RESEARCHERS CIRCLE 2008

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28 May 2008 ■■■

National Institute of Education

Nanyang Technological University

■■■ Singapore

Organized by Association of Mathematics Educators together with Mathematics & Mathematics Education Academic Group (NIE/NTU)

Introduction

This symposium is organized for the first time to provide a platform for teachers and researchers in mathematics education to meet and discuss their planned or on-going research. Graduate students in masters and doctoral programmes are strongly encouraged to participate. Schools conducting action research may find this a good platform for their teachers to interact with others doing the same thing. This symposium hopes to create a more vibrant research environment in mathematics education.

The symposium includes two keynote lectures on action research and problem-solving research in mathematics education by eminent speakers. Other than local participants, there will be teachers and educators from the region including those from Thailand, the Philippines and Indonesia.

Thirty to fifty researchers are expected to participate in this symposium.

Information for Presenters

1. Each presenter is given a 30-minute slot. It is suggested that you allocate 5 to 10 minutes for discussion. For research proposals, you may receive inputs to improve the research design. For work-in-progress, you may receive fresh perspectives into your research. For completed research, you may get suggestions for future work. The sequence of presentation is in the Programme.

2. The room has the necessary equipment for Powerpoint presentations. OHP and visualize are also available.

3. You are invited to develop your paper for possible publication in an AME Monograph. This is to provide opportunities for teacher-researchers to publish their research work. You are encouraged to develop the presentation into an 8 to 12-page paper. Please submit the first draft of the paper to banhar.yeap@nie.edu.sg by 1 August 2008. It will be sent to two reviewers. It is hoped that there is sufficient high-quality paper for the papers to be published as a monograph. Please follow the style of papers published in The Mathematics Educators. See http://math.nie.edu.sg/ame/matheduc/

Venue

National Institute of Education

Nanyang Technological University

1 Nanyang Walk Singapore 637616

Main Venue: LT6 (NIE Block 2 Level 1)

Concurrent Sessions: Maths Labs 4 (NIE Block 7 Basement)

Maths Labs 5 (NIE Block 7 Basement)

Programme

0830 – 0900 Registration

0900 – 0915 Opening @ LT6

A/P Berinderjeet Kaur, President

Association of Mathematics Educators

0915 – 1015 Keynote Lecture 1 @ LT6

Action Research in Mathematics Education

A/P Wong Khoon Yoong, Head/MME

National Institute of Education

Nanyang Technological University

1015 – 1030 Coffee & Interaction

1030 – 1130 Keynote Lecture 2 @ LT6

Conceptions of Mathematical Problem Solving and their Influence on Research in the Singapore Classroom.

A/P Foong Pui Yee, Associate Professor

National Institute of Education

Nanyang Technological University

1130 – 1230 Research Presentations @ LT6

Session 1
Problem Posing Performance of Grade 9 Students in Singapore on an Open-ended Stimulus
Chua Puay Huat & Yeap Ban Har
NIE/NTU, Singapore

Session 2
Does Providing Students with Problem-posing Experiences Help Them Solve Non-structured Multi-step Word Problems?
Wendy Yap
Montfort Junior School, Singapore

1230 – 1330 Lunch (not provided)

1330 – 1500 Research Presentations @ Maths Lab 4 & Maths Lab 5

	Maths Lab 4	**Maths Lab 5**
1330 – 1400	Session 3 Effects on Pupils' Mathematics Conceptual Understanding, Basic Computational Skills Governing Mathematical Principles, Process Thinking and Attitude with the Use of Calculator in Mathematical Problem Solving – An Action Research **Siti Muffarraha Adam** *Yangzheng Primary School, Singapore*	Session 4 Developing a Framework to Characterise the Openness of Mathematical Tasks **Joseph Yeo B. W.** *NIE/NTU, Singapore*
1400 – 1430	Session 5 Upper Primary School Students' Thinking on Open Number Sentences **Natcha Kamol & Yeap Ban Har** *Chiangmai University, Thailand*	Session 6 The MathTeach Methodology **Alice Ho** *MathTeach, Singapore*
1430 – 1500	Session 7 Visualization in Mathematical Problem Solving: A Case Study of Allison **Ho Siew Yin** *NIE/NTU, Singapore*	Session 8 Effects of Incorporating Metacognition into Lower Secondary Mathematics Problem-Solving Instruction: A Case Study **Low Pei Yun** *Singapore Chinese Girls' School, Singapore*

