Enhancing Understanding and Constructing Knowledge in Mathematics with Technology

Abstracts of the Thirteenth
Asian Technology Conference in Mathematics

15 – 19 December, 2008
Suan Sunandha Rajabhat University
Bangkok, Thailand

Editors

Wei-Chi Yang, Radford University, USA
Miroslaw Majewski, New York Institute of Technology, UAE
Tilak de ALWIS, Southeastern Louisiana University, USA
Krongthong Khairiree, Suan Sunandha Rajabhat University, Thailand

ISBN 978-0-9821164-1-8 (hard copy)
ISSN 1940-2279 (CD)
ISSN 1940-4204 (online version)

International Program Committee (IPC)

International Program Co-Chairs

- Tilak de ALWIS , Southeastern Louisiana University, USA
- Miroslaw MAJEWSKI , New York Institute of Technology, UAE
- Wei-Chi YANG , Radford University, USA

International Program Committee

- Paul ABBOTT, University of Western Australia, Australia
- Keng Cheng ANG, NIE/ Nanyang Technological University, Singapore
- Kyung Yoon CHANG, Konkuk University, South Korea
- Jen-Chung CHUAN, National Tsing Hua University, Taiwan
- Ma. Louise Antonette De Las Penas, Ateneo De Manila University, Philippines
- Gary F. FITZ-GERALD, RMIT University, Australia
- Shui-hung HOU, Hong Kong Polytechnic University, Hong Kong
- Masami ISODA, University of Tsukuba, Japan
- Peter JONES, Swinburne University of Technology, Australia
- Krongthong Khairiree, SuanSunandha Rajabhat University, Thailand
- Barry KISSANE, Murdoch University, Australia
- Ichiro KOBAYASHI, International Educational Software, Japan
- Vlasta, KOKOL-VOLJC, University of Maribor, Slovenia
- Bernhard KUTZLER, University of Linz, Austria
- Matthias KAWSKI, Arizona State University, USA
- Ming-Gong LEE, Chung Hua University, Taiwan
- Hee-chan LEW, Korea National University of Education, South Korea
- Diem M. Nguyen, The Bowling Green State University, USA
- Ruben PREISS, Universidad Diego Portales, Chile
- Antonio R. Quesada, The University of Akron, USA
- Inder K Rana, Indian Institute of Technology, Powai, India
- Katsuhiko SHIMIZU, Tokyo University of Science, Japan
- Tadashi TAKAHASHI, Kobe University, Japan
- Lu YANG , Guangzhou University, China
- Yuan Yuan , Chung Yuan University, Taiwan

Local Organizing Committee

- Assoc. Prof. Dr. Chaungchot Bhuntuvech (Advisor), Suan Sunandha Rajabhat University (SSRU)
- Dr. Pornpun Waitayangkoon, The Institute for the Promotion of Teaching Science and Technology (IPST)
- Prof. Dr. Sompong Dhampongsa, Chiangmai Uiversity
- Asst. Prof. Dr. Kridsada Krudthong, SSRU
- Asst. Prof. Weera Mahawichit, SSRU
- Asst. Prof. Dr. Krongthong Khairiree, SSRU
- Assoc. Prof. Chaweewan Kaewsaiha, SSRU
- Assoc. Prof. Ubol Klongkratoke, SSRU
- Dr. Rawiwan Tenissara, IPST
- Dr.Jaruwan Sangtong, IPST
- Dr.Panthong Gulnartsiri, IPST
- Dr. Supatra Pativisan, IPST
- Ms. Chamaiporn Thangton, IPST

Advisory Committee

- Bruno BUCHBERGER, LINZ, Austria
- Keith O GEDDES, University of Waterloo, Canada
- Peng Yee LEE, Nanyang Technological University, Singapore
- Bert WAITS, The Ohio State University, USA

Reviewers

All contributed papers were reviewed by International Program Committee (IPC) and the following external reviewers.

- Paul Abbott
- Keng Cheng Ang
- Tasos Barkatsas
- Jill Brown
- Kyung-Yoon Chang
- Jen-chung Chuan
- Jean-Jacques Dahan
- Tilak de Alwis
- Ma.Louise Antonette De Las Penas
- Maria Ailynn Diansuy
- Gary Fitz-Gerald
- Jozef Hvorecky
- Zhonghong Jiang
- Matthias Kawski
- Krongthong Khairiree
- Barry Kissane
- Vlasta Kokol-Voljc
- Bernhard Kutzler
- Luisito Lacatan
- Ming-Gong Lee
- Ana Paula Lopes
- Yoichi Maeda
- Miroslaw Majewski
- Wee Leng Ng
- Diem Nguyen
- Aruna Palipana
- Inder Kumar Rana
- Siti Aishah S Abdullah
- Hans-Stefan Siller
- Ian Stevenson
- Philip Todd
- Tin-Law Toh
- Hasan Unal
- Wei-Chi Yang
- Yuan Yuan

Abstracts for Plenary Talks and Invited Papers

Abstract for 14570

CONSTRUCTING KNOWLEDGE IN GRAPH THEORY AND COMBINATORIAL OPTIMIZATION WITHIN THE MULTIMEDIA APPLICATION 'GRAPHS'

Author: Eva Milková
Affiliations: Faculty of Informatics and Management, University of Hradec Králové

Multimedia applications together with individual approaches within the didactic process have substantially influenced education. They give teachers an excellent chance how to support not only demonstrating and visualizing the explained subject matter to be much clearer and comprehensible, but also enable them to prepare such study material for students that optimizes their study habits. The Theory of Graphs together with Combinatorial Optimization is a wonderful, practical discipline. On the one hand, there are many methods which can be used for solving the same problem, while on the other hand, using effective modifications of one algorithm, we can devise methods of solving various other tasks. To educate students in this area it is important to make them familiar with certain algorithms in contexts to be able to get deeper into each problem and entirely understand it. In the paper we present just a few ideas that have proved successful in teaching and learning this part of mathematics with a big support of the program `Graphs', whose main purpose is a visual representation of basic graph-concepts and graph-algorithms using a coloring process on graphs created within the program.

Abstract for 14594

ICT BRINGING MATHEMATICS TO LIFE AND LIFE TO MATHEMATICS

Author: Adrian Oldknow
Affiliations: University of Chichester, The Joint Mathematical Council of the UK, The Mathematical Association

Many countries are seeking ways of encouraging more secondary school students to specialise in science, technology, engineering and mathematics (STEM). The talk will include examples of ICT-based activities used in some current school based projects to help make mathematics more exciting, relevant and challenging to young learners. These include the use of digital images and video clips to stimulate modelling with 2D geometry and algebra; the use of 3D geometry software to develop visualisation and modelling in space; and the use of hand-held devices with data-loggers in capturing and analysing for experimental data.

