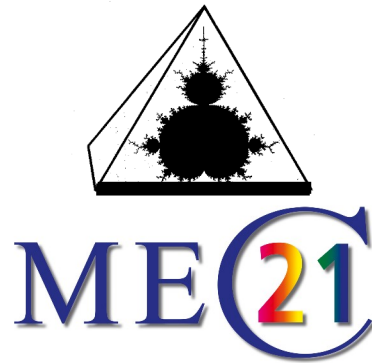


# **The Mathematics Education into the 21<sup>st</sup> Century Project**



**Rhodes University, Grahamstown**



**RHODES UNIVERSITY**  
*Where leaders learn*

**Proceedings of the 11<sup>th</sup> International  
Conference**

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

**September 11-17, 2011**

**Editor: Alan Rogerson**



**11<sup>th</sup> International Conference of the Mathematics Education  
into the 21st Century Project**

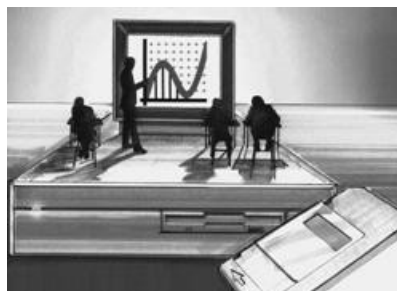
*Turning Dreams into Reality: Transformations and Paradigm Shifts in Mathematics Education*  
Sep 11-17, 2011, Rhodes University, Grahamstown, South Africa



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

**CASIO**<sup>®</sup>  
EDUCATIONAL PROJECTS

**Autograph**



# OXFORD

## UNIVERSITY PRESS

---

### SOUTHERN AFRICA

ISBN Number 83-919465-9-2

**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.**

## **International Program Committee**

### **Coordinators of the Mathematics Education into the 21<sup>st</sup> 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).  
Prof. Dr. Alicia Villar Icasuriaga, IPA, Montevideo (Uruguay).  
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 University

Carolyn Stevenson-Milln, Conference Manager, Rhodes University

Prof Mellony Graven (FRF Numeracy Chair, Rhodes University) 2011: [m.graven@ru.ac.za](mailto:m.graven@ru.ac.za)

currently: [M.Graven@sacschool.com](mailto:M.Graven@sacschool.com)

Dr Bruce Brown (HOD, Education Dept Rhodes University) [b.brown@ru.ac.za](mailto:b.brown@ru.ac.za)

Dr Rose Spanneberg (Director, Rhodes University Mathematics Education Project (RUMEP) ) [r.spanneberg@ru.ac.za](mailto:r.spanneberg@ru.ac.za)

Dr Kenneth Ngcoza (Education Dept, Rhodes University) [k.ngcoza@ru.ac.za](mailto:k.ngcoza@ru.ac.za)

Lise Westaway, Rhodes Education Dept [l.westaway@ru.ac.za](mailto:l.westaway@ru.ac.za)

Bruce Brown, HOD, Rhodes Education Dept [b.brown@ru.ac.za](mailto:b.brown@ru.ac.za)

Andrew Pinchuck, Rhodes Mathematics Dept [a.pinchuck@ru.ac.za](mailto:a.pinchuck@ru.ac.za)

Prof Werner Olivier, Nelson Mandela Metropolitan University [waolivier@nmmu.ac.za](mailto:waolivier@nmmu.ac.za)

Dr Tulsi Morar, Nelson Mandela Metropolitan University [tulsi.morar@nmmu.ac.za](mailto:tulsi.morar@nmmu.ac.za)

## 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 - a non-commercial international educational project founded in 1986. The Mathematics Education into the 21st Century 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, Waclaw 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>

These Proceedings begin with the Plenary Papers and then the contributions of the Principal Authors in alphabetical name order. 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. These Proceedings will therefore be useful in reviewing past work and looking ahead to the future.

We wish to thank especially Fayeza Mina, Ludwig Paditz and Marc Schäfer for all their support and hard work without which this conference, and these Proceedings, would not have been possible.