1500 – 1515 Coffee & Interactions

1515 – 1645 Research Presentations

	Maths Lab 4	**Maths Lab 5**
1515 – 1545	Session 9 Problem Posing as a Tool to Mathematical Problem Solving **Christine Yeo** *Montfort Junior School, Singapore*	Session 10 Mathematics Instructional Activities for Enhancing Understanding Related to Mathematical Processes for Secondary School Mathematics Teachers **Rungfa Janjaruporn** *Srinakharinwirot University, Thailand*
1545 – 1615	Session 11 Finger Multiplication **Alice Ho** *MathTeach, Singapore*	

1615 – 1630 Closing

Abstracts

CONCEPTIONS OF MATHEMATICAL PROBLEM SOLVING AND THEIR INFLUENCE ON RESEARCH IN THE SINGAPORE CLASSROOM by Foong Pui Yee, NIE/NTU, Singapore

Since the adoption of problem solving as the goal of mathematics education in the local curriculum from primary to secondary schools in the early 90's, the theme "mathematical problem solving" has captured the research interest of many teachers and researchers. The main purpose of this lecture is to share a review of about 60 research studies done locally relating to this theme. The review looks at research in various aspects relating to problem solving in mathematics covering key areas under three broad strands: a) problem-solving approaches and tasks, b) teachers' beliefs and practices, and c) students' problem-solving behaviors. An attempt is made to further analyse these local studies according to a framework that indicates how research inquiry on problem solving in mathematics could have been influenced by the different conceptions of what constitute "mathematical problem solving". By classifying the studies into a coherent framework based on different conceptions of the theme allows for a deeper reflection on the various aspects of its inquiry in the classroom and ask further questions for future direction. ■ puiyee.foong@nie.edu.sg

PROBLEM-POSING PERFORMANCE OF GRADE 9 STUDENTS IN SINGAPORE ON AN OPEN-ENDED STIMULUS by Chua Puay Huat & Yeap Ban Har, NIE/NTU, Singapore

This is an exploratory study into the individual problem posing characteristics of 152 Grade 9 students (aged 15) from four secondary schools in Singapore. The subjects were novice problem posers in that they were not given any training in problem posing skills. Each student was asked to write down a problem for their friends with the final answer as 60^0. Students also solved their own problems. The relationship between the structures of the posed problems, the topics involved in the problems and the solutions were discussed. Students' self-reported metacognitive regulatory strategies, the effects of achievement levels and of gender were also discussed. It was found that direct proposition type of problems occurred in about half of the posed problems. The presence of problem over-conditioning was significant across achievement levels and gender. Students' confidence in their posed problems was found to be related to some of the metacognitive strategies at the property noticing phase, problem construction stage and during solution checking. ■ puayhuat@chua@nie.edu.sg

DOES PROVIDING ELEMENTARY STUDENTS WITH PROBLEM-POSING EXPERIENCES HELP THEM SOLVE NON-STRUCTURED MULTI-STEP WORD PROBLEMS? by Wendy Yap, Montfort Junior School, Singapore

In Singapore, students are introduced to multi-step word problems involving three or more steps when they were in upper primary. Students usually encounter difficulties if the multi-step problems are non-structured, i.e. when there are no structured questions to guide them to the final goal of the word problem. Among the difficulties faced by students in solving multi-step word problems is the lack of ability to make connections within and across mathematical ideas in the problem situation. Recent studies on problem-posing have found that by providing students with problem-posing experiences in the classroom, it helps to broaden their perceptions of mathematical situations and enhance their problem-solving skills. When students generate problems on their own, they have to think of the solution paths to the problems they have posed, thus providing them with the opportunities to connect the mathematical ideas in the problem. Therefore this study aims to investigate whether the provision of problem-posing experiences in the classroom can help students to scaffold their own thinking process in solving non-structured multi-step problems. ■ wendy_yap@moe.edu.sg

