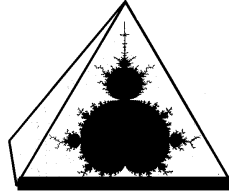


The Mathematics Education into the 21st Century Project



MEC21

Rhodes University, Grahamstown



RHODES UNIVERSITY
Where leaders learn

**Proceedings of the 11th International
Conference**

***Turning Dreams into Reality:
Transformations and Paradigm Shifts
in Mathematics Education***

September 11-17, 2011

Editors: Ludwig Paditz & Alan Rogerson

ISBN Number 83-919465-0-9

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright holder.

**The Mathematics Education into the
21st Century Project wishes to thank for
their support our Major Sponsors:**

CASIO[®]
EDUCATIONAL PROJECTS

Autograph



OXFORD
UNIVERSITY PRESS

SOUTHERN AFRICA

International Program Committee

Coordinators of the Mathematics Education into the 21st Century Project

Dr. Alan Rogerson, Mathematics in Society Project (UK/Poland).

Prof. Dr. Fayez Mina, Professor Emeritus, Ain Shams University (Egypt).

Prof. Dr. Ludwig Paditz, Dresden University of Applied Sciences (Germany).

Prof. Khaled Abuloum, University of Jordan (Jordan).

Prof. Roberto Baldino, UNESP (Brazil).

Dr. Andy Begg, Auckland University of Technology (New Zealand).

Dr. Donna F. Berlin, The Ohio State University (USA).

Prof. Dr. Werner Blum, University of Kassel (Germany).

Prof. Ubiratan D'Ambrosio, Campinas/UNICAMP (Brazil).

Prof. Bruno D'Amore, University of Bologna (Italy).

Prof. Dr. Tilak de Alwis, Southeastern Louisiana University (USA).

Prof. Dr. William Ebeid, Emeritus Professor, Ain Shams University (Egypt).

Prof. Paul Ernest, University of Exeter (UK).

Dr Hanan Innabi, UAE University (UAE).

Dr. Madeleine J. Long, Hunter College, City University of New York (USA).

Prof. Nicolina Malara, University of Modena (Italy).

Prof. Lionel Pereira Mendoza, Educational Consultant (Canada).

Prof. Dr. Ivan Mezník, Brno University of Technology (Czech Republic).

Prof. Dr. M. Ali M. Nassar, Institute of National Planning (Egypt).

Prof. Angela Pesci, University of Pavia (Italy).

Prof. Dr. David Pugalee, University of North Carolina at Charlotte (USA).

Prof. Medhat Rahim, Lakehead University, Faculty of Education (Canada).

Prof. Marc Schäfer, Rhodes University (South Africa).

Prof. Filippo Spagnolo, University of Palermo, Sicily (Italy).

Dr. Arthur L. White, The Ohio State University (USA).

Prof. Noor Azlan Ahmad Zanzali, Universiti Teknologi Malaysia (Malaysia).

Prof. Wacek Zawadowski, Siedlce University (Poland).

Local Organizing Committee

Chairman:

Prof. Marc Schäfer, Rhodes University, Grahamstown, South Africa.

Varonique Sias, Project Manager: FRF Mathematics Education Chair, Rhodes.

Carolyn Stevenson-Milln, Conference Manager, Rhodes University.

Prof Mellony Graven, FRF Numeracy Chair, Rhodes University.

Dr Bruce Brown, HOD, Education Dept Rhodes University.

Dr Rose Spanneberg, Director, Rhodes University Mathematics Education Project (RUMEP).

Dr Kenneth Ngcoza, Education Dept, Rhodes University.

Lise Westaway, Rhodes Education Dept.

Bruce Brown, HOD, Rhodes Education Dept.

Andrew Pinchuck, Rhodes Mathematics Dept.

Prof Werner Olivier, Nelson Mandela Metropolitan University.

Dr Tulsi Morar, Nelson Mandela Metropolitan University.

Foreword

This volume contains the papers presented at the International Conference on “Turning Dreams into Reality: Transformations and Paradigm Shifts in Mathematics Education” held from September 11-17, 2011 at Rhodes University, Grahamstown, South Africa. The Conference was organized jointly by Rhodes University and The Mathematics Education into the 21st Century Project - an international educational project founded in 1986. Our Project is dedicated to the improvement of mathematics education world-wide through the publication and dissemination of innovative ideas. Many prominent mathematics educators have supported and contributed to the project, including the late Hans Freudental, Andrejs Dunkels and Hilary Shuard, as well as Bruce Meserve and Marilyn Suydam, Alan Osborne and Margaret Kasten, Mogens Niss, Tibor Nemetz, Ubi D’Ambrosio, Brian Wilson, Tatsuro Miwa, Henry Pollack, Werner Blum, Roberto Baldino, Wacław Zawadowski, and many others throughout the world. Information on our project and its future work can be found on our Project home page <http://math.unipa.it/~grim/21project.htm> .

