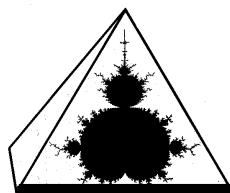


The Mathematics Education for the Future Project

Proceedings of the 12th International Conference



The Future of Mathematics Education in a Connected World

September 21–26, 2014
Hunguest Hotel Sun Resort, Herceg Novi, Montenegro

Edited by Alan Rogerson

The Mathematics Education for the Future Project thanks our Major Sponsor

Autograph



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Foreword

This volume contains the papers presented at the International Conference on *The Future of Mathematics Education in a Connected World* held from September 21-26, 2014. The Conference was organized by The Mathematics Education for the Future 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, Waclaw Zawadowski, and many others throughout the world.

Information about our project and future work can be found on the following webpages. Our Project Home Page: <http://math.unipa.it/~grim/21project.htm> leads directly to the paper proceedings of all previous conferences. [ProceedingsSouthAfrica](#) gives the proceedings of the South Africa conference 2011. Andreas Filler at <http://www.afiller.de/charlotte07> has a photo album of our Charlotte Conference. For our Polish Superkurs Home Page and National Planning Meetings webpage see: www.cdnalma.poznan.pl (in Polish - but with pictures!)

These Proceedings begin with the Plenary Paper by Douglas Butler (Autograph) followed by a list of titles, a list of abstracts, and then the full text of the papers/workshops themselves, all three lists are 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 Jasia Morska and Douglas Butler for all their support and hard work in the preparation of these Proceedings..

A handwritten signature in black ink that reads "Alan Rogerson". The signature is written in a cursive style with a long horizontal flourish underneath.

Dr. Alan Rogerson
D.Phil (Oxon), M.Sc., B.Sc., B.A. (Lon), Dip.Ed., Cert. Ed. (Cantab).
Chairman of the International Program Committee
Co-ordinator of the Mathematics Education for the Future Project

Plenary Keynote Address: Technology must be transparent and not get in the way of teaching and learning

Douglas Butler, iCT Training Centre, Oundle, UK

Software and hardware solutions for mathematics teaching are evolving all the time, leaving many teachers bewildered by the ever increasing kaleidoscope of possibilities. Douglas will attempt to bring this audience up to date with some exciting lesson plans drawing on a new generation of hardware independent resources, the emphasis always being to let the mathematics shine through.

Papers and Workshops

Teaching Students to prove by using Online Homework

Buma Abramovitz, Miryam Berezina & Abraham Berman

Mathematics, the first step in the evolution of understanding Physics: A preliminary investigation

Nadine Adams & Clinton Hayes

Evolving formative assessment for and with ubiquitous technologies

Nadine Adams & Anne Porter

Early Child Numeracy (ECN)

ADENEGAN, K. E., AKINREMI, O. V & AKINROTIMI, A. A.

From notable occurrences to situated abstractions: a window for analysing learners' thinking-in-change in a microworld

Anna Baccaglini-Frank, Celia Hoyles & Richard Noss

Sex, Religion and Statistics

Mike Bedwell

Paradox in the Teaching of Mathematics

Larry G. Blaine

Developing algebraic thinking: providing new tools to understand mathematical relationships (Workshop)

George Booker

Gatekeeping in Mathematics (Workshop)

Marcia M. Burrell

Fractions, Ratios and Interactive Dynamic Technology

Gail Burrill

Interactive Dynamic Technology: Teaching and Learning Statistics

Gail Burrill

Autograph Workshops: TSM Resources, Autograph for ages 11-16, Autograph for ages 16-19

Douglas Butler

An Intervention Strategy to Promote Intrinsic Motivation in Students Studying Mathematics for Diplomas in Engineering and Analytical Chemistry

J. Coetzee, E. Oberholster & M. Mbebe

Modelling with Algebra Tiles and Areas in Completing the Square of a Quadratic

Ysbrand de Bruyn & Gila Hanna

A PEDAGOGY OF “TEACHING THE TEST”

Du Toit Erna & Du Toit Jacqueline

Reliability versus Reality

Du Toit Gawie & Du Toit Jacqueline

The idea of using analogies

Wolfram Eid

Interdisciplinary Courses: a Personal Experience, Math, Art, Architecture

Michele Emmer

Math Festivals in the Classroom! Experience-centered Education of Mathematics through Arts and Technology

Kristof Fenyvesi

From 2d to 3d geometry: discovering, conjecturing, proving

Daniela Ferrarello, Maria Flavia Mammana & Mario Pennisi

Investigating the Learning of Spatial Visualization with Physical and Virtual Manipulatives

Beverly J. Ferrucci

Using Partnership to Grow Elementary Teachers' Content Knowledge Through Inquiry-Based, Collaborative, Mathematical Reasoning Workshops

Doug Franks & Timothy Sibbald

The influence of using concrete models on solving combinatorial problems of 5th grade students.