EFFECTS ON PUPILS' MATHEMATICS CONCEPTUAL UNDERSTANDING, BASIC COMPUTATIONAL SKILLS GOVERNING MATHEMATICAL PRINCIPLES, PROCESS THINKING AND ATTITUDE WITH THE USE OF CALCULATOR IN MATH PROBLEM SOLVING.- AN ACTION RESEARCH by Siti Muffarraha Adam, Yangzheng Primary School, Singapore

The research questions for this study were:

1. Did the use of calculator improve pupils' conceptual understanding of mathematics topics?
2. Did the use of calculator affect pupils' ability to display computational strategies manually?
3. Did the use of calculator facilitate pupils' process thinking during mathematical problem solving?
4. Did the use of calculator affect pupils' attitudes towards the learning of mathematics?

A class of primary five pupils was involved. The pupils were required to complete math journals involving the use of calculators, which were examined whether the use of calculator improved pupils' conceptual understanding of mathematics concepts and computational skills. The pupils completed a questionnaire to examine whether they could interpret how the calculator performs the operations in deriving the solution. Lastly, they completed a survey which examined their attitudes towards the use of calculators. The study has shown that thoughtful instruction combined with stimulating questions can improve pupils' conceptual understanding of mathematics rules and principles. ■ siti_muffarraha_adam@moe.edu.sg

DEVELOPING A FRAMEWORK TO CHARACTERISE THE OPENNESS OF MATHEMATICAL TASKS by Joseph B. W. Yeo, NIE/NTU, Singapore

Standard mathematics textbook tasks are usually closed and their purpose is to practise students on procedural skills learnt earlier in the class. But many educators prefer to expose their students to authentic mathematical tasks which are usually open or open-ended. Some researchers use the terms 'open' and 'open-ended' interchangeably while others distinguish between them. Moreover, some of these tasks seem to be more open than others, suggesting that there may be different degrees of openness. The objectives of this paper are to clarify which aspect of a mathematical task is open and to develop a framework to characterise the openness of mathematical tasks based on two types of open goal, two types of open method, two types of scaffolding, two types of open answers and two types of extension. Then the openness of mathematical tasks will be classified into three broad categories (task-inherent, task-statement-dependent and student-dependent) to help teachers choose or design more appropriate tasks for their students. Such elucidation of the construct of openness in mathematical tasks will also help researchers to define the boundaries of their research more clearly. ■ josephbw.yeo@nie.edu.sg

UPPER PRIMARY SCHOOL STUDENTS' THINKING ON OPEN NUMBER SENTENCES
Natcha Kamol & Yeap Ban Har, Chiangmai University, Thailand
This study is part of a larger study on algebraic thinking of upper primary school Thai students. This paper focuses on their thinking in completing open number sentences tasks such as 32 + 45 = ☐ + 30. 132 upper primary (grades four to six) students were tested using paper-and-pencil instruments. Subsequently, six students from each level were purposefully sampled to be interviewed. The findings indicated that students' thinking on open number sentences can be seen as comprising four levels. Students at Level 1 were confused or unable to understand the tasks. They showed misconception of the equal sign as being an operator meaning "the total". In finding the missing number in an open sentence, they typically operated on all the given numbers. Students at Level 2 showed misconception about equal sign as an operator meaning "the answer". Typically, they found the missing number of an open sentence by computing the given numbers on the left side of the equal sign and placing that number on the right hand side. At Level 3, students demonstrated an understanding of the equal sign. They thought of the equal sign as a relationship between the numbers on each side of the equal sign. Level 4 students showed their thinking about the equal sign in an open number sentence as a relational sign and used a relationship between the numbers on each side of the equal sign to find the missing number of an open sentence. ■ natcha@chiangmai.ac.th