In this year, 2011, we celebrate the 25th anniversary of the founding of our Project, when Manmohan Singh Arora suggested the idea to Fayez Mina and myself around a swimming pool in Bahrain (of all places!) That first meeting was, however, typical of the multi-cultured and global character of our Project and it’s subsequent conferences throughout the world.

These Proceedings begin with the Plenary Papers and then the other contributions in alphabetical name order of the principal authors. We sincerely thank all of the contributors for their time and creative effort. It is clear from the variety and quality of the papers that the conference has attracted many innovative mathematics educators from around the world.

I wish to thank especially Ludwig Paditz and Douglas Butler for all their support and hard work in the preparation of these Proceedings.



Plenary Speeches

School-Mathematics all over the world – some differences

Ludwig Paditz

1

Mathematics online and mathematics mobile – where is all this going?

Douglas Butler

9

Presented Papers and Workshop Summaries

Setting mathematics laboratory in schools Adenegan, Kehinde Emmanuel	10
Technology: The bridge to facilitate learning of adult learners of mathematics LaVerne Alan	16
Using a values-based approach to promote self-efficacy in mathematics education Pam Austin & Paul Webb	22
Problem-centred teaching and modelling as bridges to the 21st century in primary school mathematics classrooms P. Biccard & D.C.J. Wessels	28
iMath - Reaching the i-generation in the mathematics classroom Norma J. Boakes & Katie Juliani	34
Physicists use mathematics to describe physical principles and mathematicians use physical phenomena to illustrate mathematical formula – Do they really mean the same? Ulrike Böhm, Gesche Pospiech, Hermann Körndle & Susanne Narciss	39
Moving from diagnosis to intervention in numeracy – turning mathematical dreams into reality George Booker	44
Professional learning communities and teacher change Karin Brodie	50
Numbers: a dream or reality? A return to objects in number learning Bruce J. L. Brown	56
Correlated science and mathematics: A new model of professional development for teachers Sandra T. Browning	62
Mathematical practices and the role of interactive dynamic technology Gail Burrill	68
Hands-on workshops Douglas Butler	74
Mathematics teachers' knowledge growth in a professional learning community Million Chauraya	75
Using online textbooks and homework systems: In particular MyMathLab and WebAssign Wil Clarke	81
Hearing the teacher's voice: teachers' views of their needs for professional development Els De Geest	87

Using a computer pen to investigate students’ use of metacognition during mathematical problem-solving	
Iris DeLoach Johnson & Nirmala Naresh	92
Conceptualization – a necessity for effective learning of mathematics at school	
Gawie du Toit	98
Meeting under the “Omei” tree in the Torres Strait Islands: Networks and funds of knowledge of mathematical Ideas	
Bronwyn Ewing	104
Problem solving: a psycho-pragmatic approach	
Paul Giannakopoulos & Sheryl B. Buckley	110
Reflecting problem orientation in mathematics education within teacher education	
Günter Graumann	116
A good instruction in mathematics education should be open but structured	
Olga Graumann	122
Do South African mathematics teachers need narrative therapy?	
Mellony Graven	127
Horizontal and vertical concept transitions	
May Hamdan	133
The importance of using representations to help primary pupils give meaning to numerical concepts.	
Tony Harries, David Bolden & Patrick Barnby	137
“Shuffle and Shake” and “Pay as you go” - The VG grade 8 experiment	
Ms Nicci Hayes (Sarah Abel, Susan Richards & Soosan Babu)	142
Left to their own devices: Student-led inquiry into mathematical ideas in kindergarten	
Marjorie Henningsen	148
Adjusting the mathematics curriculum into the 21st century. Classroom examples	
Hoffmann R. & Klein R	151
Intervening for success	
Marilyn Holmes & Viv Thompson	157
What can be learned from comparing performance of mathematical knowledge for teaching items found in Norway and in the U.S.?	
Arne Jakobsen, Janne Fauskanger, Reidar Mosvold, & Raymond Bjuland	163
A comprehensive model for examining pre-service teachers’ knowledge of technology tools for mathematical learning: The T-MATH framework	
Christopher J. Johnston & Patricia Moyer-Packenham	169

