

**INTERNATIONAL GROUP FOR THE
PSYCHOLOGY OF MATHEMATICS EDUCATION**



**13-18 July, 2003
Honolulu, HI**

**PROCEEDINGS OF THE 2003
JOINT MEETING OF PME AND PMENA
Volume 1**

**Editors
Neil A. Pateman
Barbara J. Dougherty
Joseph T. Zilliox**

**CRDG, College of Education,
University of Hawai'i**

Proceedings of the 27th Conference of the International Group for the Psychology of Mathematics Education held jointly with the 25th Conference of PME-NA

Volume 1

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The Proceedings are also available on CD-ROM

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ISSN 0771-100X

Design of the PME27 PME-NA Logo: Darrell Asato and Neil Pateman
Cover Design: Cissy Gray

Printed by the Center for Research and Development Group, University of Hawai'i,
Honolulu, HI, USA

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WELCOME TO PME27 AND PMENA25

It has been over ten years since it was possible to welcome members of both PME and PMENA to a Joint Annual Conference of the International Group for the Psychology of Mathematics Education. The local organizing committee is therefore doubly pleased to offer a very warm aloha to members of both groups, and to assure you all that the spirit of friendship and grace that is characteristic of the Pacific Islands will embrace everyone during the Conference. We extend a special welcome to the Pacific Island Scholars who are attending for the first time in the history of PME.

When we offered to host the joint meeting, we had no idea of the amount of work that would be involved. As the starting date of the Conference approaches, we can reflect back on that work, and with deep appreciation express thanks to many people who assisted us in the preparations for the Conference.

The Program Committee, listed below, spent two very intense weekends, one in late January and one in late March, matching reviewers to papers and then making the difficult final selection of research papers, short orals and posters for the conference.

Dr. A. J. (Sandy) Dawson (PREL), Chair	Dr. Judy Olson (Western Illinois Univ.)
Dr. Barbara Dougherty (UH)	Dr. Melfried Olson (Western Illinois Univ.)
Dr. Janete Bolite Frant (Brazil)	Dr. Neil Pateman (UH)
Dr. Anne Berit Fuglestad (Norway)	Dr. Mary Pat Sjoström (UH)
Dr. Rina Hershkowitz (Israel)	Dr. Hannah Slovin (UH)
Dr. Marit Johnsen Høines (Norway)	Dr. Catherine Sophian, (UH)
Dr. Masataka Koyama (Japan)	Dr. Judith Sowder (San Diego State Univ.)
Dr. Julie Kaomea (UH)	Dr. Joseph Zilliox (UH)

The academic quality of the conference rests in the hands of the many colleagues who reviewed proposals for the Program Committee. They and the Program Committee did an outstanding job of maintaining the high standards established previously.

The local organizing committee, chaired by Sandy Dawson, and composed of Barbara Dougherty, Neil Pateman, Yvonne Yamashita, and Joe Zilliox, with Sandra Dawson and Glen Schmitt handling 'Ohana arrangements, spent countless hours attending to the details of conference registration, accommodation, and the multitude of details required to launch the conference. They have done a remarkable job.

Neil Pateman developed an exceptional academic database for the conference. Pam Ishii was extremely diligent in her work of maintaining this database and cataloging and managing the vast number of proposals that were submitted to the Conference. Neil also spent endless hours editing accepted proposals so that they matched Conference guidelines thereby generating a set of Proceedings that look as scholarly and professional as possible.

The Conference is co-hosted by Pacific Resources for Education and Learning (PREL) and the College of Education of the University of Hawai'i (UH). Both organizations have been unstinting in their support of the Conference for which we give our heartfelt thanks, and in particular we wish to acknowledge Dr. Tom Barlow, CEO of PREL, and Dr. Randy Hitz, Dean of the College of Education.

More formally, we would like to thank the following for their generous support:

- The National Science Foundation (ESI-0209393) for its support in bringing the Pacific Island Scholars to PME27/PMENA25. The Pacific Island Scholars are twenty-seven mathematics educators from across the Pacific region served by PREL, three each from American Samoa, the Republic of Palau, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, the Republic of the Marshall Islands (RMI), and the Federated States of Micronesia which includes the states of Chuuk, Kosrae, Pohnpei, and Yap;
- Pacific Resources for Education and Learning (PREL) for supplying the conference bags and program;
- The Eisenhower Pacific Regional Mathematics/Science Consortium for assistance with local transportation arrangements, support for the conference volunteers, and providing poster board materials for the Pacific Island Scholars;
- The Office of the Chancellor of the University of Hawai'i for financial and administrative support to the Conference;
- The University of Hawai'i Conference Center for the administration of Conference registration and accommodation services;
- The College of Education for providing secretarial and equipment support in the preparation of Conference materials;
- The Curriculum Research and Development Group of the College of Education provided generous support in the printing of the Proceedings;
- Maile Beamer Loo and her H_lau Hula 'O Kaho'oilina Aloha for performing Kaliko Beamer-Trapp's chant and introducing the international PME community to the beauty and intricacies Hawaiian hula;
- Dr. Kerri-Ann Hewett for arranging to hold the Opening Plenary and Reception at the Kawaiaha'o Church;
- Outrigger Hotels International for providing the incredibly economical hotels rates that enabled so many participants to attend the Conference;
- Hawai'i Convention Center for providing the use of its facilities at such a reasonable rate;
- John Held of Kaeser & Blair for producing the participant and volunteer tee shirts and bags.

