

ABSTRACTS OF SHORT COMMUNICATIONS

Realistic contexts as critical sites for problem solving

Karoline Afamasaga-Fuata'i
National University of Samoa

The paper discusses one of three case studies to investigate students' conceptualisations of quadratics by solving quadratic contextual problems. The theoretical framework which guided the study was constructivism. The methodology was teaching interviews between a researcher and student solving problems. A multi-representational software FUNCTION PROBE was available as a tool to aid students in their problem solving. The results showed that using realistic situations as problem contexts invited a multiplicity of interpretations and methods for defining quadratic functional relationships. By reasoning empirically from the context of the problem, the student conceptualised quadratic relationships iteratively and in terms of summation in contrast to the most common view of quadratics as a product of two linear variations. Further, requiring students to verify and justify their strategies by cross-referencing between multiple representations of functional relationships and problem context led them to construct viable schemes to characterise quadratics in terms of rate of change, dimensionality, and symmetry. This paper describes the case study of a student who generated difference equations as a means of predicting maximum values of quadratics mainly as a result of her struggles to reconcile her conjectures and errors in her numerical values. Her subsequent resolution of errors motivated her to pursue an alternate approach to the problem which led her to derive a more elegant form of her quadratic function in contrast to her initial summative expression.

Teachers' views of collaborative learning in secondary classrooms

Mary Barnes
University of Melbourne

A survey was conducted of teachers who make use of collaborative learning approaches in teaching secondary mathematics. Collaborative learning is taken to mean forms of classroom organisation in which students work together in small groups, on shared tasks and with common goals. No particular organisational or assessment structure is implied. The questionnaire aimed to discover how teachers implement collaborative learning in mathematics, some of their reasons for using it (or not using it) at different levels, and their impressions of how students respond to learning in this way. This paper reports the results of the survey.

Grounding knowledge and skills with understanding and meaning in mathematics education: A preliminary report

Stephen (Sen) Campbell
University of California, Irvine

This short communication offers a preliminary report on one component of a National Science Foundation Reform Initiative for Undergraduate Education in Science, Mathematics, Engineering, and Technology at the University of California, Irvine. This component involves the development of a new course in mathematics education for prospective teachers, with the intent of grounding mathematical knowledge and skills with understanding and meaning. The report focuses upon the theories and methods used in researching the design, implementation, and evaluation of this course.

Record keeping by teachers of mathematics: A search for meaningful and manageable purposes and practices in assessment

Barbara Clarke
Monash University

Doug Clarke
Australian Catholic University

Donna Gronn
Australian Catholic University

Multiple modes of assessment provide rich information about student learning and “capturing” a range of performances. However, the challenges of meaningful and manageable record keeping are considerable, and the research and professional literatures provide little support. This project is using questionnaires, semi-structured interviews, collections of relevant documents, and the advice of an expert panel of teachers to document a range of promising models of record keeping currently in use in schools, with a view to identifying and sharing exemplary practice.

Evaluation of the mathematics node of NSW HSC On-Line (A report of the first six months)

Bob Dengate
School of Teacher Education, Charles Sturt University, Bathurst

The NSW On-Line Project was initiated by Charles Sturt University (CSU) in 1996 as a resource for senior school students, teachers and relevant community and professional bodies. It was developed as a joint venture with the NSW Department of Education and Training (DET); the partners were successful in winning an Access Australia CMC Research Seeding Grant to evaluate the development of the website and provide recommendations for further development. Central themes emergent from the evaluation included general satisfaction with the site’s appearance and structure, excitement and enthusiasm about its potential as an educational resource and the need for future promotion of the site. An outcome of the research was the need to further explore appropriate online pedagogies and to determine models to train and develop teachers in the effective use of the medium compared with traditional techniques. Research recommendations regarding strategic planning, technical development and implications for best teaching practice need now to be contextualised so that, for example, implications for Mathematics Education can emerge. The author, who coordinates the Mathematics Node of the site, seeks ongoing feedback and advice regarding publication, structure, pedagogical design and strategic research planning for the site’s Mathematics Node, in particular, and for the Project generally.

