

International Study Group on the Relations Between
the History and Pedagogy of Mathematics

AN AFFILIATE OF THE INTERNATIONAL
COMMISSION ON MATHEMATICAL INSTRUCTION

Newsletter

NORTH AMERICAN EDITION

No.5: October 1983

Editorial Committee

Charles V. Jones EDITOR
IHPST, Victoria College
University of Toronto
Toronto, Canada M5S 1K7

Bruce Meserve ISGHPM COCHAIRMAN
Dept of Mathematics
The University of Vermont
Burlington, Vermont 05405

Phillip S. Jones
Dept. of Mathematics
The University of Michigan
Ann Arbor, Michigan 48109

V. Frederick Rickey
Dept. of Mathematics
Bowling Green State Univ.
Bowling Green, Ohio 43403

David Wheeler
Dept. of Mathematics
Concordia University
Montréal, Canada H4B 1R6

Distributed to interested persons in Canada, Mexico, and the United States and selected individuals overseas by Duane E. Deal (Ball State University, Muncie, Indiana 47306), Phillip S. Jones, David Wheeler, and Charles V. Jones. Send requests and address changes to the Editor.

Calendar of Coming Events

1983 Oct 27-30 Norwalk, Conn.
History of Science Society (session
commemorating tenth anniversary of *Historia
Mathematica*). Contact: J.W. Dauben, Dept of
History, Lehman College, CUNY, Bedford Park
Blvd. W., Bronx, N.Y. 10468.

1984 April 23-28. San Francisco
ISGHPM workshop April 23-25: San Francisco
University High School. Contact Craig McGarvey,
SFU High School, 3065 Jackson St, San
Francisco, CA 94115. Annual meeting of the
National Council of Teachers of Mathematics,
April 26-28: contact NCTM, 1906 Association Dr,
Reston, VA 22091. [See this issue.]

1984 Aug 24-30 Adelaide
Fifth International Congress on Mathematical
Education (ICME 5). Contact: ICME 5 Travel
Planners, P.O. Box 32366, San Antonio, Texas
78216 (512/341-8131) [See this issue.]

1984 Sept 26-30. Oxford
A conference on Renaissance mathematics with
pedagogy among its themes. Contact: Dr.
Cynthia Hay, Conference Secretary, Faculty of
Mathematics, The Open University, Walton Hall,
Milton Keynes. MK7 6AA. England.

1985 April 17-20. San Antonio
National Council of Teachers of Mathematics.
Suggestions are invited for ISGHPM meetings in
conjunction with the NCTM annual meeting.
Contact: Bruce Meserve, Dept of Mathematics,
The University of Vermont, Burlington, Vt.
05405.

1986 April 2-5 Washington, D.C.
National Council of Teachers of Mathematics.
Suggestions are invited for ISGHPM meetings in
conjunction with the NCTM annual meeting.
Contact: Bruce Meserve, Dept of Mathematics,
The University of Vermont, Burlington, Vt.
05405.

From the Editor

Getting History Back In the Classroom

Among all the sciences only the history of astronomy is as ancient as the history of mathematics. The value of history for enrichment and motivation in the classroom has long been recognized, and in the early parts of this century history courses were incorporated into mathematics and teacher training programs throughout the United States and Canada. It is somewhat ironic to find it now so little used in teaching. Moreover, even though the amount of historical research has increased in the last several decades, historical articles seem to appear less frequently in the general mathematics journals (specialized journals now carry them). What has caused this change? Obviously a natural and easy avenue for introducing history disappeared with the demise of the geometry course patterned after Euclid's *Elements*. And of course the old undergraduate theory of equations course gave easy if not direct contact with other historical developments. These courses and others were consolidated into a new pedagogy based on set theory, functions and transformations which brought a new coherence and unity to the curriculum, but perhaps not without hidden costs which are now becoming apparent.