We wish you fond "Aloha" and hope you have a wonderful time in Hawai'i.

Sandy Dawson

on behalf of the PME27/PMENA25 Conference Committees

July 2003

INTRODUCTION

THE INTERNATIONAL GROUP FOR THE PSYCHOLOGY OF MATHEMATICS EDUCATION (PME)

History and Aims of PME

PME came into existence at the Third International Congress on Mathematics Education (ICME3) held in Karlsruhe, Germany in 1976. Its past presidents have been Efraim Fischbein (Israel), Richard R. Skemp (UK), Gerard Vergnaud (France), Kevin F. Collis (Australia), Pearla Neshet (Israel), Nicolas Balacheff (France), Kathleen Hart (UK), Carolyn Kieran (Canada), Stephen Lerman (UK) and Gilah Leder (Australia).

The major goals of both PME and PMENA are:

- To promote international contacts and the exchange of scientific information in the psychology of mathematics education.
- To promote and stimulate interdisciplinary research in the aforesaid area with the co-operation of psychologists, mathematicians and mathematics educators.
- To further a deeper understanding into the psychological aspects of teaching and learning mathematics and the implications thereof.

PME Membership and Other Information

Membership is open to people involved in active research consistent with the Group's goals, or professionally interested in the results of such research. Membership is on an annual basis and requires payment of the membership fees (US\$40 or the equivalent in local currency) per year (January to December). For participants of PME27 Conference, the membership fee is included in the Conference Deposit. Others are requested to contact their Regional Contact, or the Executive Secretary.

Website of PME

For more information about PME as an association see its home page at igpme.tripod.com or contact the Executive Secretary, Joop von Dormolen.

Honorary Members of PME

Hans Freudenthal (The Netherlands, deceased)

Efraim Fischbein (Israel, deceased)

Present Officers of PME

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PROCEEDINGS OF PREVIOUS PME CONFERENCES

Copies of some previous pme conference proceedings are available for sale. For information, see the PME home page at <http://igpme.tripod.com>, or contact the executive Secretary, Dr. Joop von Dormolen whose address is on page of this volume. All proceedings, except PME1 are included in ERIC. Below is a list of the proceedings with their corresponding ERIC codes.

PME INTERNATIONAL			
No.	Year	Place	ERIC Number
1	1977	Utrecht, the Netherlands	Not available in ERIC
2	1978	Osnabrück, Germany	ED 226945
3	1979	Warwick, United Kingdom	ED 226956
4	1980	Berkeley, USA	ED 250186
5	1981	Grenoble, France	ED 225809
6	1982	Antwerpen, Belgium	ED 226943
7	1983	Shoresh, Israel	ED 241295
8	1984	Sydney, Australia	ED 306127
9	1985	Noordwijkerhout, Netherlands	ED 411130 (vol. 1) ED 411131 (vol. 2)
10	1986	London, United Kingdom	ED 287715
11	1987	Montréal, Canada	ED 383532
12	1988	Veszprém, Hungary	ED 411128 (vol. 1) ED 411129 (vol. 2)
13	1989	Paris, France	ED 411140 (vol. 1) ED 411141 (vol. 2) ED 411142 (vol. 3)
14	1990	Oaxtepec, Mexico	ED 411137 (vol. 1) ED 411138 (vol. 2) ED 411139 (vol.3)
15	1991	Assisi, Italy	ED 413162 (vol.1) ED 413163 (vol. 2) ED 413164 (vol.3)
16	1992	Durham, USA	ED 383538
17	1993	Tsukuba, Japan	ED 383536
18	1994	Lisbon, Portugal	ED 383537
19	1995	Recife, Brazil	ED 411134 (vol. 1) ED 411135 (vol. 2)
20	1996	Valencia, Spain	ED 453070 (vol. 1) ED 453071 (vol. 2) ED 453072 (vol. 3) ED 453073 (vol.4)
21	1997	Lahti, Finland	ED 416082 (vol. 1) ED 486083 (vol. 2) ED 486084 (vol. 3) ED 486085 (vol. 4)