Abstract for 14596

INSPIRING MATHEMATICS LESSONS FOR LEARNERS OF ALL ABILITIES

Author: Alan Catley
Affiliations: Tyne Metropolitan College, NCETM

Come and get a flavour of some inspirational lesson ideas that have been developed by the presenter to ensure that the best possible use is made of technology resources available in his classroom in U.K. These approaches have had such a profound impact on the motivation, understanding, learning and examination performance of his own students that Alan is now delivering mathematics conferences to large groups of students (anything from 60 to 600!) using suitable software.

The way he is making appropriate use of resources such as Autograph, Excel and web resources to keep the learners totally engaged in mathematical activity is something all mathematics teachers should experience and this talk is your big chance. During a recent student conference (focused on raising the achievement levels of low achieving students) at a school in the south west of England one 16 year old boy (not renowned for his

enthusiasm for mathematics) had to be 'thrown out' after 3 hours to go to his scheduled French Oral examination . . . he wanted to stay and do more mathematics!

Abstract for 14725

THE DESIGN AND IMPACT OF TECHNOLOGY-BASED LEARNING ENVIRONMENT IN AN INQUIRY-ORIENTED APPROACH TO UNDERGRADUATE MATHEMATICS

Author: Oh Nam Kwon
Affiliations: Seoul National University

Research on the relationship between different teaching methods and students' understanding of mathematics at the university level is essential for cumulative improvement in mathematics. However, a number of researchers have reported that there is the gap between what is taught and what is learned in mathematics in traditional modes of teaching. This talk explores more effective teaching method at the university level. An example of inquiry-oriented mathematics teaching at the university will be discussed and illustrated how to enhance students' authentic understanding in an ordinary differential equations course. The design of these learning environments also will be explored in explicit attention to the use of computer and calculator tools.

Abstract for 14745

ANIMATIONS THAT HELP STUDENTS CONSTRUCT KNOWLEDGE IN MATHEMATICS

Author: Darel Hardy
Affiliations: Colorado State University, Hardy Calculus LLC

Traditionally mathematics teachers lecture and their students learn by listening. Students develop a narrow set of skills, which quickly fade. More active approaches to learning show that students can indeed develop deep understanding that does not fade over time. Computer animations actively engage students in the learning process. If a picture is worth a thousand words, then pictures that move must be worth a fortune. Wouldn't it be great if students could create their own animations? Unfortunately, most computer animations currently used for mathematics instruction are written in languages such as Java, Maple, or Mathematica. Creating such animations requires special syntax and knowledge of the underlying system. Scientific Notebook makes it easy to generate animations. To watch a hyperbolic paraboloid transform into an elliptic paraboloid, enter x^2+ty^2, choose Plot 3D Animated from a menu, and change the t-interval to $-1 \le t \le 1$. Multiple formulas can be dragged to the plot frame one at a time to create sophisticated animations. In this talk, a variety of novel animations demonstrate fundamental concepts from algebra, geometry, trigonometry, and calculus. These animations can be used by the instructor as classroom demonstrations or assigned as lab exercises for the students to create for themselves.

Abstract for 14789

TOTALLY INTERACTIVE ONLINE TEACHING OF MULTIVARIABLE CALCULUS

Author: Thomas Banchoff
Affiliations: Brown University, MAA, AMS

Online interactive programs allowing for dynamic presentation and exploration of spatial configurations is ideal for teaching and learning in multivariable calculus. We will report on a course totally built around online materials, taking the place of a traditional textbook.

Abstract for 14970

USING MAPLE'S CUSTOMIZED INTERFACE TO IMPROVE MATHEMATICS EDUCATION

Author: Douglas Meade
Affiliations: Department of Mathematics, University of South Carolina, Industrial Mathematics Institute, USC

Computer algebra systems have existed for more than 20 years. Almost immediately they were promoted as a great benefit for mathematics education. This transformation was neither immediate nor universal. Two long-standing obstacles are the syntax and the user interface. Keeping pace with the advances can be a challenge. In this talk we will explore some of the major milestones in the development of Maple, including worksheets, context menus, maplets, tutors, task templates, and embedded components. While the Maplets for Calculus will be a common theme throughout this discussion, examples from linear algebra, differential equations, number theory, and geometry will also be included. The talk will conclude with some predictions, and requests, for the future.

Abstract for 15337

DYNAMIC GEOMETRY: THE NEXT 10 YEARS

Author: Nicholas Jackiw
Affiliations: KCP Technologies, Inc., Simon Fraser University

Keywords: Dynamic Geometry, software, Sketchpad

Since its origin twenty years ago, the genre of dynamic, interactive geometry construction software has had wider global impact on school mathematics education than any other software technology, and today features over 50 software packages exploring variations on the technological themes pioneered by The Geometers Sketchpad and Cabri Géomètre. In this talk, Sketchpads designer summarizes the state of the field today, and identifies current developments – both in research and in the social use context of educational technology-- that indicate the direction of the fields evolution over the coming decade.

Abstract for 15429

EXPRESSING GENERALITY: A COMPUTATIONAL APPROACH

Author: Richard Noss
Affiliations: London Knowledge Lab, Institute of Education, University of London

The paper will describe the recent work of recent interdisciplinary research - the MiGen project - which aims at designing, building and evaluating a pedagogical and technical environment for improving 11-14 year-old students' learning of mathematical generalisation.

Abstract for 15450

THE PREPARATION OF SECONDARY PRE- AND INSERVICE MATHEMATICS TEACHERS ON THE INTEGRATION OF TECHNOLOGY IN TOPICS FOUNDATIONAL TO CALCULUS

Authors: Antonio Quesada, Laurie A. Dunlap
Affiliations: The University of Akron, Department of Theoretical and Applied Mathematics and Department of Curriculum and Instruction the University of Akron, Akron, Ohio 44325-4002

The graphing calculator has been on the market for 21 years. It is a fair question to ask whether or not we are taking full advantage of the main capabilities that hand-held graphing technology (HHGT) offers, without Computer Algebra Systems (CAS), to provide precalculus students with the best possible preparation for calculus? To answer this question in the USA, we decided first to establish criteria on how the integration of technology expands the study of families of continuous functions at this particular level. Then, we proceeded

to explore the knowledge on the integration of HHGT that secondary pre- and inservice teachers have. A test based on the established criteria was administered to three intact groups consisting of 46 preservice secondary teachers from three universities from the Midwest in the USA. The same test was also given to a group of 74 secondary inservice teachers representing 40 school districts from the same geographical area. The test results were very low. In addition, the preservice and inservice teachers, immediately before taking the test, were asked to answer a survey where they rated their knowledge on the established criteria. The self-evaluation of both groups on the chosen topics ranges from very little to some knowledge, corroborating their self-awareness on their lack of preparation on these topics.