Avikam Gazit & Nitza Chay

Incorporating research projects in the initial training programmes of Mathematic teachers: A South African case study

Johanna L Geldenhuys

EFFECTS OF MATHEMATICAL MODELING INTERVENTION PROGRAM ON CREATIVE THINKING ABILITIES

Talya Gilat & Miriam Amit

Calendars in different cultures and its importance for school in a connected world

Günter Graumann

What Characterises Mathematics in the Nordic countries?

Liv Sissel Grønmo

Mathematical Modeling in the Teaching of Game Theory

Ein-Ya Gura,

Taming Abstraction through Classification

May Hamdan

Engaging Mathematics Students in an Introductory College Mathematics Course

Heidi B. Hansen & Todd Frauenholtz

**The symbiotic existence of mathematics and mathematics education research:
An example involving sibling curves**

Ansie Harding

Building Self-Efficacy for Self-Efficacy Builders: (Workshop)

Gary Harris & Tara Stevens

**Mathematical Reality and Modelling – new problems for mathematical classes
and teaching mathematics in the secondary school**

Herbert Henning

**What would you like to assess with this task? Matching mathematical tasks and
teaching objectives.**

Hodaya (Liora) Hoch & Miriam Amit

**Teaching Mathematics in a Different Connected World of the 21st Century:
Computer Simulations in Mathematics Education**

Ronit Hoffmann & Ronith Klein

**Using photo-elicitation to investigate student accounts of mathematical reasoning
during whole class mathematical discussions**

Jodie Hunter

**Teacher actions to facilitate productive mathematical discourse with diverse
learners (Workshop)**

Roberta Hunter

Realistic Mathematics Education in Solving Low Carbon Society Problems

Zaleha binti Ismaila, Kavitha a/p Dayalanb , Hamidreza Kashefic & Shiau
Wei Chand

**Creativity Fostering Behavior of Mathematics Teachers through the
Implementation of School Based Assessment**

Zaleha Ismail, Yudariah Mohammad Yusof & Helen Pappu

Intimations of class in responses to innovative mathematics pedagogy in initial teacher education

Colin Jackson & Hilary Povey

Developing an Understanding of Horizon Content Knowledge: Experiences from a Practice-based Approach in Norway

Arne Jakobsen

Comparative study on structural organisation of Mathematics Continuous Professional Development (MCPD) in selected Sub-Saharan countries

Zingiswa Mybert Monica Jojo

Pre-service teachers' perceptions of a Mathematics specialist teacher's role in grades 6-8 classrooms

Karen Junqueira & Kathleen T. Nolan

Some trends in mathematics professional development in selected developing and developed countries: an insight into post-apartheid South Africa

Luckson M. Kaino, Mapula G Ngoepe, Moshe M Phoshoko, Zingi MM Jojo, Joseph Dhlamini & Ronél Paulsen

The important teaching material for mathematics teacher remedial education

Toshimitsu Karasawa

Teaching Experiments: A Vehicle for Practice-based Professional Development

Lisa Kasmer & Esther Billings

The Measurement Properties of the APLUS Assessment of Kindergarten Mathematics Skills

Richard G. Lambert, Chuang Wang, Christie Martin & David K. Pugalee

COMPONENTS OF MATHEMATICAL COMPETENCE IN MATH GRADE OF SPANISH UNIVERSITIES

Genoveva Leví , Eduardo Ramos & José Antonio Carrillo

LATENT FACTORS IN THE FORMATION AND DEVELOPMENT OF MATHEMATICAL COMPETENCE

Genoveva Leví , Eduardo Ramos & José Antonio Carrillo

Conceptual Understanding and Computational Fluency

Cheryl A. Lubinski, JoAnn Cady & Albert D. Otto

Generalization questions at early stages: the importance of the theory of mathematics education for teachers and pupils (Workshop)

Nicolina A. Malara & Giancarlo Navarra

USING HISTORY IN TEACHING

Pieter Maritz

TEACHER INSTRUCTION INFORMED BY STUDENTS' MATHEMATICAL WRITING

Christie Martin, Drew Polly, Chuang Wang & Richard Lambert

40 years after the New Math movement of school mathematics - what we should learn from the failure

Soshi Matsunami & Ryosuke Nagaoka

Suggested Future Policies for Teaching and Learning Mathematics In Elementary Grades

Fayez M. Mina

OBTAINING INEQUALITIES FROM PROBABILITY

Laurentiu Modan

The Effects of Different Virtual Manipulatives for Second Graders' Mathematics Learning in the Touch-Screen Environment

