notion of permutations into the study of solutions of equations.

*History of Calculus A* . This survey of calculus began with the ancient problems of determining the area and volume of regions bounded by curves and surfaces. Some of these problems (including the area of a circle and the volume of a pyramid) were solved initially in Babylonia and Egypt, but solution methods now characterized as rigorous were first developed in Greece. The Greek method of exhaustion was taken over by Islamic mathematicians who managed to solve certain problems left unsolved by the Greeks, but it was not until the 17th century that a concerted effort was mounted to find algorithmic procedures for determining areas and volumes. Such algorithms were also sought for the initially unrelated problem of determining maxima and minima. This first course concluded with the algorithms developed by Newton and Leibniz as a consequence of realizing that the two problems were inverses of one another.

*History of Calculus B* . The second part of the calculus survey covered the 18th and 19th centuries. This included the work of the Bernoullis in using Leibniz's ideas to solve many significant problems; the work of Euler in systematizing the calculus of the transcendental functions and in discovering the fundamental principles of the calculus of variations; the work of Lagrange in trying to found calculus on the notion of a power series; the work of Cauchy in bringing us the epsilon and delta; and the work of Weierstrass and his followers in "arithmetizing" analysis. The course concluded with Abraham Robinson's attempts to integrate the ancient notion of infinitesimals into modern mathematics.

*History of Geometry* . The geometric notions of ancient peoples were explored and participants considered some of the influences on the Greeks leading them to adopt their axiomatic treatment of geometry. The course presented the attempts through the centuries to prove Euclidís parallel postulate and the ultimate discovery of non-Euclidean geometry in the 19th century. It considered also the relationship of geometric perspective to painting during the Renaissance and the subsequent development of projective geometry. The course concluded with a study of Hilbert's new axioms for geometry at the turn of the 20th century.

During the remainder of the day, participants worked in teams on their particular modules, although there was some time for interacting with the historians of mathematics who presented as part of IHMT. I had the opportunity to spend some time talking with Marcia Ascher, a highly-regarded ethnomathematician.

The topics of the modules were chosen during the spring of 1998 by Victor Katz and Karen Dee Michalowicz, in consultation with the writing teams. The materials that are being developed should be usable in classes that the teachers will teach during the following academic year. During the two weeks in Washington, the teams worked on developing their modules, insuring both historical accuracy and teacher-friendliness. It is expected that a given module will contain approximately two weeks worth of material, although it should be designed in a way that various sections can be used independently.

Each team has been working during the fall of 1998, communicating electronically and meeting together. The project directors have been working closely with the teams as well. Each module should be ready for use by spring semester, 1999. Each teacher on the writing team will test a completed module (or parts of it) in his or her own classrooms during the spring and will, if possible, also recruit other teachers in the school to do the same.

The teams will return to Washington for three weeks during July of 1999. During that time, they will revise the first set of modules, begin work on a new set, and take additional courses in the history of mathematics, including material on Number Theory and Finite Mathematics. Work will continue on the new set of modules during academic year 1999-2000 as before. Teachers will return to Washington for two additional weeks in July of 2000 to complete work on the second set of modules.

In addition to the pilot testing by the writing team teachers in their own classrooms, the modules will also be field tested by other teachers around the country. Once the field testing is complete and final revisions have been made, the modules will be published, either by a commercial publisher, the NCTM, or the MAA.

For more information you can contact, Victor J. Katz; e-mail vkatz@maa.org or phone: 202-274-5374 or Karen Dee Michalowicz e-mail: karendm@aol.com.

---

Dawn L. Anderson is a doctoral student at the University of Georgia. Her interests are history of mathematics, gender and social issues in mathematics and ethnomathematics. Her email address is dlanders@coe.uga.edu

---