Using large-scale datasets to teach abstract statistical concepts: Sampling distribution	
Gibbs Y. Kanyongo	175
Transforming instruction and assessment using student-created video	
Virginia (Ginny) Keen	180
A case study of a teacher professional development programme for rural teachers	
Herbert Khuzwayo, S Bansilal, Angela James, Dr Lyn Webb & Ms Busisiwe Goba	181
Mathematics through language	
Allen Lambert	187
An action research study of the growth and development of teacher proficiency in mathematics in the intermediate phase – an enactivist perspective. Work-in-progress	
Mandy Lee & M. Schäfer	189
Mathematical competence assessment of large groups of students in a distance education system	
Genoveva Leví & Eduardo Ramos	193
The Influence of geographical, social and cultural factors in the mathematical competence level	
Genoveva Leví & Eduardo Ramos	199
Phantom graphs	
Philip Lloyd	205
Workshop: Error analysis of mathematics test items	
Rencia Lourens; Nico Molefe & Karin Brodie	213
Isomorphic visualization and understanding of the commutativity of multiplication: from multiplication of whole numbers to multiplication of fractions	
George Malaty	217
Assessing the teaching efficacy beliefs of teacher trainees	
Sheila N Matoti & Karen E Junqueira	223
On economic interpretation of Lagrange multipliers	
Ivan Mezník	229
Dreams, paradigm shifts and reforms in mathematics education: classification and plan of action	
Fayez M. Mina	232
An initial examination of effect sizes for virtual manipulatives and other instructional treatments	
Patricia S. Moyer-Packenham & Arla Westenskow	236

New and emerging applications of tablet computers such as iPad in mathematics and science education.	
Mehryar Nooriafshar	242
Science, Technology, Engineering, and Mathematics (STEM) Development: Pathways for universities to promote success	
Eric D. Packenham	248
The basics of set theory – some new possibilities with ClassPad	
Ludwig Paditz	254
Challenges and possibilities in emergency education: Insights for mathematics teaching and learning at a Johannesburg refugee school.	
Pausigere, Peter	261
Mathematics connections to current events	
Esther M. Pearson	267
Exploring the challenges of teachers’ and learners’ understanding of solution strategies using whole numbers	
Tom Penlington	270
Stepping into statistics: Providing a head start for students	
Anne Porter & Norhayati Baharun	276
Transforming mathematical tastes: a twist of lemon – or a pretzel?	
Shirley Porter	282
Tangram-base problem solving in radical constructivist paradigm: high school student-teachers conjectures	
Medhat H. Rahim, Radcliffe Sidlo & Moushira Issa	287
VITALmaths – Transforming learning experiences through mathematical video clips	
Duncan Samson, Helmut Linneweber-Lammerskitten & Marc Schäfer	293
Figural pattern generalisation – the role of rhythm	
Duncan Samson & Marc Schäfer	298
Probability in Mathematics: Facing Probability in Everyday Life	
Malka Sheffet & Bassan-Cincinatus Ronit	304
Teaching derivations of area and measurement concepts of the circle: A conceptual-based learning approach through dissection motion operations	
Tracy Shields & Medhat H. Rahim	310
Creating desirable difficulties to enhance mathematics learning	
William R. Speer	316
Why don’t we make it our business to teach Business statistics well? Some parlous practices and some recommended remedies.	
Bruce Stephens	322
Using technology to assist Mathematical Literacy learners understand the implications of various scenarios of loan circumstances when buying a house.	
Joyce Stewart	326

Developing Skills for Successful Learning Liz Swersky	328
Teaching mathematical modelling to tomorrow's mathematicians or, You too can make a million dollars predicting football results. Kerry J Thomas	334
Teaching and learning high school mathematics through an interdisciplinary approach Ariana-Stanca Văcărețu	340
A new elementary mathematics curriculum: Practice, learning and assessment - Some classroom episodes Isabel Vale & António Borralho	346
Mathematical modelling in classroom: The importance of validation of the constructed model Michael Gr. Voskoglou	352
An Investigation into the design of advanced certificates in education on mathematical literacy teachers in KwaZulu-Natal Lyn Webb, Sarah Bansilal, Angela James, Herbert Khuzwayo & Busisiwe Goba	358
Using a modelling task to elicit reasoning about data Helena Wessels	364
Comparing the use of virtual manipulatives and physical manipulatives in equivalent fraction intervention instruction Arla Westenskow	370
Workshop title: A new rational approach to the teaching of trigonometry in schools and colleges N J Wildberger	376
Comprehensive indicators of mathematics understanding among secondary school students. Noor Azlan Ahmad Zanzali, Abdul Halim Abdullah, Norulhuda Ismail, Aziz Nordin & Johari Surif	377
The use of graphic organizers to improve student and teachers' problem-solving skills and abilities Alan Zollman	381