A mathematical inquest: Explaining a negative outcome of instruction

Carmel Diezmann
Queensland University of Technology

After instruction in the strategy draw a diagram, there was a decline in the number of Year 5 students who were successful on a deductive reasoning task. Although this result suggested that the intervention adversely affected students' performances, an investigation revealed that most students benefited from the intervention by developing some understanding of diagram use in problem solving. The anomalous result is explained by spontaneous change in students' strategies and their differing proficiency in the use of a diagram.

Challenges facing tertiary mathematics: Lecturer's views

Helen Forgasz
La Trobe University

Downsizing in the tertiary sector, the apparent lack of appeal of careers in mathematics and recent patterns of declining enrolments in majors and postgraduate degrees have placed tertiary mathematics departments under increasing pressure. In this paper, the views of six mathematics lecturers who spoke frankly about the roles of their departments and the challenges ahead are presented. Concerns for the discipline of mathematics and for students were evident. Despite a climate in which budgetary constraints dominate over teaching and learning considerations, there was some optimism for the future.

An investigation into the use of active reading skills in individualised mathematics diagnostics and their impact on mathematics education

Freda Goodall
Victoria University of Wellington

In testing the diagnostics with students from seven to fourteen years it was found that the majority exhibited difficulties in three aspects of reading: reading accurately, recall, and application of content. Questions beginning with : who, what, when, where, why, how, were constructed for use in the diagnostic. The experiment indicated that the mathematics results of the students in the experimental classes improved when compared with those not receiving assistance in reading.

The importance of validity in test construction

Freda Goodall
Victoria University of Wellington

This paper examines the validity of the diagnostics (tests) for the purposes they are designed for, which are to allow the teacher to understand the levels of learning a child or student has reached in mathematics education, at a particular point in time. To prove the validity of the diagnostics, the work of Crooks et al. (1995) will be used to illustrate that the tests perform the functions for which they are designed.

What are approaches to learning statistics?

Sue Gordon
Mathematics Learning Centre, The University of Sydney

In this presentation I discuss my development of a questionnaire — the Approaches to Learning Statistics Questionnaire. I argue that while surface approaches are often equated with rote learning, this is not what characterises these approaches. Instead, it is the learner's intention that is important. I discuss facets of deep approaches to learning statistics emerging from my questionnaire. My data support a systemic view of teaching and learning in context. They raise issues concerning the support of statistics education at university.

Learning about probability in a constructivist classroom

Chris Linsell
Dunedin College of Education

When students engage in rich mathematical activities our intention is that they should construct their own mathematical knowledge consistent with the achievement objectives of the lesson. Four Year 9 students were videorecorded during lessons on probability. The videorecordings were then used to conduct stimulated recall interviews with each student. Preliminary analysis of the data shows a wide range of achievement, with even the most able students finding some concepts difficult to grasp.

Teaching area in Year 1 and Year 2 classrooms

Diane McPhail
University of Western Sydney, Macarthur

This paper will give a progress report on the first part of a project which aims to improve student learning outcomes in the Area strand of primary school mathematics, through enhanced teacher awareness and an understanding of how students may be assisted to develop Area concepts. This initial project will trial a sequence of four lessons in each of four classrooms, focusing on recognising and calculating repeated units (squares and triangles) within a grid pattern. Evidence of student learning will be documented through observations of activities, collection of work samples, videotaped interviews with students and audio taped interviews with class teachers.

**Changing practice towards improving learning in mathematics:
A teacher's story**

Lyn Nothdurft

This paper discusses an action research study focused on approaches to improve learning with a class of Queensland Year 12 Mathematics B students. There is evidence that, for many of these students, the experience of school mathematics involves following rules without understanding and/or enjoyment. In this study the students are being encouraged to actively seek deep understanding and take control of their own learning. The teaching strategies emphasise making sense of the mathematics, collaborative group work with a problem-solving approach, and student reflection on learning. Current indications are that the students are responding well to this approach.

**Enriching learning through investigative and collaborative teaching in a
senior secondary classroom**

**Bruce Nulty
Centralian College, Alice Springs**

“Interpretive” research methodology was used for a small scale ethnographic case study of investigative and collaborative teaching strategies for one topic (coordinate geometry) in one Year 11 mathematics class. This was a qualitative study using anecdotal data. The findings supported the literature, which indicated that qualitative differences in student outcomes were likely to be observed. Furthermore there was likely to be more of a focus on student understanding and appropriate use of graphics calculators and computers.