Abstract for 15454

INTEGRATING CERTAIN TYPES OF RATIONAL FUNCTIONS WITHOUT PARTIAL FRACTIONS

Author: Tilak de Alwis
Affiliations: Southeastern Louisiana University

In this paper, we will discuss a new method of integrating certain types of rational functions without using partial fractions. Our method mainly depends on writing the numerator of the integrand as a linear combination of the factors of the denominator. This method uses only basic algebra, and is generally more efficient than the traditional method. One weakness of the traditional method is that it usually requires solving large systems of equations, which is a tedious task. We have used certain features of the computer algebra system Mathematica to verify our results.

Abstract for 15805

DECONSTRUCTING CHINESE LATTICES WITH MuPAD

Authors: Miroslaw Majewski, Jiyan Wang
Affiliations: New York Institute of Technology, Abu Dhabi Campus, Department of Mathematics
East China Normal University Shanghai, China

Chinese lattices are an interesting form of applied mathematical art. This paper contains a brief attempt to analyze mathematical structure of two simple examples of Chinese lattices and show how they can be modeled using MuPAD – a Computer Algebra System developed by a group of scientists from Paderborn University and SciFace Software GmbH & Co. KG, in Germany.

Abstract for 15806

FROM F(X) TO XF: USING TECHNOLOGY TO PROMOTE ADVANCED MODERN MATHEMATICAL THINKING

Author: Matthias Kawski
Affiliations: Arizona State University

This article discusses the virtual absence of modern mathematics through not only secondary, but also most curricula at the beginning postsecondary level. This is in stark contrast with the sciences whose curricula more or less emphatically embrace discoveries made in the last few decades.

We propose to utilize modern computing technology to create the intellectual need for developing modern mathematical viewpoints. We discuss several examples, primarily at the level of second year of collegiate mathematics where judicious use of modern computing tools can change complacency into excitement about modern mathematical thinking. Mathematical topics include vectors, functions, actions, and transforms.

Abstract for 15868

AN INQUIRY-ORIENTED APPROACH TO UNDERGRADUATE MATHEMATICS: CONTRIBUTIONS TO INSTRUCTIONAL DESIGN OF DIFFERENTIAL EQUATIONS

Author: Oh Nam Kwon
Affiliations: Seoul National University

To improve undergraduate mathematics learning teachers need to recognize and value characteristics of classroom learning environments that contribute to powerful student learning. The broad goal of this special issue is to share such characteristics and the theoretical and empirical grounding for an innovative approach called the inquiry oriented differential equations (IO-DE) project. We use the IO-DE project as a case example of how undergraduate mathematics can draw on theoretical and instructional advances initiated at the K-12 level to create and sustain learning environments for powerful student learning. In addition to providing an overview of the five articles in this special issue, in this introductory article we highlight the theoretical background for the IO-DE project and provide a summary of two quantitative studies done to assess the effectiveness of the IO-DE project on student learning.

Abstract for 15968

PERSPECTIVES ON INSTRUMENTAL ORCHESTRATION AND ASSESSMENT - FROM CHALLENGES TO OPPORTUNITIES

Author: Lenni Haapasalo
Affiliations: University of Joensuu

When developing instructional praxis of mathematics, there are following tensions to be considered: (1) Objectivism vs. Radical Constructivism, (2) Developmental Approach emphasizing procedural knowledge vs. Educational Approach stressing conceptual knowledge, (3) Gagne's Systematization emphasizing guided learning vs. Minimalist Instruction emphasizing student's volition to learn, (4) Instrumentation where technology is shaping the actions of doing mathematics vs. Instrumentalization where technology is shaping also the mathematical objects, (5) Learning by Instructional Materials vs. Learning by Design, (6) Teaching mathematical contents vs. Emphasizing sustainable heuristics from the history of mathematics, and (7) Looking internal problems of mathematics education vs. Applying business principles to shift the bad reputation of mathematics. This article represents responds to these dilemmas and discusses pedagogical implementations with critical issues.

Abstract for 16120

ENGAGE IN MATHEMATICS WITH CABRI ELEM DIRECT MANIPULATION

Author: Jean-Marie Laborde, Colette Laborde
Affiliations: Cabrilog, University Joseph Fourier, France

Cabri Elem offers two environments: an environment for teachers to create mathematical activities meant for students of primary school and beginning of secondary school and an environment for students solving these activities. Through the example of Cabri Elem, direct manipulation of mathematics concepts will be discussed from two perspectives:

(A) design choices about the ways of representing mathematical actions on these objects for young learners

(B) use of direct manipulation by teachers to create activities for students in which they can play on values given to task variables in order to favor learning

To enforce Direct Manipulation in Mathematics Cabri Elem offers virtual tools and reconciles 2D and 3D in one unique environment.

Abstracts for Full Papers

Abstract for 14580

MATHEMATICAL METHODS FOR OPTIMIZATION OF CUTTING OPERATIONS OF 5-AXIS MILLING MACHINES

Author: Stanislav Makhanov
Affiliations: Sirindhorn International Institute of Technology, Thammasat University

Keywords: optimization, mathematical methods in manufacturing

The paper presents mathematical methods for tool path planning for five-axis machining based on minimization of the kinematics error. The error is derived explicitly from the inverse kinematics equations corresponding to a particular five-axis machine. A method for an automatic symbolic calculation the kinematics error for arbitrary machine kinematics is implemented and verified. The numerical experiments demonstrate that the proposed procedure is superior with the reference to conventional engineering techniques.

Abstract for 14918

HOW WE CAN IMPROVE EDUCATION OF MATHEMATICS BY IT

Authors: Saeed Seyed Agha Banihashemi
Affiliations: Mfa. Dpt Scince and Technology

In this article we are going to state how IT and history of mathematics can help education of mathematics.

Abstract for 14956

INNOVATIVE WAYS TO INFUSE MATHEMATICAL CONCEPTS TO SECONDARY STUDENTS THROUGH INTERNET INSTRUCTIONAL RESOURCES TO DESIGN AN ACTIVE CLASSROOM.

Authors: Venkataraman Swaminathan
Affiliations: Dunearn Secondary School Singapore, Ministry of Education Singapore

Mathematics is something that people do. In the ages before the recent rapid developments in technology, this activity called "doing mathematics" has been restricted to those who happened to be able to master a variety of artificial, mechanical, formal processes. Now though, technology allows freedom for many more people to benefit from being able to "do mathematics", and for others to benefit from the results of that. This paper describes one of the initiatives to support teachers in integrating internet resources into the instructional process in Mathematics while shifting their instruction to a more constructivist approach to create an "Active Classroom". To be prepared for the demands of the knowledge economy, students need to know how to use their knowledge and skills by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas communicating, collaborating, solving problems, and making decisions.

