### Institute in the History of Mathematics and Its Use in Teaching: Ten Years After

This summer marks the tenth anniversary of the first of three graduating classes from the Institute in the History of Mathematics and Its Use in Teaching (IHMT), offered by the Mathematical Association of America (MAA) from 1995 to 1999. The impact of the Institute was immediate, and has continued to grow over the years, until today its influence can be seen throughout the American mathematical community and beyond. Of IHMT's early and continued success, Institute Director Victor Katz says, "We certainly hoped it would be successful, but we have been very pleasantly surprised at the impact we have had. Certainly, even in the second year, it was clear that we were having a major impact in the mathematical community."

Held at American University (1995-97) and Catholic University of America (1998-99) in Washington, D.C., IHMT included three classes of about 40 college and university faculty members each, the first during the summers of 1995 and 1996, the second during 1996-97, and the third in 1998-99. Institute directors were Victor Katz, of the University of the District of Columbia; Steven Schot, of American University; and Fred Rickey, then of Bowling Green State University, Ohio, and now of the United States Military Academy, West Point, New York. Florence Fasanelli served as MAA liaison and was instrumental in obtaining the National Science Foundation grants that funded the Institute.

The goal of IHMT was to increase the presence of history in the undergraduate mathematics curriculum by preparing participants to teach undergraduate courses in the history of mathematics and to incorporate historical issues in all of their teaching. Although participants ranged from neophytes (like myself) to experts (Kim Plofker was in the first class), the typical IHMT participant was a college or university mathematics or mathematics education professor who had been teaching an undergraduate mathematics

history course, but whose knowledge of mathematics history came mainly from secondary sources. IHMT exposed us to new research in mathematics history; introduced us to original sources; got us started on using mathematics history in all of our courses; and inspired many of us to do our own original research in mathematics history.
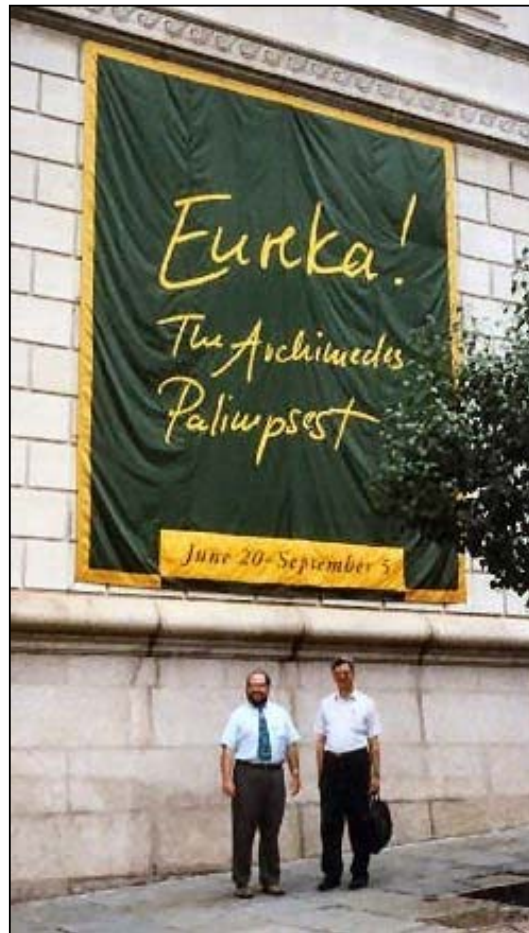
Each two-year course included:
- Lecture series by outstanding historians of mathematics (for instance, in 1999, Eleanor Robson on Mesopotamian mathematics, Harold Edwards on the history of number theory, and Karen Parshall on American mathematics);
- Instruction both in teaching history of mathematics courses and in using history of mathematics in mathematics courses;
- Survey course in history of mathematics from ancient to modern times;
- Historiography course;
- Original source reading groups;
- Group research projects;

- Field trips to rare book libraries and museums (for instance, in 1997, curator Peggy Kidwell showed us rare mathematics books and early American mathematical manipulatives at the Dibner Library in Washington, D.C., and, in 1999, we viewed the Archimedes Palimpsest at the Walters Museum in Baltimore, Maryland); and
- Reports by second-year participants on historical research and teaching experiences during the preceding academic year.
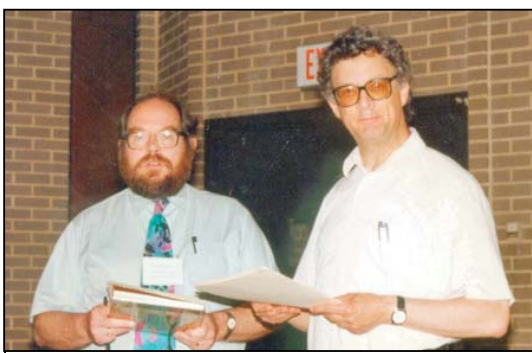
Fred Rickey & Victor Katz