Our diminishing success in communicating mathematics to the general audience in the education system is so well known that it is now a high priority item on the national agenda. To what extent might the new foundations of pedagogy have been responsible for this? Could it be that by cutting off mathematics from its long traditions and dressing it in a new garb of sets and structures, many topics lost their charm and attraction? Certainly the new pedagogy, notwithstanding all its other advantages, further removed many 'old' topics from their historical context and consequently from the enriching and intuitive matrix which often inspired their creators. Far more students understand and appreciate the fundamental theorem of calculus, say, when they first see it as the result of a long search for solutions to practical, historical problems, than if their first introduction is to a relation between operators which satisfy certain algebraic properties.

Two things seem quite apparent: the percentage of students who have difficulty with mathematical thinking is on the rise, and the amount of historical enrichment in the curriculum is on the decline. Although at present we cannot determine for certain the underlying cause, these two trends may very well be linked. History can enrich and inspire the mathematics student, now in this new pedagogy as in the old. It just may not be as easy; and as a consequence it just may not be so often tried. Perhaps it is time to return to a well tested classroom motivator—once again to put the history of mathematics into the mathematics class and not leave it solely to the history classroom. We may not have thrown out the baby with the bath water in ridding mathematics of the older, less coherent collection of courses and topics, but we may have thrown out the bar of soap. (We all know how easy it is to find a student who thinks mathematics stinks!) □

Your views, opinions, or reactions are invited. Send them to C.V. Jones, Editor, ISGHPM Newsletter, Victoria College, University of Toronto, Toronto, Canada M5S 1K7.

ISGHPM Will Meet With NCTM

The ISGHPM (North American Section) will meet again this year for three days immediately preceding the annual meeting of the National Council of Teachers of Mathematics in San Francisco. San Francisco University High School will host the ISGHPM gathering April 23 to 25 (Monday to Wednesday). Later in the week, a session of the NCTM program will be devoted to discussing the ISGHPM meeting.

The detailed form which the ISGHPM meeting will take has not been settled and, in fact, is awaiting some suggestions from *you*, the readers of this *Newsletter*. Here are some suggestions which are already being discussed. Formal talks from invited speakers on requested topics are possible. What topics would be interesting? Workshop sessions similar to last year's meeting could be devoted to presenting and discussing classroom kits or lesson plans utilizing a historical approach to specific mathematical topics. These might include a lecture or lesson plan with accompanying homework, a week's or fortnight's unit with text materials and exercises, or a description of a

historical approach to a specific problem. A book display including each participant's favorite could be coordinated with a bibliography of historical sources. Ample time would be available for discussing and sharing of materials.

If you are interested in the use of history in the teaching of mathematics, first send your ideas and suggestions to the organizers (listed below), and then plan to attend and participate. The session at Ann Arbor last year was particularly congenial and productive, and this workshop promises the same. *If you have a historical unit which you use in your teaching of mathematics, present it at this ISGHPM meeting.* Units which can be used in the mathematics classroom and not simply history of mathematics course material are especially solicited. Write to either co-organizer, Fred Rickey (Bowling Green St. U., Bowling Green, Ohio 43403) or Craig McGarvey (address below).

There may be a nominal registration fee for the workshop. Nearby accommodations may be arranged at least three weeks in advance at the El Drisco Hotel (2901 Pacific Ave, S.F., CA 94115; phone 415/346-2880) or the Laurel Motor Inn (Presidio & California, S.F., CA 94115; phone 415/567-8467). Further information on the program and requests to attend and participate should be sent to Craig McGarvey, San Francisco University High School, 3065 Jackson St., San Francisco, CA 94115 (phone 415/346-8400). □

ICME 5 Is Participation Oriented

Participants in the Fifth International Congress on Mathematical Education, ICME 5, will be actively encouraged to be involved in working groups of two varieties, Action Groups and Theme Groups. These groups meet each day as well sessions in which there will be presentations. The Action Groups are identified by levels of instruction (early childhood, elementary, and so on) and the principal Themes will include problem solving, curriculum development, technology, applications and modelling, professional life, theory and research, and mathematics for all. Other subsidiary themes have been identified, including sessions sponsored by ISGHPM on pedagogy and history.