### **Plenary Address**

**School-Mathematics all over the World – some Differences**

Ludwig Paditz

### **Plenary Address**

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

Douglas Butler

## **Presented Papers and Workshop Summaries**

**Setting Mathematics Laboratory in Schools**

Adenegan, Kehinde Emmanuel

**Technology: The Bridge to Facilitate Learning of Adult Learners of Mathematics**

LaVerne Alan

**Using A Values-Based Approach To Promote Self-Efficacy In Mathematics Education**

Pam Austin & Paul Webb

**The evaluation system in the Algerian university. The teacher gave me a C**

Nadia Azrou

**Problem-centred teaching and modelling as bridges to the 21st century in primary school mathematics classrooms**

P. Biccard & D.C.J. Wessels

**iMath- Reaching the iGeneration in the Mathematics Classroom**

Norma J. Boakes & Katie Juliani

**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

**Moving from Diagnosis to Intervention in Numeracy – turning mathematical dreams into reality**

George Booker

**Professional Learning Communities and Teacher Change**

Karin Brodie

**Numbers: a dream or reality? A return to objects in number learning**

Bruce J. L. Brown

**Correlated Science And Mathematics: A New Model Of Professional Development For Teachers**

Sandra T. Browning

**Mathematical Practices and the Role of Interactive Dynamic Technology**

Gail Burrill

**Hands-On Workshops**

Douglas Butler

**Mathematics Teachers' Knowledge Growth in a Professional Learning Community**

Million Chauraya

**Using Online Textbooks and Homework Systems: In Particular MyMathLab and WebAssign**

Wil Clarke

**Hearing the teacher voice: teachers' views of their needs for professional development**

Els De Geest

**Using A Computer Pen to Investigate Students' Use of Metacognition during Mathematical Problem-Solving**

Iris DeLoach Johnson & Nirmala Naresh

**Conceptualization – a necessity for effective learning of mathematics at school**

Gawie du Toit

**Meeting under the “Omei” Tree in the Torres Strait Islands: Networks and Funds of Knowledge of Mathematical Ideas**

Bronwyn Ewing

**Problem solving: A psycho-pragmatic approach**

Paul Giannakopoulos & Sheryl B. Buckley

**Reflecting Problem Orientation in Mathematics Education within Teacher Education**

Günter Graumann

**A Good Instruction in Mathematics Education should be Open but Structured**

Olga Graumann

**Do South African Mathematics teachers need narrative therapy?**

Mellony Graven

**Horizontal and Vertical Concept Transitions**

May Hamdan

**The importance of using representations to help primary pupils give meaning to numerical concepts.**

Tony Harries, David Bolden & Patrick Barmby

**“Shuffle and Shake” and “Pay as you go” - The VG grade 8 experiment**

Ms Nicci Hayes (team including Sarah Abel, Susan Richards & Soosan Babu)

**Left to their own devices: Student-led inquiry into mathematical ideas in kindergarten**

Marjorie Henningsen

**Adjusting the Mathematics Curriculum Into the 21st Century. Classroom Examples**

Hoffmann R. & Klein R

**Intervening for Success**

Marilyn Holmes & Viv Thompson

**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

**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

**Using Large-Scale Datasets to Teach Abstract Statistical Concepts: Sampling Distribution**

Gibbs Y. Kanyongo

**Transforming Instruction and Assessment Using Student-created Video**

Virginia (Ginny) Keen

**A case study of a teacher professional development programme for rural teachers**

Herbert Khuzwayo, S Bansilal, Angela James, Dr Lyn Webb & Ms Busisiwe Goba

**Mathematics through Language**

Allen Lambert

**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

**Mathematical Competence Assessment of Large Groups of Students in a Distance Education System**

Genoveva Leví & Eduardo Ramos

**The Influence of Geographical, Social and Cultural Factors in the Mathematical Competence Level**

Genoveva Leví & Eduardo Ramos

**Phantom Graphs**

Philip Lloyd

**One Little Step to Improving Mathematics in Urban Settings**

Madeleine J. Long

**Workshop: Error Analysis of Mathematics Test Items**

Rencia Lourens; Nico Molefe & Karin Brodie

**Isomorphic Visualization and Understanding of the Commutativity of Multiplication: from multiplication of whole numbers to multiplication of fractions**

