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From Calculus to Computers: Using the Last 200 Years of Mathematics History in the Classroom
Edited by Amy Shell-Gellasch and Dick Jardine. Washington, DC (The Mathematical Association of America). 2005. ISBN 0-883-85178-4. 250 pp. $48.95

Numerous books and articles have appeared in the past decade dealing with the use of the history of mathematics in the teaching of mathematics. In fact, in 1997 the International Commission on Mathematical Instruction commissioned a study in its ICMI Studies series to consider this issue. As is standard with ICMI studies, an international conference took place (in 1998), and in 2000 the 10th ICMI Study appeared, *History in Mathematics Education*, edited by John Fauvel and Jan van Maanen. Since the appearance of this book, work in this area has increased, leading to numerous journal articles and presentations at national and international conferences.

The book under review originated in two contributed paper sessions at summer meetings of the Mathematical Association of America, which were in turn stimulated by the editors' realization that there was a dearth of material on using recent history of mathematics in the mathematics classroom. Indeed, the majority of the mathematical ideas referred to in the ICMI Study come from an earlier time period. Thus the current book is a welcome supplement to that volume. Of course, as in nearly any collection of articles, there is a great variation in quality and significance. Nevertheless, this compilation contains many articles which will be of great use to college teachers who want to use the history of recent mathematics in their teaching.

The first three sections of this collection contain 15 articles demonstrating how to use particular ideas from the history of recent mathematics in teaching various undergraduate courses, while the final section, with 7 articles, deals with more general ideas on the history of mathematics and its teaching. I will only briefly consider 13 of the articles.

David Pengelley begins the work by giving us some brief selections from Arthur Cayley's first paper on group theory [Cayley, 1854] and then showing how to make use of these excerpts in an introductory abstract algebra course. Most importantly, he emphasizes the pedagogical importance of asking the students questions about Cayley's article, forcing them to consider how Cayley's definitions and results compare with the material they find in their textbooks. (An instructor using this material might also wish to consult the recent article by Chakraborty and Chowdhury [2005].)

Lawrence D'Antonio, in a more extensive article, discusses the use of six original sources in dealing with the notion of elliptic curves. However, he does not give us the sources themselves but only outlines them, noting that in the senior-level course he has taught, excerpts from the original sources are read by the students. Nevertheless, a teacher who follows even parts of D'Antonio's program will lead his students quickly into some very deep aspects of number theory and introductory algebraic geometry. For example, D'Antonio writes about the algebra text of the Islamic mathematician Baha' al-Din Muhammad ibn Husain 'Amili (1547–1621) on finding all rational solutions of a particular set of two equations in three unknowns. D'Antonio then shows how this problem was transformed by Êdouard Lucas in the 1870s into a problem involving rational points on an elliptic curve, which then provides a good example to illustrate various definitions.

Historical material is used effectively by Holly Hirst to demonstrate how to build mathematical models in the development of various solutions to the predator–prey question. Not only does she develop the relevant differential equations, but she also details how to use the material both in a liberal arts mathematics course and in a sophomore introduction to mathematical modeling course.

How can one use history in teaching geometry? Daina Taimina and David Henderson give a wonderful answer, showing in particular how to "clarify common confusions." For example, does Euclid's parallel postulate distinguish the non-Euclidean geometries from Euclidean geometry? The "naïve" answer to this question is, of course, yes—but the authors note that surely Euclid's postulate (as given, for example, in Heath's translation) is true in spherical geometry. On the other hand, the "high school postulate"—"given a line and a point not on the line, there is one and only one line through the point that is parallel to the given line," often incorrectly called Playfair's Postulate and often asserted to be equivalent to Euclid's postulate—is certainly not true in spherical geometry. So is spherical geometry a "non-Euclidean" geometry? Or is the geometry where lines have more than one parallel the only true "non-Euclidean" geometry? The authors discuss this and other common confusions, deftly weaving the history of geometry into their discussions.

Did you ever wonder how the protractor came to be? Amy Ackerberg-Hastings answers all your questions in a fascinating historical article, tracing the device from its earliest beginnings in the late 16th century to the modern plastic versions still used in schools. A more technical geometrical article is "Euler on Cevians" by Eisso Atzema and Homer White. The authors here discuss Euler's 1780 theorem on cevians (lines that are not sides which pass through any vertices of a triangle). They then discuss various generalizations of Euler's result and give numerous suggestions for further investigations to be used as student projects.

Shai Simonson shows how to use history in teaching computer science students. In particular, since the subject of public key cryptography is of very current interest, he shows how he structures some of his computer science courses around the history of cryptography. Beginning with two basic results, Euclid's algorithm and Fermat's Little Theorem, he presents a brief history of cryptography, including the Vigenère cipher, and concludes with a detailed study of the mathematics behind public key cryptography. In particular, he deals with the RSA algorithm, at least in a simple version. The article also contains some interesting comments on the development of the RSA algorithm by Ron Rivest (the "R" in "RSA"). Jerry Lodder also uses history in beginning computer science courses. In particular, he demonstrates how to use Alan Turing's original paper "On computable numbers" [Turing, 1937] to teach some of the basic notions behind the modern computer. Lodder describes the projects he assigns to students, based on their readings, and offers advice to other instructors on implementing this program.