Abstract for 14957

LEARNING TRIANGLE PROPERTIES THROUGH GEOMETRICAL SKETCHPAD ACTIVITIES

Authors: Venkataraman Swaminathan
Affiliations: Dunearn Secondary School Singapore, Ministry of Education Singapore

Progression in Learning Is Usually From the Concrete to the Abstract. Young people can learn most readily about things that are tangible and directly accessible to their senses visual, auditory, tactile, and kinaesthetic.

With experience, they grow in their ability to understand abstract concepts, manipulate symbols, reason logically, and generalize. These skills develop slowly, however, and the dependence of most people on concrete examples of new ideas persists throughout life. Concrete experiences are most effective in learning when they occur in the context of some relevant conceptual structure. In many mathematics textbooks, the properties of triangles, and their medians, angle bisectors, altitudes, and other special lines in triangles, are listed as theorems or statements. This paper provides an opportunity for interactive, discovery activities for students to learn properties of triangles using Sketchpad. It gives them opportunities for hands-on experimentation with medians, angle bisectors. They discover the properties on their own, and help each other and discuss their discoveries through Sketchpad activities which assist them in these explorations. I find that when students have this kind of experience, they understand the properties rather than just memorising them, and not only help them to remember the properties, but they have a kind of "ownership" of the information, and their understanding is an active process.

Abstract for 14986

HYPERBOLIC GEOMETRY AS A VIEW SCREEN IN MINKOWSKI SPACE

Authors: Hirokazu Yoshida, Yoichi Maeda
Affiliations: Tokai University

Let AOB be an angle in the three dimensional Euclidean space. When we look at this angle from various view points, the angle AOB changes its appearance, which we call gvisual angleh. Masahiro Mori in Tokai University studied the relation among three visual angles of three dimensional orthogonal axes. He discovered several geometric properties of these visual angles. In this paper, we will make a similar discussion in Minkowski space. The visual angle is realized on an equidistance surface from the view point. For example, in the Euclidean space the view screen is a sphere centered at the observer. On the other hand, the view screen in Minkowski space is a (Euclidean) hyperboloid of two sheets. We will make clear the difference of visual angles of three dimensional orthogonal axes between Euclidean and Minkowski space.

Abstract for 14997

USING THE R STATISTICAL PROGRAMMING ENVIRONMENT IN THE TEACHING OF A LINEAR ALGEBRA COURSE

Authors: Scott Hyde
Affiliations: Brigham Young University – Hawaii

Keywords: R, Linear Algebra, Matrices, Open Source Software

The R statistical programming environment is an open source implementation of the S computer language. Its main functions are to analyze statistical problems, manipulate data, and produce graphics. However, because many statistical problems require the use of matrices, R is also a very powerful matrix program, which makes it ideal to use in teaching a Linear Algebra course. In addition, R is an open source program and part of the GNU project, ensuring its availability for all to download and use. This gives R a distinct advantage over programs like Matlab, Mathematica, and Maple, as they are not always available and can be cost prohibitive. R is available for many different operating systems, including UNIX, Linux, MacOS, and Windows.

R is also extensible, which allows R to be changed to fit the needs of the user, either by writing new packages, or by installing additional packages from the Comprehensive R Archive Network (CRAN). The goal of this paper is to introduce the use of R in teaching a Linear Algebra course. Topics include creating vectors and matrices, extracting elements from a vector or a matrix, operations on matrices, and matrix factorizations. Instructions on the installation of R on a Windows system, as well as an example of using R in a Linear Algebra course are given.

Abstract for 14999

LINKING VISUAL ACTIVE REPRESENTATIONS AND THE VAN HIELE MODEL OF GEOMETRICAL THINKING

Author: Stavroula Patsiomitou
Affiliations: University of Ioannina ,Greece

Keywords: Linking Visual Active Representations , van Hiele model, Dynamic geometry environment

The present study presents the different modes of LVAR which can be constructed in Geometer's Sketchpad v4 dynamic geometry software. The paper posits an explanation of the correlation between the five phases in the apprenticeship/learning process proposed by van Hiele and the developing theory on LVAR. A few examples of the different modes of LVAR are presented, including the answers of the pupils participants in the didactic experiment conducted. We can thus conclude that transformations through LVAR lead students to structure mental transformations relative to the development of their van Hiele level.

Abstract for 15000

CUSTOM TOOLS AND THE ITERATION PROCESS AS A REFERENT POINT FOR THE CONSTRUCTION OF MEANINGS IN A DGS ENVIRONMENT

Authors: Stavroula Patsiomitou
Affiliations: University of Ioannin, Greece

Keywords: custom tools , iteration process, Dynamic geometry environment

The paper draws on an experiment conducted in a secondary school mathematics classroom in Greece which aimed to explore ways in which students develop their intuition, their meanings construction and the proving process in the Geometer's Sketchpad v4 DGS environment, using a custom tool which combines the beautiful drawing and the figure with geometric properties. Custom tools and the iteration process can be shown to be a suitable and valuable way of enhancing the construction of mathematical meanings. By this way, the DGS environment offers openable windows which guide students in their study of infinite structures and convergent, divergent sequences in both numeric and graphic notations. Both the bridging of empirical and traditional methods by presenting the proofs using dynamic means and aesthetic development through the computer software enhance the user's interaction, instilling a `digital proof' impulse.

Abstract for 15001

DO GEOMETRICAL CONSTRUCTIONS IN A DGS ENVIRONMENT AFFECT STUDENT'S ALGEBRAIC EXPRESSIONS?

Authors: Stavroula Patsiomitou
Affiliations: University of Ioannina, Greece

Keywords: Euclid Elements, Dynamic geometry environment, structural algebraic units

The present paper attempts to bridge the world of digital technology and the world Euclid bequeathed us in his "Elements". The role of the design process of activities in a dynamic geometry interactive environment such as that of Geometer's Sketchpad v4 is examined, along with ways in which students can be assisted to understand algebraic concepts through geometrical reconstructions. The ways in which it can facilitate the understanding of geometrical concepts are examined, along with the bridging, between the fields of algebra and geometry, and strategies for overcoming obstacles. Two constructional examples are presented which can lead to the visual proving process and the formulation of the algebraic expression through the theoretical calculation of the areas of shapes.