Of the many types of activities offered at the Institute, Katz says, "The one that was surprisingly successful was having participants do mini-research projects in history. Many of the participants continued and expanded this work afterwards." Indeed, several participants published their work and many more gave talks on their projects at conferences. Participants published articles on the history of school mathematics topics, including subtraction (Pratt-Cotter and Ross), multiplication (Berg 2001), quadratic equations (Allaire and Bradley 2001), related rates (Austin *et al* 2000), and the Quotient Rule (Curtin 2005). Paul Pasles, of Villanova University, Pennsylvania, continued his project on American founding father Benjamin Franklin's work on magic squares, finding three little known squares and one previously unknown square (Pasles 2001). Shai Simonson, of Stonehill College, Massachusetts, has continued to study and translate the mathematics of Levi ben Gershon and has shared his work with teachers (Simonson *MT* 2000) and researchers (Simonson *HM* 2000).
Institute Director Fred Rickey identifies the original source reading groups as well as the

research projects as being surprisingly successful, saying, "Perhaps the biggest surprise of IHMT for me was the interest that the participants took in reading original sources. Victor and I, as well as others whom we talked to about the planning, knew it would be a good idea to have people read some original sources so that they could come to appreciate what historians do. For the same reason, we designed the research projects into the plan. What surprised us was how many people took a serious interest in doing history themselves and how many decided that teaching history courses using original sources was a good idea. This pleased us very much." IHMT graduates have founded two very active original source reading groups. Ed Sandifer of Western Connecticut State University started the Readings in the History of Mathematics from Original Sources (ARITHMOS) group, while Dan Curtin of Northern Kentucky University and Danny Otero of Xavier University, Ohio, organized the Ohio River Early Sources in Mathematical Exposition (ORESME) Reading Group.

IHMT participants have been instrumental in founding and running other professional organizations and activities. Sandifer and Rob Bradley, of Adelphi University in New York, helped found the Euler Society (www.eulersociety.org), which holds annual conferences in the United States. In 2001, IHMTers helped found the MAA History of Mathematics Special Interest Group (www.maa.org/homsigmaa), which organizes mathematics history paper sessions, panels, and invited addresses at national MAA meetings, and also sponsors a student writing contest in mathematics history. Bradley and Patricia Allaire, of Queensborough College in New York, founded the Frederick V. Pohle Memorial Colloquium Series in the History of Mathematics at Adelphi University. Several IHMTers have participated in this monthly seminar series for New York City area mathematics historians. Many IHMT graduates have joined the Canadian Society for the History and Philosophy of Mathematics (CSHPM) and participate in its annual conferences, and IHMT graduate Bob

Stein of California State University, San Bernardino, is president of the HPM Americas Section.

Katz measures IHMT's success primarily in terms of its original goal of increasing the presence of history in the undergraduate mathematics curriculum, noting, "The greatest successes are simply that so many people are involved with the use of history in the classroom. You see this directly at every Joint Meeting. And so many people have written articles and books that started in their experience at IHMT. Of course, the other great success is in the new research in the history of mathematics which participants continued after IHMT." There have been lively and well-attended paper sessions on using history of mathematics in teaching, often organized by IHMTers, at every Joint Winter Meeting of the American Mathematical Society (AMS) and MAA since IHMT began. Most recently, IHMT graduates Dick Jardine of Keene State College, New Hampshire, and Amy Shell-Gellasch, currently of Germany, organized a contributed paper session on "Using History of Mathematics in Your Mathematics Courses" at the 2006 Joint Meetings in San Antonio, Texas. Over the past ten years, there has been a dramatic increase in the number of paper sessions, panels, invited addresses, and mini-courses on mathematics history and on its use in teaching at AMS, MAA, and National Council of Teachers of Mathematics national and regional meetings.

Examples of IHMT participants' innovations in both mathematics history and mathematics courses include the following.
- Next summer, Herb Kasube of Bradley University, Illinois, will teach his university's history of mathematics course for mathematics majors with the added attraction of readings from Newton's *Principia* and a trip to England to visit Oxford, Cambridge and Bletchley Park.
- Agnes Tuska of California State University, Fresno, developed group projects for her mathematics history course centered around mathematical videos. Groups of students

view, critique, research, and then present math history-related videos.
- Lynn Reed has the students in her calculus courses at the Maggie L. Walker Governor's School in Virginia make annotated timelines and biographical scrapbooks.
- At the University of Redlands, California, a team of six mathematics majors (all but one of whom planned to become teachers) and I designed an activity-based mathematics history course for non-science majors. We offered MATH 115, Mathematics through its History, twice, and I have since offered the course twice more with different student teaching assistants. One of my teaching assistants, Rachel Balsam, went on to design and teach a mathematics history course for the gifted fifth and sixth graders in the Johns Hopkins University Center for Talented Youth program.
- Joanne Peeples of El Paso College, Texas, helped a team of students write and produce *Count Her In!,* a play about women in mathematics, both historical and modern. Her team of twelve women high school, undergraduate, and graduate students presented their play at the MAA's 2005 Summer MathFest in Albuquerque, New Mexico, where it received rave reviews.