George Malaty

**Assessing the teaching efficacy beliefs of teacher trainees**

Sheila N Matoti & Karen E Junqueira

**On Economic Interpretation of Lagrange Multipliers**

Ivan Mezník

**Dreams, Paradigm Shifts and Reforms in Mathematics Education: Classification and Plan of Action**

Fayez M. Mina

**An Initial Examination of Effect Sizes for Virtual Manipulatives and Other Instructional Treatments**

Patricia S. Moyer-Packenham & Arla Westenskow

**New and Emerging Applications of Tablet Computers such as iPad in Mathematics and Science Education.**

Mehryar Nooriafshar

**Science, Technology, Engineering, and Mathematics (STEM) Development: Pathways for Universities to Promote Success**



Eric D. Packenham

**The basics of set theory – some new possibilities with ClassPad**

Ludwig Paditz,

**Challenges and Possibilities in Emergency Education: Insights for Maths Teaching and Learning at a Johannesburg Refugee School.**

Pausigere, Peter

**Mathematics Connections to Current Events**

Esther M. Pearson

**Exploring the challenges of teachers' and learners' understanding of solution strategies using whole numbers**

Tom Penlington

**Stepping into Statistics: Providing a Head Start for students**

Anne Porter & Norhayati Baharun

**Transforming Mathematical Tastes: a Twist of Lemon – or a Pretzel?**

Shirley Porter

**Tangram-base Problem Solving in Radical Constructivist Paradigm: High School Student-Teachers Conjectures**

Medhat H. Rahim, Radcliffe Siddo & Moushira Issa

**VITALmaths – Transforming learning experiences through mathematical video clips**

Duncan Samson, Helmut Linneweber-Lammerskitten & Marc Schäfer

**Figural pattern generalisation – the role of rhythm**

Duncan Samson & Marc Schäfer

**Probability in Mathematics: Facing Probability in Everyday Life**

Sheffet Malka & Bassan-Cincinatus Ronit

**Teaching Derivations of Area and Measurement Concepts of the Circle: A Conceptual-Based Learning Approach through Dissection Motion Operations**

Tracy Shields & Medhat H. Rahim

**Creating Desirable Difficulties to Enhance Mathematics Learning**

William R. Speer

**Why don't we make it our business to teach Business Statistics well? Some parlous practices and some recommended remedies.**

Bruce Stephens

**Using technology to assist Mathematical Literacy learners understand the implications of various scenarios of loan circumstances when buying a house.**

Joyce Stewart

**Developing Skills for Successful Learning**

Liz Swersky

**Teaching Mathematical Modelling to Tomorrow's Mathematicians or,  
You too can make a million dollars predicting football results.**

Kerry J Thomas

**Teaching and learning high school mathematics through an interdisciplinary  
approach**

Ariana-Stanca Văcărețu

**A New Elementary Mathematics Curriculum: Practice, Learning and  
Assessment Some Classroom Episodes**

Isabel Vale & António Borralho,

**Mathematical modelling in classroom: The importance of validation of the  
constructed model**

Michael Gr. Voskoglou

**An Investigation into the design of Advanced Certificates in Education on  
Mathematical Literacy teachers in KwaZuluNatal**

Lyn Webb, Sarah Bansilal, Angela James, Herbert Khuzwayo & Busisiwe  
Goba

**Using a Modelling Task to Elicit Reasoning about Data**

Helena Wessels

**Comparing the Use of Virtual Manipulatives and Physical Manipulatives in  
Equivalent Fraction Intervention Instruction**

Arla Westenskow

**Workshop title: A new rational approach to the teaching of trigonometry in  
schools and colleges**

N J Wildberger

**Comprehensive indicators of mathematics understanding among secondary  
school students.**

Noor Azlan Ahmad Zanzali, Abdul Halim Abdullah, Norulhuda Ismail, Aziz  
Nordin & Johari Surif

**The Use of Graphic Organizers to Improve Student and Teachers Problem-  
Solving Skills and Abilities**

Alan Zollman