A framework for assessing and fostering students' statistical thinking

**Ian Putt
James Cook University**

**Bob Perry
University of Western Sydney
Macarthur**

**Graham Jones, Carol Thornton, and Cynthia Langrall
Illinois State University**

The short communication will outline an initial framework which has been developed from our observations of Year 1 to 5 students' statistical thinking over a one-year period, and previous research (e.g. Curcio, 1987; Friel, Bright, & Curcio, 1997; Pereira-Mendoza, 1995; Mokros & Russell, 1995; Wainer, 1992). Analysis of preliminary data obtained via a structured interview protocol has allowed us to refine the set of descriptors of the four key constructs of the framework. These key constructs, reading data displays, organising data, displaying data, and analysing data, have been adapted from the four data handling concepts identified by Shaughnessy, Garfield and Greer (1996).

In the presentation and the accompanying paper we will outline the descriptors and give some examples of the protocols obtained from the structured interviews with students at the various grade levels. Exploratory analysis of the data suggests the existence of four levels of statistical thinking across the four constructs: idiosyncratic, transitional, quantitative, and analytical.

Fundamental concepts in algebraic thinking at the junior high school algebra level

**R. E. Roberts
Nambour State High School**

The substance of this paper is a subset of the substance of a larger study of the cognitive and affective characteristics of high and low achievers in Year 10 algebra. The major study is concerned with curriculum development and addresses the key questions, "What is it that enables some students to succeed in school algebra while others fail?", and, "Are there key concepts which underlie algebra, and algebraic thinking, and which teachers are missing the opportunity to emphasise; and which are possessed by successful students of algebra, and not by the others?"

An analysis of school algebra curricula from Australia, the UK, and the United States appears to indicate that there are such concepts. Written tests of these concepts were developed, and taken by a sample of high and low achieving Year 10, state school and private school, students from a semi-rural community. The results, and some possible implications for curriculum development, of these tests will be discussed, and the broader context of the study - which includes an affective data questionnaire, and a algebraic problem solving interview - will be discussed.

Multimedia for mathematics teacher education

**Kaye Stacey and Dianne Chambers
University of Melbourne**

We will report on two initiatives using multimedia to enhance the experience of face-to-face teaching for pre-service education students, funded by the University of Melbourne and being conducted by a team from our department. Multimedia presents new opportunities for teacher education, including bringing "virtual children" into the lecture and tutorial room. Research associated with the use of multimedia is developing around several themes, including the degree to which the case presented should be "cleaned" before use and the useability of the resources, which have enhanced discussions in workshops.

**For several years mathematics has endured substantial horrible ill
treatment
- We need to act now!**

**Philip Swedosh
The University of Melbourne**

Mathematics is under attack. Far less time is now allocated to mathematics in schools. About 50% of Years 7-8 and 20% of Years 9-10 mathematics classes are taught by individuals who have never studied a tertiary mathematics subject. Fewer students are studying mathematics at upper secondary and tertiary levels. Many students receive advice which turns them away from mathematics and affects their future course and career possibilities. Each of these issues has serious consequences and action should be taken now.

Some effects of self-assessment using the Self Test package on student learning

**Janet Taylor
University of southern Queensland**

In this paper we present the results of trialing a new flexible self assessment package called Self Test. This package has been designed primarily for distance students to assess their readiness or mastery of particular topics. It differs from other packages in that it allows a student to mark a series of questions as if they were an expert tutor giving them the flexibility to complete a problem in up to six different ways and to be credited when only part of the problem is accurate. Results of the evaluation of the package with groups of engineering students studying mathematics are presented briefly and the implications of how students utilise this type of package to learn mathematics are discussed.

An outline of forming a phenomenology of writing-to-learn mathematics

**Andrew Waywood
Australian Catholic University**

In this paper an overview is offered of a study of writing-to-learn mathematics which was undertaken as a doctoral thesis. The study illustrates an application of a phenomenological method to a corpus of writing-to-learn journals produced by seventeen Year ten students at a catholic secondary girls' school. The outcomes of the study to be emphasised in this paper are a methodological refinement of the phenomenological method, and, a repositioning of the theoretical understanding of teaching and learning away from the cognitive sciences and towards the human sciences.