Abstract for 15005

SPREAD OF HIV: A MATHEMATICAL MODEL

Authors: Anulekha Tapadar, Koushik Ghosh
Affiliations: Department of Mathematics, University Institute of Technology, University of Burdwan, Department of Mathematics Dr. B.C. Roy Engineering College Jemua Road, Fuljhore Durgapur-713 206 West Bengal India

Keywords: HIV/AIDS, unsafe sex, transfusion of contaminated blood or blood products or sharing of contaminated needles, Equilibrium Points, Stability, Series Solution, Mutual Co-existence

Each year a large number of people all over the world die from HIV/AIDS. Although there are many complicating factors behind the spread of HIV, we still believe that relevant mathematical models can provide a good insight of the dynamics of the spread of it. If we can provide a satisfactory profile of this dynamics it will certainly help government officials to make timely remedial actions. In the present work we have established a mathematical model of epidemiology for the spread of HIV. We have made a search for equilibrium points for the system and discussed about their stabilities. Efforts have been made to find the solution of the proposed system. On the basis of extensive analysis relevant comments are made on mutual co-existence of the group infected by HIV and the group not infected by that.

Abstract for 15023

THE PARADOX OF TWINS DESCRIBED IN A THREE-DIMENSIONAL SPACE-TIME FRAME

Authors: Tower Chen, Zeon Chen
Affiliations: University of Guam, Independent Researcher

Keywords: paradox of twins, length contraction, time dilation, stationary inertial frame, moving inertial frame

After traveling from outer space, the elder twin looks younger than his brother waiting on the earth based on the calculation from the formula of Special Relativity. There is no absolute reference coordinate in the universe. Theoretically, the younger twin could describe the motion of his brother flying forward, vice versa; the elder twin could describe the motion of his brother flying backward. If the younger twin felt his brother looking younger, the older twin should also felt his brother looking younger. It is hard to comprehend that in reality the elder twin actually looks younger than the younger twin. The motion of an object described in a three-dimension space-time frame by embedding time into space could be drawn using the graph-command of MATLAB. It leads a better understanding the paradox of twins based on the calculation from the graphic method in the 3-d s-t frame.

Abstract for 15028

TEACHING AND LEARNING CALCULUS USING COMPUTER

Authors: Ahmad Fauzi Mohd Ayub, Tengku Mohd Tengku Sembok, Su Luan Wong
Affiliations: University Putra Malaysia, Faculty of Information Technology and Computer Science, Universiti Kebangsaan Malaysia, Faculty of Educational Studies, Universiti Putra Malaysia

Keywords: calculus, achievement

Learning mathematics is a major focus of educational institutions at all levels and technology has long been an importance teaching tool in the field of mathematics. The new technological tools such as computers and computer software have provided educators and students with more opportunities to teach and to learn mathematics in new ways. The used of multimedia interactive courseware with its ability to visualize concepts will help lecturers to explain calculus concepts, which previously, cannot be illustrate through the conventional method of teaching. This paper will discuss the effectiveness of the Teaching and Mastering Calculus Computer Courseware (TEMACCC) on the achievement of diploma students in the subject Calculus. Therefore, this paper will discuss the effectiveness of TEMACCC versus traditional tutorial type on the achievement of diploma students in the subject of mathematic Calculus. This research is a quasi-experimental research involving students from three groups assigned to a control (28 students), TECCC groups (24 students) and TEMACCC

groups (23 students). TECCC and TEMACCC group defined as two treatment groups. Statistical analysis revealed that there was statistically significant difference between students' achievement in the control and TECCC groups and control and TEMACCC groups. Findings indicate that students in TECCC and TEMACCC group performed better than control group. Students from TEMACCC groups have better performance compared to the two groups. This research implies that TEMACCC could be use as a tool in teaching and learning calculus.

Abstract for 15110

LEARNING MATHEMATICS ON THE INTERNET

Authors: Barry Kissane
Affiliations: Murdoch University

Keywords: Internet, learning, mathematics, Java

The Internet offers new opportunities for school students to learn mathematics. This paper analyses these opportunities, based on presently available web sites that do not involve subscriptions by users. A typology of six different sorts of opportunities is described, justified and exemplified: (i) Interactive opportunities allow students to interact directly with mathematical objects; (ii) Reading interesting materials allows supplementation of available textual resources; (iii) Reference materials provide more extensive and accessible sources than usually available to students; (iv) Communication permits students to communicate with other students or with teachers about mathematics across existing barriers; (v) Problem solving opportunities are more extensive than normal classrooms can offer; and (vi) webquests provide structured investigational opportunities that specifically exploit Internet opportunities. The ways in which the Internet is accessed in practice are recognised to be of significance to the prospects for successful educational use of these resources, as are the pedagogies invoked by teachers.

Abstract for 15115

INFERENTIAL STATISTICS: USING A GRAPHICS CALCULATOR TO ENHANCE UNDERSTANDING OF HOW CHANGES IN SAMPLE VALUES AFFECT THE SIGNIFICANCE OF OUTCOMES

Authors: Marian Kemp, Jen Bradley
Affiliations: Murdoch University

Keywords: Inferential statistics, graphics calculators

Students often have difficulty with understanding statistical inference. In this paper we demonstrate how technology can be used to aid students in developing an understanding of some concepts in hypothesis testing. The graphics calculator provides an ideal tool for students to investigate how changes in sample values affect the significance of the outcomes. Two scenarios will be presented: the concept of the proportion for a single population, specifically addressing the idea of a majority and secondly the concept of the mean difference from two related populations, specifically addressing the idea of a significant difference. In these scenarios the effects of both changes in the sample values (i.e., sample proportion or sample mean difference) and the sample sizes will be explored. The changes that are readily observable through the use of the calculator will be related back to underlying concepts of variation in the standard errors (i.e., the standard deviations of the distribution of the sample values). Whilst the explorations could also be carried out using a spreadsheet such as Excel, graphics calculators offer more accessible learning experiences which involve students in active participation and critical thinking. These activities would be suitable at either upper secondary school or first year undergraduate level, whenever students are first introduced to inferential statistics.

Abstract for 15116

THE EFFECTIVENESS OF A MULTIMEDIA COURSEWARE AS AN ALTERNATIVE FOR TUTORING APPLICATION OF INTEGRATION

Authors: Josefina Barnachea Janier, Afza Bt Shafie, Wan Fatimah Bt. Wan Ahmad
Affiliations: EE Department, Universiti Teknologi PETRONAS, Electrical and Electronics Engineering Department, Universiti Teknologi PETRONAS, Computer and Information Sciences Department, Universiti Teknologi PETRONAS

The significant increase in enrolment in the mathematics courses at Universiti Teknologi PETRONAS (UTP) over the past semesters has resulted in an increase of teaching loads for the instructors. This has left little time for the instructors to be involved in supervision of graduate students and do research work.

Due to this recurring problem that the instructors encounter every semester, an alternative method of tutoring is needed to help reduce the teaching load of the instructors. One of the alternatives is the use of an interactive courseware. A courseware learning the application of integration was developed by the instructors using the Toolbook and composed of six modules. This topic forms as part of the course contents for the Engineering Math 2, a course offered during the Foundation Programme. The courseware was used as a tutoring system during tutorial sessions for Engineering Math 2 course in the January 2008 semester.