Besides incorporating mathematics history into our own mathematics courses and creating teaching and performance opportunities for our students, IHMT graduates have developed instructional resource materials for others. For example:
- Shirley Gray of California State University, Los Angeles, founded and maintains the National Curve Bank, a mathematics website with strong emphases on both history and pedagogy (curvebank.calstatela.edu). Many IHMT graduates have contributed to the website and serve on its advisory council.
- Amy Shell-Gellasch and Dick Jardine co-edited the collection *From Calculus to Computers: Using the Last 200 Years of Mathematics History in the Classroom* (Bookstore at www.maa.org).
- IHMT graduate Fernando Gouvea and colleague William Berlinghoff from Colby College, Maine, wrote an elementary mathematics history text, *Math through the*

Ages: A Gentle History for Teachers and Others, now in its second edition (Bookstore at www.maa.org).
- Several IHMT participants served as team leaders for the Historical Modules Project, 1998-2001, which produced *Historical Modules for the Teaching and Learning of Mathematics,* a CD containing eleven book-length sets of historical lesson materials on topics such as geometry, trigonometry, and statistics (Bookstore at www.maa.org). The modules were written by teams of high school teachers (led by IHMT graduates); edited by project directors Victor Katz and Karen Michalowicz; and published by the MAA. Katz reports, "The Historical Modules project is having a definite impact---and it certainly had an impact on the teachers involved in writing and testing it." He cites as one example former high school teacher Kathy McGarvey Clark, who is completing a Ph.D. at the University of Maryland with a dissertation on the effectiveness of the use of history in teaching logarithms in a pre-calculus course (see also the Oberwolfach conference report in this issue).

Many IHMT participants, myself included, consider IHMT to be one of the most important professional experiences of our careers. In addition to gaining enough knowledge and confidence to teach my university's mathematics history course for mathematics majors and to design and teach the hands-on elementary mathematics history course described above, I also found what I had been looking for unsuccessfully for many years: an intellectual pursuit that is both personally engaging and directly related to my teaching. Patricia Allaire, one of six or so mathematics history Ph.D. candidates who participated in IHMT, recalls, "IHMT was a defining professional moment for me. I came fresh from passing exams and seeking a dissertation topic, and left well on the way to having one. When Helena Pycior spoke about British symbolical algebra, I knew I was home." She also cites the impact of IHMT on her teaching: "History now informs all my teaching. Even when I'm not being explicitly historical, history is always there in the form

of an anecdote, background material, a face to go with a name, etc."

Besides the intrinsic interest of the subject matter, I believe what made the Institute so successful was the energy and enthusiasm of the directors, invited speakers, and participants; the cooperative spirit of inquiry we all shared; the expectation of serious work and the willingness of participants to do it; and the promise the Institute held to improve one's teaching and scholarship. This cooperation and commitment have persisted over the years, with many of us continuing to collaborate on various projects. Allaire reports, "At IHMT–95, my research mini-project with Antonella Cupillari was on Artemas Martin. Antonella and I have become great friends and collaborators. We have written and spoken together and individually on Martin." (See Allaire and Cupillari 2000.) Shirley Gray, who, in addition to founding the National Curve Bank, wrote an article with Ed Sandifer on the *Sumario Compendioso* (Gray and Sandifer 2001), identifies as highlights of IHMT the camaraderie of the participants and their commitment to learning mathematics history, saying, "IHMT created a nucleus of like-minded kindred souls who have continued to enjoy knowing and seeing one another after ten years. Most of the individuals who applied were those who could be expected to participate at any level of mathematics. However, almost all of us had degrees in pure mathematics, rather than history. For some innate reason, we simply wanted to know a great deal more about the subject we were teaching."

IHMT and Historical Modules Project Invited Speakers, 1995-2001

Tom Archibald, 19th century European mathematics
Marcia Ascher, ethnomathematics
Ron Calinger, historiography
Ubi D'Ambrosio, ethnomathematics
James Donaldson, African-American mathematicians

Bill Dunham, history of mathematical analysis
Harold Edwards, history of number theory
John Fauvel, mathematics of England and America
Judy Grabiner, Maclaurin and calculus
Judy Green, women mathematicians

Eleanor Robson

Uta Merzbach, Gauss and his legacy
Karen Parshall, American mathematics
David Pengelley, teaching with original sources
Kim Plofker, Indian mathematics
Helena Pycior, British algebra
Eleanor Robson, Mesopotamian mathematics
Shai Simonson, mathematics of Levi ben Gershon

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Augustus De Morgan (1806-1871), a great mathematician and a historian of mathematics

Augustus De Morgan was born in India, of British colonial parents, and Professor R. C.Gupta has written this tribute in recognition of the 200th anniversary of his birth.

Augustus De Morgan, born in India was the first president of the London Mathematical Society (LMS). He was a major mathematician of his time and a great teacher