Refer to the May 1983 *Newsletter* and to the "Coming Events" in this issue for an address and other information. □

ISGHPM Planning ICME 5 Pre-session

Plans are going forward to have a meeting of ISGHPM in Adelaide on August 23 and 24, immediately preceding the ICME 5 meeting. Accommodations for rooms, meals, and conferences are being arranged. Those interested in attending this session should contact either co-chairman of ISGHPM, Prof. Bruce Meserve (University of Vermont, 16 Colchester Ave., Burlington, VT 05401) or Prof. Roland Stowasser (Technical University of Berlin, Strasse des 17 Juni 135, D-1000 Berlin 12, F.R.Germany). □

ISGHPM at Warsaw International Congress

(*David Wheeler*)—Three two-hour sessions at the 1983 International Congress of Mathematicians were organized on behalf of ISGHPM by Roland Stowasser (West Berlin) and W.M. Zawadowski (Warsaw). Unfortunately two of these sessions were scheduled at the same time as meetings of the International Commission on Mathematical Instruction (ICMI) to which ISGHPM is affiliated. The writer had a prior commitment to the ICMI sessions and so could not attend all the ISGHPM presentations, but the following remarks may give some idea of what went on.

Probably the highlight of the sessions, even though it had no reference to make to pedagogy, was the presentation (in German) by Arpád Szabó (Budapest) on aspects of the early history of astronomy. Szabó's philological approach has yielded fresh insights about Greek mathematics (see his *The Beginnings of Greek Mathematics*, Reidel, 1978) and seems to be bearing fruit in the area of Ptolemaic astronomy. He would agree, I think, that most of his work is at present demonstrating an approach rather than achieving conclusive results, but since the history of mathematics is an interpretation of incomplete and often mysterious evidence, a fresh attack on the data is welcome. The careful attention that Szabó gives to language is not unknown in other historical fields but has rarely, if ever, been applied so penetratingly to historical documents in mathematics.

Four presentations attempted the task of relating history and pedagogy--the *raison-d'être* of ISGHPM. Roland Stowasser showed how the topic of geometrical constructions can be treated as a problem solving area for student teachers. By presenting the students with an unusual geometrical "instrument", for example, one formed from two rays meeting at a fixed angle, and inviting them to consider if and how it could be used to perform the elementary Euclidean constructions, he led them to see traditional ruler-and-compass constructions as one solution among many to a particular class of geometrical questions. Waclaw Zawadowski considered how geometrical methods of establishing the existence of incommensurables could complement the algebraic methods more commonly used and provide additional insights into the history and the mathematics of incommensurables. Abraham Arcavi (Weizmann Institute of Science, Israel) outlined in a splendid presentation how materials dealing with the history of negative numbers had been prepared by members of the Institute for use in courses for teachers. Noteworthy criteria that were adopted included the use of original documentation in the original languages (with some translation clues supplied) and the development of suitable tasks for the teachers to perform. The writer of this report considered cardinality and ordinality as a case study to suggest how developments which are favourable for mathematics may induce unfavourable developments in mathematical pedagogy.

Probably none of the four talks managed to probe very deeply into the relation between history and pedagogy (and not much can be conveyed in addresses of 20 to 30 minutes duration). One was reminded again how difficult is the task that the ISGHPM has set itself. How much easier it is to talk about the history of mathematics without considering its relation to pedagogy (and vice versa)! But the occasional illuminating connection, even if rarely experienced, reinforced the writer's conviction that the difficulties are eminently worth battling with.

Other presentations were made by U. Laugwitz (Darmstadt) on "Calculus is algebra: a reconstruction of Euler's *Introductio*", by R. Duda (Wroclaw) on "Historical development of

the concept of dimension", and by H. Wussing (Leipzig) on "Geschichte der Mathematik als Teil der Lehrerausbildung." □

Course Outlines and Materials Available

Dorothy Goldberg (Kean College) has been collecting course outlines and syllabi for the past couple of years. She has reviewed them, analyzed them, carried them around from meeting to meeting to let people know about this resource. presented summaries to several meetings, and generally done considerable work in trying to provide support for college and university courses in the history of mathematics. Through delays in the mail, the following announcement of these materials missed our May 1983 Newsletter. If you want some ideas on how you might structure your course, take advantage of her offer. You too will then be indebted to her for taking on this rather difficult task. --Ed.