The objective of this paper is to evaluate the effectiveness of the developed multimedia courseware as an alternative tool in tutoring the application of integration. Two groups of students; the control and experimental (a total of 50) were involved in the study. Besides improvement in learning the topic, the results also showed that the experimental group had performed as well as the control group. This implies using the developed courseware is an effective alternative tool for tutoring the topic.

Abstract for 15210

FUZZY CLUSTERING WITH AN APPLICATION ON CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

Authors: Manoj Kumar Jain, Dr. A. K. Dalala, Dr. Sandeep Tiwari
Affiliations: Wipro Technology, Govt Science College Virkamal, Anand Calony BaldevBag, Jabalpur Jabalpur , Reader School of Mathematics Vikram University Ujjain

Keywords: Unsupervised Clustering Methods,

Unsupervised clustering methods are examined to develop a customer relationship management (CRM) system and fuzzy c-means clustering is used to assign customer to the different clusters of customer activity. The results are compared with the results of hard k-means clustering according to performance classification. This application shows that fuzzy clustering methods can be an important supportive tool for the customer relations.

Clustering techniques are rich and diversified. They have been continuously developing for over a half century following a number of trends, depending upon the emerging optimization techniques, main methodology and application area. Areas of application of fuzzy cluster analysis include for example data analysis, pattern recognition, and image segmentation.

Abstract for 15215

CREATING SCREEN CAPTURE VIDEOS TO ENHANCE THE STUDY OF MATHEMATICS

Authors: Jonathan Lewin
Affiliations: Kennesaw State University

Keywords: video, multimedia, on-screen document

This presentation is a sequel to other presentations I have made discussing the role of video content as a companion to lecture notes and textbooks in the learning of mathematics. My previous presentations showed

how video content can help students who follow their course material as it is presented in the classroom but then find it much more difficult to read from their lecture notes.

In this presentation, I shall demonstrate techniques for producing study material in video form. Two separate kinds of video making will be discussed: recordings of lectures given in the classroom, and more polished videos made outside the classroom.

For recordings made in the classroom, the main priority is speed. It is necessary to be able to export the video, master a CD, upload the image to a computer that drives a CD duplicator, and to have the disks ready within a few minutes for students who are waiting for them.

For more polished videos made outside the classroom, the principal priority is quality of the product. For such videos, I shall demonstrate the use of sophisticated editing features, importation of special effects such as callouts, hotspots, embedding a video into an HTML file to endow it with a dynamic table of contents, and use of a DRM service to protect the work from piracy. I shall also discuss how to choose the right kind of hardware to ensure that video and audio quality will meet professional standards.

Finally, I shall demonstrate some of the videos that I have made.

Abstract for 15217

INCORPORATING CALCULATORS INTO PRIMARY SCHOOL MATHEMATICS: PROSPECTIVE AND PRACTICING TEACHERS' BELIEFS ABOUT THEIR ROLE

Authors: Jack Carter, Beverly Ferrucci, Ban Har Yeap
Affiliations: California State University, East Bay, Keene State College USA, National Institute of Education Nanyang Technological University SINGAPORE

Keywords: Calculators, Mathematics Teacher Education, Teacher Beliefs

Singapore recently mandated the use of scientific calculators in the curriculum for students in upper primary grades. The current sought to gain an understanding of prospective and practicing primary school teachers' beliefs of their role in the implementation of the new curriculum as well as the impact of the scientific calculator on the teaching and learning of primary school mathematics. Survey participants were enrolled in courses or a workshop at Singapore National Institute of Education and each participant completed a survey consisting of both scaled response items and open-ended commentaries. Analyses of the survey indicated that the pre-service primary school teachers were more inclined to regard calculators as a crutch whereas practicing teachers responses indicated that calculators served as a catalyst for enhancing students' mathematical achievement. Responses by the prospective and practicing teachers also differed with respect to belief categories related to teaching knowledge and practices with the future teachers expressing less confidence in their capabilities to teach with the technology and practicing teachers indicating beliefs more supportive of calculator-enhanced instructional practices. Conclusions include recommendations for increasing future primary school teachers (1) exposure to, and knowledge of, teaching mathematical topics through the use of the scientific calculator, and (2) pedagogical knowledge pertaining to the use of the scientific calculator in promoting critical thinking, problem solving, and reasoning skills for their students. Since practicing teachers expressed greater confidence in being able to integrate the scientific calculators into their future teaching, it is suggested that teacher education institutions consider using practicing teachers as resources in improving the technological expertise of new teachers.

Abstract for 15219

A SURVEY OF THE APPLICATION OF CALCULATOR GRAPHIC IN THE SCHOOLS IN BATU PAHAT , JOHOR, MALAYSIA

Authors: Nafisah Kamariah Md Kamaruddin, Zulkarnain Md Amin
Affiliations: Universiti tun Hussein onn Malaysia

Keywords: graphic calculator, mathematics, secondary school, Malaysia

The sixth challenge in the Malaysian Vision 2020 is the challenge of establishing a scientific and progressive society, a society that is innovative and forward-looking, one that is not only a consumer of technology but also a contributor to the scientific and technological civilization of the future. Since then many methods of teaching and learning with the aid of technology have been introduced so that the students will not only learn the theory or concept but also will be exposed to the technology. In 2004, selected secondary schools in Malaysia were given graphic calculator. Only two secondary schools in one of the districts in Johor were given 40 graphic calculators for each school where one of the schools is situated in the city and another in the rural area. Since then, no research was done to survey the use of graphic calculators in the schools. Hence, this study was conducted with the purpose of obtaining the feedback from the teachers in regarding the use of graphic calculator in the teaching and learning mathematics. The participants of the Graphic Calculator Course conducted by the Universiti Tun Hussein Onn Malaysia (UTHM), which consisted of 31 secondary and primary school mathematics teachers, were chosen as the research samples. The research design used was of survey descriptive. Quantitative data was collected from the respondents using questionnaires. The data was analyzed to obtain the percentage, mean, and standard deviation.

Research finding showed that the respondents agreed that the school management informed and encouraged the teachers to use graphic calculator however, the level of the skill and knowledge of the teachers on graphic calculator is low. They have never attended any graphic calculator course before coming for the course organized by UTHM. The teachers are not confident of using graphic calculator in schools even though the level of acceptance of using graphic calculator in the teaching and learning mathematics is high. Even though the use of graphic calculator can help students and teachers in the teaching and learning mathematics but from this survey shows that the teachers do not use the graphic calculator as they do not know how to use the tool. Thus, training and monitoring of any implementation is very important, as there is no point of spending so much money to buy graphic calculators or other teaching tools if the tools are not being used.