Mathematical logic is another course that can be enhanced by the use of its history, as Francine Abeles shows. In particular, because she felt her students had insufficient experience in proving theorems, Abeles introduced a proof technique called the tree method along with its historical development in the work of Gerhard Gentzen (1909–1945) and Stanislaw Jaśkowski (1906–1965). This method helps students work out formal proofs and, historically, led to the beginning of automated theorem-proving with computers as early as the 1950s. Abeles also provides details to enable the reader to understand the tree method proof procedure.

Noting that most statisticians today argue for a small role for probability in introductory statistics courses, Patti Hunter considers the place of probability in some major statistics texts in the first half of the 20th century. Of course, the definition of probability itself varied through the years, from the classical definition of Laplace and earlier writers, to the frequentist approach advocated by von Mises, to the measure-theoretical approach of Kolmogorov. Each of these definitions appeared in one or more of the statistics texts Hunter discusses; the subsequent deductions from these definitions then help to clarify the basic statistical results.

Sarah Greenwald shows how she incorporates the mathematical achievements of women and minority mathematicians in her classroom through historical projects. It was important, she found, for each student to create worksheets about a particular mathematician studied, so that the rest of the class would be engaged in the activity. Greenwald created her own worksheets in some classes to model the process. Among the mathematicians she dealt with are Carolyn Gordon and David Blackwell, the latter of whom is the subject of a recent article [Agwu et al., 2003].

Amy Shell-Gellasch gives numerous suggestions on how to teach a history of mathematics course from a "local perspective." Using the model of her own school, the United States Military Academy at West Point, she urges instructors to learn about the history of their own mathematics departments, so they can use these ideas in constructing their own such courses. Finally, Peggy Kidwell traces the history of the metric system in American classrooms. Although Thomas Jefferson recommended that the U.S. adopt a decimal-based system of weights and measures back in 1790, and although various reformers advocated the adoption of the metric system in the U.S. in the 19th century, there were always numerous obstacles to the success of the system. Kidwell discusses some of these, as well as the many ways in which knowledge of the metric system entered the schools.

From Calculus to Computers is one of a growing number of recent books to give teachers at various levels concrete ideas for incorporating the history of mathematics into their teaching. Unfortunately, like most of its predecessors, the book itself only presents anecdotal evidence about the success of such teaching. Although the authors of the articles here—like the authors in similar books and even the author of this review—believe strongly that incorporating history improves students' learning of mathematics, this notion will only make a difference beyond the classrooms of believers when serious research studies are able to demonstrate a positive effect. I hope that some readers of this book will be motivated not only to try out some of the wonderful ideas included in it, but also to conduct some educational research to demonstrate that using the history of mathematics, whether that of ancient times or of the past 200 years, will increase our students' ability to learn mathematics.

References

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Mathematics and the Historian's Craft: The Kenneth O. May Lectures

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The essays collected in this volume are based on keynote lectures given at annual meetings of the Canadian Society for History and Philosophy of Mathematics (CSHPM/SCHPM). Since at the time of writing I am the president of the CSHPM, I should perhaps begin this review by acknowledging an apparent conflict of interest. However, although the book was edited by a past president and a former *Proceedings* editor of the society, the CSHPM had no official role in its publication. It was in fact published by the Canadian Mathematical Society and Springer, in the *CMS Books in Mathematics* series.

Readers of this review are necessarily familiar with the legacy of Kenneth O. May, since he was the founding editor of this journal. He established *Historia Mathematica* as a newsletter in 1972 and brought out the first issue of the journal of the same name in 1974. It was during the same two-year period that he played midwife to the birth of the CSHPM, which was officially established at a meeting held at Queen's University in 1973 and held its first annual meeting the following year. Shortly afterwards, in 1977, Ken May passed away at the tragically young age of 62. In his honor, the CSHPM established the Kenneth O. May Fund to assist in bringing invited speakers to its annual meetings.

Amy Shell-gellasch (Editor). 0.00 Â· Rating details. Â· 0 ratings Â· 0 reviews.Â From Calculus to Computers is a resource for undergraduate teachers that provides ideas and materials for immediate adoption in the classroom and proven examples to motivate innovation by the reader. Contributions to this volume are from historians of mathematics and college mathematics instructors with years of experience and expertise in these subjects. Examples of topics covered are probability in undergraduate statistics courses, logic and programming for computer science, undergraduate geometry to include non-Euclidean geometries, numerical analysis, and abstract algebra. ...more. Get A C From Calculus to Computers: Using the Last 200 Years of Mathematics History in the Classroom, Amy Shell-Gellasch and Dick Jardine (eds), 2005, 200 pp., illustrations, $48.95 (MAA member price $39.50) paperbound. ISBN: 0-88385-178-4. MAA notes, Catalog Code NTE-68, MAA Service Center, P.O. Box 91112, Washington, DC 20090-1112, 1-800-331-1MAA, www.maa.org. This collection of articles assembled by editors Amy Shell-Gellasch and Dick Jardine grew from a series of proposed talks for MAA Math Fest during the summers of 2001 and 2002. The motivation of this volume was to address a â€œnoticeable lack of Dick Jardine. Abstract. From Calculus to Computers is a resource for undergraduate teachers that provide ideas and materials for immediate adoption in the classroom and proven examples to motivate innovation by the reader. Contributions to this volume are from historians of mathematics and college mathematics instructors with years of experience and expertise in these subjects.Â An empirical study on the use of history (as a goal) in mathematics education is discussed in this article. A historical module was designed and implemented in a Danish upper secondary class to study how students' discussions of metaperspective issues of the historical development of mathematics may be anchored in the taught and learned subject matter of the module.