Patricia S. Moyer-Packenham, Arla Westenskow, Jessica F. Shumway, Emma Bullock, Stephen I. Tucker, Katie L. Anderson-Pence, Jennifer Boyer-Thurgood, Cathy Maahs-Fladung, Juergen Symanzik, Salif Mahamane, Beth MacDonald, & Kerry Jordan

A Critical Review of Research in Self-Efficacy in Mathematics Education

Priscilla Murphy, Leigh Wood & Leanne Carter

PROBLEM-BASED LEARNING IN SCHOOLS

Najihah binti Mustaffa & Zaleha binti Ismail

On mathematics teaching in Finland

Marjatta Näätänen & Liisa Näveri

How Do We Plant Seeds of Algebra in the Elementary Grades?

Monica Neagoy

The voice of the teachers about Mathematics Continuous Professional Development

Mapula G Ngoepe

History of Mathematics and Mathematics Education - A reflective study on the possibility of History of mathematics to be implemented as teaching material in upper secondary level

Sho Niitsuma & Ryosuke Nagaoka

Studying the intersections of real, virtual and 'best practices' in becoming a mathematics teacher through professional learning communities

Kathleen T. Nolan

The Applications of Augmented Reality Technologies in Mathematics Education

Mehryar Nooriafshar & Darius Nooriafshar

The Relationship Between Learning Styles and Achievement in Linear Algebra Course

Nevin Orhun

WORDS OR CONCEPTS? STUDENTS' UNDERSTANDING OF 'RIGHT ANGLE'

NICK VINCENT OTUMA

Providing Student Support for Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP)

Eric Packenham

Peer Interaction for Improving High Students' Argumentation Ability in Mathematics Problem Solving: Results from a Study

Angela Pesci

Evolution From e-learning materials to the i-Textbooks in Slovenia

Igor Pesek, Blaž Zmazek, Darko Drakulič & Eva Zmazek

Mathematics in a Connected World

Anne Porter

Transformative learning through educative assessment: one student's experience of a learning journal

Hilary Povey

Who Owns the Learning, and can the Learner be the teacher?

Dena Reddan

Connecting through mathematics: on non-specialists' mathematics teacher identity

Melissa Rodd & Cosette Crisan

Formative Mathematics Assessment: Supporting Learning and Understanding for Teachers and Students

Angelique Seifert, David K. Pugalee, Chuang Wang, Richard Lambert & Christie Martin

Educational Drama (EduRama): An innovative Pedagogical Model for Enhancing Learners' Interest in Mathematics

Nalin Sharda

Teaching Area and Measurement Property Concepts into the Future: Empowering through acknowledging traditional Indigenous interrelationship ideologies.

Tracy J. Shields

Formation Research Competences of Future Teachers of Mathematics Using Technology of Portfolio and Virtual environment Moodle

Skornyakova Anna

Aiding Transition from Secondary School to Entry-level College Mathematics

William R. Speer

Preliminaries for a first year course on Modelling

Kerri Spooner

Whole-class discussion in the mathematics classroom: Analyzing a multimedia case in teacher education

Rosa Tomás Ferreira, Hélia Oliveira & Márcia Cyrino

Preparing Teachers for Common Core State Standards-Based Instruction of Mathematics in California

Agnes Tuska & Rajee Amarasinghe

Using the TIMSS results for improving mathematics learning

Ariana-Stanca Văcărețu

CREATIVITY THROUGH CHALLENGING LEARNING TASKS

Isabel Vale & Ana Barbosa

Investigating the behaviour of the FGH predator-prey model using technology

Quay van der Hoff, Johanna C. Greeff & Temple H. Fay

Problem Solving as a Tool for Learning Mathematics (Workshop)

Natalya Vinogradova

Teacher Use of Formative Assessment and its Relationship to Primary Students' Mathematical Skills

Chuang Wang, Christie Martin, Richard G. Lambert & David K. Pugalee

Cute Drawings? What Students' Fractional Representations Reveal About Their Whole Number Bias

Arla Westenskow, Patricia S. Moyer-Packenham, Katie L. Anderson-Pence, Jessica F. Shumway & Kerry Jordan

Using Blended Learning for the teaching of High School Mathematics.

Bruce White, Alan Barnes & Mike Lawson

TRANSCENDING MATHEMATICAL BOUNDARIES: THE CASE OF CRYPTOLOGY

Kalvin Whittles

Using Problem Solving to Transform Students' Algebraic Thinking

Will Windsor & George Booker

University Students' Limited Knowledge of Limits – from Calculus through Differential Equations

Alan Zollman