Abstract for 15220

FOUR-VECTOR ALGEBRA

Authors: Diego Saá
Affiliations: Escuela Politécnica Nacional

Keywords: four-vectors, division algebra, 3D-rotations, 4D-rotations

The algebra of four-vectors is described. The four-vectors are more appropriate than the Hamilton quaternions for its use in Physics and the sciences in general. The four-vectors embrace the 3D vectors in a natural form. It is shown the excellent ability to perform rotations with the use of four-vectors, as well as their use in relativity for producing Lorentz boosts, which are understood as simple rotations.

Abstract for 15227

PROOF OF BERNHARD RIEMANNFS FUNCTIONAL EQUATION USING GAMMA FUNCTION

Authors: Zacharie M'Baitiaga
Affiliations: Department of Media Information Engineering, Okinawa National College of Technology

Keywords: gamma function, specific vertical line

In this paper, the gamma function is used to prove the Riemann functional equation, based on the location of the real part of the non-obvious zeros that lie on the specific vertical line in the complex plane along with the extended Euler's zeta function in the distribution of prime numbers.

Abstract for 15230

A STUDY OF THE EFFECTIVENESS OF THE CONTEXTUAL LAB ACTIVITY IN THE TEACHING AND LEARNING STATISTICS AT THE UNIVERSITI TUN HUSSEIN ONN MALAYSIA (UTHM)

Authors: Nafisah Kamariah M Kamaruddin, Zulkarnain M Amin
Affiliations: Universiti Tun Hussein Onn Malaysia, University Tun Hussein Onn Malaysia

Keywords: contextual, statistics, lab activity

Inaccurate concept in statistics contributes to the assumption by the students that statistics do not relate to the real world and is not relevant to the engineering field. There are universities who introduced learning statistics using statistics lab activities. However the learning is more on the learning how to use software and not to enhance the knowledge in statistics. Thus this research was done to test the effectiveness of the contextual lab activities in learning engineering statistics for the engineering students in UTHM. The objectives of this research is to identify the level of understanding, motivation, and acceptance between the students who had gone through the contextual lab activity and the non contextual lab activity based on the questionnaires. The quiz result was measured using the independent t-test. This research is done using the quasi-experiment. There were 265 civil, mechanical and electric students who are taking BSM 2922 Engineering Statistics for their 2nd semester session 2007/2008. The sample consisted of 155 students which were divided into two groups: 72 engineering degree students in the treated group and 83 engineering degree students in the control group. The treated group followed the contextual lab activity while the control group followed the non contextual lab activity. The findings showed that there is no significant difference between the level of understanding and motivation from both groups. However there is a significant difference for the acceptance level between both groups. The findings also show that there is a significant difference for the Postest mean score between the two groups. The treated group who had gone through the contextual lab activity scored higher than the non contextual. In conclusion, the contextual lab activity is able to help the engineering statistics students in their learning process.

Abstract for 15258

USING TECHNOLOGY TO HELP ENGINEERS LEARN MATHEMATICS

Authors: Martin Harrison, Dave Pidcock, Joe Ward
Affiliations: Mathematics Education Centre, Loughborough University, UK, iJMEST (International Journal of Mathematical Education in Science & Technology), Mathematics Education Centre Loughborough University Loughborough, UK

For a number of years, Loughborough's Mathematics Education Centre, recently awarded national Centre for Excellence in Teaching and Learning status, has worked with others to provide innovative learning resources to enhance the teaching and learning of mathematics. This paper describes some of the uses we have made of technology to help and support our engineering undergraduates' learning of mathematics; most are taught mathematics using the HELM (Helping Engineers Learn Mathematics) resources, which we briefly describe. HELM was a major curriculum development project involving a consortium of five UK universities led by Loughborough that uses interactive technology for teaching and assessment. Its success is evidenced by their considerable uptake at other institutions. E-learning is part of our overall learning and teaching strategy and a key component of our work is to develop the use of emerging modern technology in the delivery of mathematics at all levels, whilst pursuing the relevant pedagogic research. Consequently we describe some recent developments we have used in our teaching with engineers, which have included the use of Tablet PCs and electronic voting systems. We make significant use of our university's VLE to deliver the material, and other recent developments have included the use of podcasts and Moodle quizzes for formative assessment, which we outline. Finally, we comment on some of the issues involved.

Abstract for 15263

FIVE STEPS PRIMALITY TEST

Authors: Manuel Meireles
Affiliations: USP- University of Sao Paulo, FACCAMP

Keywords: primality test, prime numbers, hexa-pentagonal stratification of numbers

This article is divided into four parts. In the first one, the natural numbers are N* hexagonally stratified. For each stratification, the names á ,ð ,ϕ , ,â ,ø are given. This is done in a penta-hexagonal stratification which allows a primality test in just five steps of simple division, independent of the size of the number being tested. The basic structure of the algorithm is supplied here. This way is opened for people interested in Mathematical Sciences and Technology, the opportunity to develop more powerful and fast algorithms to test the primality of the odd numbers. Then it becomes easier, not only to identify a potential prime number but, also, to certify if a number n is or is not a prime number. The ability to discover bigger prime numbers depends only on ability and computational potency.

Abstract for 15272

A PROBLEM SOLVING METASTRATEGY

Authors: David Driver
Affiliations: Brisbane State High School, Queensland Association of Mathematics Teachers

Keywords: Please stick to the deadlines and submission guidelines, CAS problem solving

The introduction of calculators (or computers) with built-in Computer Algebra Systems into senior secondary mathematics classrooms has exacerbated a problem caused by the introduction of graphical calculators. Algebraic calculators provide students with a greatly increased range of strategies and procedures that can be used in problem solving. Many problems can now be solved using numerical, graphical, algebraic or geometrical procedures. Some of these procedures provide exact solutions, while others provide only approximate solutions. Students need some strategies for deciding which procedure to employ in a particular problem. It is suggested that, especially when using mathematical modelling to solve real-world problems, one such strategy is to consider whether or not an exact solution is possible, justified and necessary, given the context of the problem.

Abstract for 15273

PEDAGOGICAL USE OF A CAS

Authors: David Driver
Affiliations: Brisbane State High School, Queensland Association of Mathematics Teachers

Keywords: Please stick to the deadlines and submission guidelines, CAS Pedagogy High School

A CAS can be used as either a functional tool or a pedagogical tool. A trial was conducted using Casio Classpad calculators with a class of year 10 extension students. They studied the same content as 8 parallel classes in the same public school for one semester. The pedagogical use of the CAS was emphasized in class work. During examinations the experimental groups were not permitted to use their CAS calculators, although they could use then at any time in class and during a take-home assignment.