(Dorothy Goldberg→) During the last two years ISGHPM has received syllabi, bibliographies, and other educational material in the history of mathematics from educators at colleges and universities in the United States and Canada. From time to time descriptions of them will appear in the Newsletter, and copies will be made available at cost. Moreover you can take advantage of this service of ISGHPM and share your course outline, bibliography, tests, lecture notes, or materials with those teaching the history of mathematics.

Please send your request or your course materials to Dr. Dorothy Goldberg, Department of Mathematics and Computer Science, Kean College of New Jersey, Union, N.J. 07083.

•Dr. David E. Flesner of Gettysburg College in Pennsylvania sent materials for a history course which is taken by liberal arts students and mathematics majors, especially teacher candidates. The class meets for three to four hours per day for the four weeks of the January term. A syllabus, extensive bibliographies, study problems, and midterm and final examinations are included. Cost: \$1.85.

•Professor Frank Swetz of Pennsylvania State University offers an upper level course to undergraduate seniors and master's degree

candidates. Described as "an historical development of the major ideas in mathematics and their scientific and social impact", it is run as a seminar. Classroom sessions are comprised of "lectures, student reports, film showings and varied activities." A description of the course, together with a set of problem studies in the history of mathematics were sent. Cost: see next item.

Professor David E. Kullman of Miami University of Ohio sent an annotated bibliography for a junior/senior level course for students with at least one and one-half years of college level mathematics as a prerequisite. For students seeking teacher certification, it counts towards the mathematics major. Cost for both (Swetz & Kullman): \$1.15.

•Dr. M.A. Malik of Concordia University in Montreal teaches the history of mathematics in the Master of the Teaching of Mathematics Program at his University. "Rather than discussing the mathematics of each period in history", he discusses in his lecture notes "only the important aspects of the history of each selected topic; along with the appropriate mathematical content". Cost: \$7.00. □

Have You Read?

We are introducing a new feature in this issue of the Newsletter. "Have You Read?" will list articles and books that address the problem of teaching mathematics using history. There is no one journal devoted to this problem, so the editorial committee felt that such a feature might prove useful. Many references will not deal directly with history in the mathematics classroom, but all should have the potential for motivating or enriching. If you find some historical item interesting, and you think you see how it might help in teaching mathematics, likely others will find it interesting as well. What you might consider an obvious reference sure to be seen by everyone (e.g., an article in Historia Mathematica) may be missed by many of our readers. So take the time to send the reference along. The value of this feature will be determined by the response from readers; even if you do not have a reference to contribute, let us know if you find the feature useful.

Supply complete bibliographic information: include both the volume and date of journals; complete titles of both the article and journal; edition, copyright date, publisher and place of publication for books. Accuracy in spellings and wording is critical. —Ed.

• Wytze Brower and Aman Singh. "The historical approach to science teaching." *The Physics Teacher* 21 (1983) 230-35. —VFR

• Volume 15, number 2 (1983) of the *New England Mathematics Journal* is a "Special Theme Issue: The History of Mathematics in the Classroom" which includes the following. (Copies available from William E. Geeslin, ATMNE Business Manager, Dept of Mathematics, Univ. of New Hampshire, Durham, NH 03824-3591. Include \$2.00 for each copy.) —BEM

Bruce E. Meserve, "Historical resourcefulness"; Stanley Bezuska, S.J., "Let's try some Egyptian mathematics"; David M. Burton, "The Pythagorean theorem in antiquity"; Arthur V. Johnson, II, "Non-mathematicians make history"; Howard Eves, "Pi to eleven million decimal places"; Waldeck E. Mainville, Jr, "Using the history of mathematics in the classroom"; Paul L. Estes, "Fibonacci"; Richard H. Balomenos and Donovan H. VanOsdol, "Pentagons, stars, and other things".

• Cecil J. Schneer. 1983. "The Renaissance background to crystallography." *The American Scientist* 71 (May-June) 254-63.