22	1998	Stellenbosch, South Africa	ED 427969 (vol. 1) ED 427970 (vol. 2) ED 427971 (vol. 3) ED 427972 (vol. 4)
23	1999	Haifa, Israel	ED 436403
24	2000	Hiroshima, Japan	ED 452031 (vol. 1) ED 452032 (vol. 2)
25	2001	Utrecht, Netherlands	In process
26	2002	Norwich, United Kingdom	In Process

PME NORTH AMERICAN CHAPTER

2	1980	Berkeley, CA (with PME2)	ED 250186
3	1981	Minnesota	ED 223449
4	1982	Georgia	ED 226957
5	1983	Montréal, Canada	ED 289688
6	1984	Wisconsin	ED 253432
7	1985	Ohio	ED 411127
8	1986	Michigan	ED 301443
9	1987	Montréal, Canada (with PME11)	ED 383532
10	1988	Illinois	ED 411126
11	4989	New Jersey	ED 411132 (vol. 1) ED 411133 (vol. 2)
12	1990	Oaxtepey, Mexico (with PME14)	ED 411137 (vol. 1) ED 411138 (vol. 2) ED 411139 (vol. 3)
13	1991	Virginia	ED 352274
14	1992	Durham NH (with PME16)	ED 383538
15	1993	California	ED 372917
16	1994	Louisiana	ED 383533 (vol. 1) ED 383534 (vol. 2)
17	1995	Ohio	ED 389534
18	1996	Panama City, FL	ED 400178
19	1997	Illinois	ED 420494 (vol. 1) ED 420495 (vol. 2)
20	1998	Raleigh, NC	ED 430775 (vol. 1) ED 430776 (vol. 2)
21	1999	Mexico	ED 433998
22	2000	Tuscon, AZ	ED 446945
23	2001	Snowbird, UT	In process
24	2002	Athens, GA	In process

Abstracts can be inspected on the ERIC website (<http://www.accesseric.org>) and on the website of ZDM/MATHD1 (<http://www.emis.de/MATH/D1/htm>). Microfiches may be available at university libraries or purchased from ERIC/CSMEE, 1929 Kenny Rd. Columbus, OH 443210-1080; Tel: (614) 292-6717; FAX: (614) 293-0263; email: ericse@osu.edu.

MATHD1 is the web version of the Zentralblatt für Didaktik der Mathematik (ZDM, International Reviews on Mathematical Education). For more information, contact Gerhard König FAX: +49 7247 808 461; email: gk@fiz-karlsruhe.de.

REVIEW PROCESS OF PME27

The reviews (3 for each proposal) of all research report (RR) proposals were examined by the Program Committee, a committee composed of 17 members of the international mathematics education community. All reviews are read and a decision made based on the reviews. PME policy is that proposals which receive 3 accepts, or 2 accepts and 1 not accept from reviewers are accepted for inclusion in the conference. A proposal that receives 3 not accepts from reviewers is not accepted by the Program Committee.

PME policy is that research reports which receive 2 not accepts and 1 accept from reviewers are scrutinized carefully, that the Program Committee then makes a decision to accept the RR or not, if the decision is to not accept the proposal, a further decision is made as to whether the report should be recommended to be offered as a short oral or a poster.

The Program Committee also examines the reviews in cases where a Research Report receives 3 not accepts from reviewers, 3 accepts from reviewers, or 2 accepts and 1 not accept from reviewers. This is done in order to make sure reviews are reasonable, respectful, and offer the proposer useful information and guidance regarding the proposal. In rare cases, a proposal receiving 3 not accept reviews might be recommended for offering as a short oral or a poster particularly if the proposal is from a scholar who has not submitted to PME previously. In the case of Short Oral and Poster Proposals, each is reviewed by the Program Committee. Posters are accepted or not. A short oral, if not accepted, may be recommended for presentation as a Poster.

The **Program Committee** (PC) for PME27 completed the task of the selection of research reports, short orals, posters, discussion groups, working sessions. To give you an idea of the level of activity presented for the conference, the outcomes of the PC meeting was as follows:

Research Reports	Short Orals	Posters
Received: 280	Received: 92	Received: 44
Accepted: 176 <i>(acceptance rate of approximately 63%)</i>	Not accepted: 37 <i>(acceptance rate of approximately 60%)</i>	Not accepted: 2
Not accepted, recommended as Short Orals: 25	Accepted: 55	Recommended to be Short Orals: 1
Not accepted recommended as Posters: 24	Accepted from Research Reports proposals: 25	Accepted: 42
Not accepted: 55	Accepted from Posters: 1	Accepted from Research Report proposals: 24
	Potential Short Oral sessions: 81	Accepted from Short Orals: 21
		Potential Posters: 87

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The Pacific Island Scholars' participation in the 2003 Joint Meeting of PME and PMENA is made possible through a grant from the National Science Foundation (NSF), award number ESI 0209393. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

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