VISUALIZATION IN MATHEMATICAL PROBLEM SOLVING: A CASE STUDY WITH ALLISON
Ho Siew Yin, NIE/NTU, Singapore
Renowned mathematician, Paul Hamos, commented on the importance of the ability to visualize (Halmos, 1987). Terence Tao, a child who exhibited a formidable mathematical precociousness as reported by Clements (1984), emphasized the importance of visualization in the problem-solving activity of any individual. This presentation focuses on three interviews with a student, Allison, over three years when she was in the fourth grade till the sixth grade. In each grade year, Allison was asked to solve the same set of six related verbal word problems having high degree of visuality. I will be discussing how Allison's method for solving each of the six related verbal word problems changed over the three years, and the implications for teaching. Allison was interviewed on a one-to-one setting. The interview procedure was structured such that Allison was engaged in the highest possible level of intellectual process, thus every opportunity was given for success in each word problem. The audio-recording, the artefacts (Allison's written solutions) and field notes taken during the interview were used to triangulate the data obtained. As defined by Presmeg (1986), a visual method of solution is one which involves visual imagery, with or without diagram, as an essential part of the method of solution, even if reasoning and algebraic methods are also employed. A nonvisual method of solution is one which involves no imagery as an essential part of the method of solution. At Grade Four, Allison solved all the problems using a visual method for each problem. Except for the first problem, the rest of the five problems were novel for her. At Grade Five, she solved the two problems using a nonvisual method as she solved similar problems before. She used a visual method for the rest of the four problems. It is noted that even though two of these four problems were no longer novel to Allison at Grade Five – she, however, used a visual method for solving as she found the problem situation more complex than the first two problems. At Grade Six, Allison 'formalized' her method of solving such problem types and solved five of the six problems using a nonvisual method. ■ siewyin.ho@nie.edu.sg

EFFECTS OF INCORPORATING METACOGNITION INTO LOWER SECONDARY MATHEMATICS PROBLEM-SOLVING INSTRUCTION: A CASE STUDY by Low Pei Yun, Singapore Chinese Girls' School, Singapore
In the learning of mathematics and enquiring of mathematical problem-solving skills, metacognition plays an important role, as advocated by MOE in its framework. This pilot study aims to look at the effects of incorporating metacognitive skills during instruction by the teachers and the acceptance of such incorporation by the students. Three students underwent three sessions of "metacognitive" lessons of one hour each. They were introduced metacognitive action statements at first. Then they went through the process of solving non-routine mathematical tasks with the incorporation of metacognitive processes by the teacher by interjecting metacognitive action statements throughout the entire problem-solving process. Finally, they were asked to give feedback about the metacognitive process. It was found that the pupils were supportive of the incorporation of metacognitive behaviour by the teacher during instruction to help problem solving. ■ low_pei_yun@moe.edu.sg

MATHEMATICS INSTRUCTIONAL ACTIVITIES TO ENHANCE UNDERSTANDING RELATED TO MATHEMATICAL PROCESSES FOR SECONDARY SCHOOL MATHEMATICS TEACHERS by Rungfa Janjaruporn, Srinakharinwirot University, Thailand

The purposes of the study were to develop mathematics instruction activities to enhance the understanding related to mathematical processes for secondary school mathematics teachers and to study the effects on their understanding related to mathematical processes, i.e., concept of mathematical processes, implementing mathematics instruction using the problem-solving approach, and evaluation students' mathematical processes. In the Thai mathematics curriculum, mathematical processes comprise problem solving, reasoning, communication and representation, connection, and creative thinking. The mathematics instructional activities were provided to the teachers to learn the concept of mathematical processes, how to implement mathematics instruction using the problem-solving approach, and how to evaluate students' mathematical processes. In the experimental class, teachers participated in cooperative learning group, group problem solving, presentation, and discussion. They recognized the importance of implementing the mathematics instruction using the problem-solving approach, and the roles of a teacher and students in the classroom. In addition, teachers had a lot of experience to evaluate students' written work using rubrics. Twenty-nine secondary mathematics teachers were the subjects of the study. A pretest-posttest design was used for the study. There were fourteen 2-hour mathematics instruction activities for the study. Pretest and posttest on understanding related to mathematical processes and an observation form were used to collect the data. Results of the study were as follows: The median score on understanding related to mathematical processes of posttest was significantly higher than that of pretest at the 0.05 level. There were evidence that when teachers worked on more activities, they recognized the importance of implementing the mathematics instruction using problem-solving approach, preparing challenging learning material, using rubric scoring to evaluate students' mathematical processes, and roles of a teacher and students in the classroom. They could explain the concept of problem solving, reasoning, communication and representation, connection, creative thinking, and how to develop them. ■ rungfa@swu.ac.th