Subtitled "The search for harmonious proportions and perfect shapes in the natural world opened the way to the science of crystals." Relates to polyhedra, tessellations, Kepler, Dürer, Nicholas of Cusa, Pacioli, Clavius, Leclerc (Buffon), artists and others. —PSJ

• Herbert E. Scarf. 1983. "Fixed point theorems and economic analysis." *The American Scientist* 71 (May-June) 282-96.

Development and application of Brouwer's Fixed Point Theorem to economic analysis from Walras' *Elements d'Economie Politique* (1874) to Brouwer (1912) and Ginsburg and Waelbroeck (1981). —PSJ

- Patricia Cline Cohen, *A Calculating People, the Spread of Numeracy in North America*. University of Chicago Press. —PSJ
- J.A. Bennett. 1982. *The Mathematical Science of Christopher Wren*. Cambridge Univ Press. —PSJ
- Ronald Gowling. 1983. *Roger Cotes, Natural Philosopher*. Cambridge Univ Press. —PSJ
- I. Grattan-Guinness, Editor. *From the Calculus to Set Theory, 1630-1910. An Introductory History*. Chapters by the editor, H.J.M. Bos, R. Bunn, J.W. Dauben, T.W. Hawkins, K. Moller Pedersen. 1980. Gerald Duckworth & Co. Ltd., The Old Piano Factory, 43 Gloucester Crescent, London NW1.
Easily missed since no American publisher.
- Ronald Calinger, Editor. 1982. *Classics Of Mathematics*. Oak Park, Illinois: Moore Publishing Co. Inc.
Selections from other source books, from pre-Greek to twentieth century; paperback.
- Clark Kimberling. 1983. "Euclidean Algorithm and continued Fractions", *The Mathematics Teachers*. 76:7 (Oct) 510-512, 548.
Ancient topic although not presented historically; BASIC programs.
- George P. Loweke. 1982. *The Lore of Prime Numbers*. NY: Vantage Press.
Briefly reviewed, favorably, in *Mathematics Teacher* 76:7 (Oct 83) 541.
- Delvin J. Johnson. 1982. *Solutions to the Three Historical Problems by Compass and Straightedge*. NY: Vantage Press.
More briefly reviewed, unfavorably, in *MT* 76:7 (Oct 83) 542 (see previous item).
- K.W. Smillie. 1981. "A service course in computing science presented from a historical point of view", *SIGCSE Bulletin* 13:2 (June) 27-33.
Course for first year undergraduates, going back to Egyptian and Babylonian topics. □

Journals Solicit Historical Articles

The editors of two journals recently have made it known that they are interested in historical material for their publications. Dr. Warren Page,

editor elect of the *Two-Year College Mathematics Journal* (a publication of the Mathematical Association of America), is interested in publishing historical articles which can be used for classroom motivation or enrichment. If you have something for publication, or want more information, contact Dr. Warren Page, TYCMJ, New York City Technical College, 300 Jay St, New York, NY 11201.

The editor of the NCTM publication, *Journal for Research in Mathematical Education*, is interested in receiving historical material which fits the journals mandate. Write to Jeremy Kilpatrick, Univ. of Georgia, Athens, GA. 30602, for more information. □

Varied Program at Toronto Workshop

A workshop on developing historical materials for use in the mathematics classroom was held at the University of Toronto, July 25 to August 2. There were two talks given in the mornings and the afternoons were devoted to discussions, films and the use of the library. On the last day of the conference, registrants presented materials and described some of their experiences in using history. Talks presented were as follows: Stillman Drake, "Euclid Book V From Eudoxus to Dedekind"; J.L. Berggren, "Mathematical Methods in Early Science"; I. Grattan-Guinness, "What Was and What Should Be the Calculus", and "Work for the Workers"; Barnabus Hughes, "Developing Proof from Pythagoras to Viète", and "Episodes from the History of Mathematics for Enrichment"; Charles V. Jones, "From Greek Mathematics to Algebra"; Helena Pycior, "British Abstract Algebra: Development and Early Reception", and "Good' Biography and the Mathematics Classroom"; C.J. Scriba, "The So-Called Classical Problems in the History of Mathematics", and "Uses of History in Teaching Number Theory".

A Proceedings is planned and publication information will be announced at a later date. □