A control group, who were matched on the criteria of working mathematically and thinking mathematically using their grade 9 results, was used to evaluate the effectiveness of the trial. At the conclusion of the trial, student scores on knowledge and procedure for the experimental were slightly lower on average than those of the control group, but with a smaller spread. The scores on modeling and problem solving were almost identical for the experimental and control groups.

Abstract for 15274

STUDENTS' PERCEPTIONS TOWARDS BLENDED LEARNING IN TEACHING AND LEARNING MATHEMATICS: APPLICATION OF INTEGRATION

Authors: Wan Fatimah Wan Ahmad, Afza shafie, Josefina Barnachea Janier
Affiliations: Universiti Teknologi PETRONAS

Blended learning has gained considerable popularity in training and education in recent years. This form of learning which combines face-to-face teaching with some technological aids has been widely used in teaching and learning, making it suitable to be applied in teaching and learning mathematics. A courseware has been developed on the topic of application of integration. It is designed to supplement the lectures given in class and to assist students studying the topic at their own pace and time. This courseware was introduced to students in the January 2008 semester. The objective of this paper is to determine if blended learning approach which combines the traditional classroom learning, courseware and web-based learning will help the students in learning application of integration. It also examines the influence of blended learning approach on students' perceptions towards learning this topic. A total of thirty engineering students were involved in the study. A set of questionnaire was given to evaluate the students' perceptions. From the findings, conclusion has been drawn regarding the role of blended learning to support teaching and learning. The result shows that students demonstrate positive perceptions using the blended learning approach.

Abstract for 15275

SECONDARY STUDENTS' VIEWS REGARDING THE USE OF COMPUTERS IN MATHEMATICS LEARNING: EXPLORING THE

Authors: Vasilis Gialamas, Tasos Barkatsas, Katerina Kasimatis
Affiliations: Monash University, Australia, National University of Athens, Greece, School of Pedagogical and Technological Education, Greece

Keywords: Attitudes, engagement, motivation, technology, mathematics education, gender, achievement

The aim of this study was to investigate the complex relationship between the students' mathematics confidence, confidence with technology, attitude to learning mathematics with technology, affective engagement and behavioural engagement, achievement, gender and year level. The participants were Middle High school students from co-educational schools in Greece. A factor analytic data reduction method was used, followed by a Cluster Analysis. Gender differences as well as differences between the seven resulting clusters were investigated by using a MANOVA (Only the Cluster Analysis and partial MANOVA results are reported in this paper). It was found that boys expressed more positive views towards mathematics and more positive views towards the use of technology in mathematics, compared to girls. It was also found that high achievement in mathematics was associated with high levels of mathematics confidence, strongly positive levels of affective engagement and behavioural engagement, high confidence in using technology and a strongly positive attitude to learning mathematics with technology.

Abstract for 15283

FROM CAS/DGS INTEGRATION TO ALGORITHMS IN EDUCATIONAL MATH SOFTWARE

Authors: Ulrich Kortenkamp, Andreas Fest
Affiliations: Pädagogische Hochschule Schwäbisch Gmünd, Cinderella

Keywords: Applications by integrating Dynamic Geometry with CAS, Mathematics Teaching, Learning and Assessment using Technology

The standard triumvirate of New Media in the mathematics curriculum -- CAS, DGS and spreadsheet -- is establishing its secured position in teaching. This article illustrates, using the evolution of the software Cinderella as a guiding example, how a further integration of these products will allow for new teaching approaches. These will support the formation of important mathematical competencies, such as the ability to

find and rate mathematical models for real world problems. A central observation is the algorithmic nature of user-defined functions and that it is crucial for the learning process to be able to execute algorithms step by step.

Abstract for 15291

DESIGN OF A PI CONTROLLER WITH H2 OPTIMAL PERFORMANCE AND TIME RESPONSE CONSTRAINTS

Authors: Tetsu Yamaguchi, Takuya Kitamoto
Affiliations: Yamaguchi University, Cybernet Systems, Co., LTD

Keywords: PID control, H2 optimal control, computer algebra, parametric system

In this paper, we apply compter algebra systems to PID control theory. We focus on a PI controller that has the form kp+ki/s with two real parameters kp and ki. Although the form of the controller is simple, design of such PI controller usually requires trial and error process. Because it is often hard to determine parameter values kp and ki so that controlled system has desired properties (usually there is no clear link between parameter values and desired properties of a controlled system).

This paper presents a method to determine the parameters kp and ki so that H2 cost function is minimized. Such control is called ''''H2 optimal control'''' in modern control theory, and our method can be viewed as a mixture of classical and modern control theory. We also consider time response constraints, and present a method to determine the parameters kp and ki so that controlled system satisfies given time response constraints.

Abstract for 15292

ON STRONG POSITIVE REALNESS OF A SYSTEM THAT CONTAINS A PARAMETER

Authors: Tetsu Yamaguchi, Takuya Kitamoto
Affiliations: Yamaguchi University, Cybernet Systems, Co., LTD

Keywords: strong positive real system, computer algebra, parametric system

Compute algebra systems are getting more and more attention from the society of engineering and industry, because of its ability to handle a symbolic parameter. This ability is particularly advantageous for a controller design of a system that contains a parameter, since it is difficult to apply conventional numerical methods to such a system directly.

Given a square transfer function matrix G(s), G(s) is said to be strongly positive real if and only if G(i w)+G(-i w)^T is a positive definite matrix for all real numbers and at infinity.

Strongly positive real systems, in short, correspond to systems made up of passive elements such as resistance, inductance and capacitance. The concept of strongly positive real functions has been used in, for example, stability analysis of nonlinear systems, adaptive control, and so on. Although algorithms to check strong positive realness have been already reported, the algorithms are numerical and can not be applied directly to a system that contains a parameter.

This paper focuses on a system that contains a parameter. In this case, the system is strongly positive real for certain values of k, i.e. there exists a range U of real numbers such that k is in U if and only if the given system is strongly positive real. In this paper, we present a method to compute such a range U of the parameter k.

The method utilizes the properties of a certain ARE (Algebraic Riccati Equation) that has close relationships with strong positive realness of a system.

Abstract for 15294

A PROPOSAL TO TEACH 3D VECTOR OPERATIONS IN A ROLE-PLAYING GAME

Authors: Hitoshi Nishizawa, Takayoshi Yoshioka
Affiliations: Toyota National College of Technology

Keywords: Role-playing game, 3D vectors, application

In the college the authors work for, the students' achievement in linear algebra has been lower than the ones of other fields in mathematics. Many students try just to memorize the formulas and solutions for certain problems expected at the examinations but do not think about the mechanism nor connect them to graphical objects, and forget the isolated knowledge in a short period. The lack of actual applications has worsen the situation.

To improve the situation, we have introduced some graphical explanations of vector operations in 2D and 3D space with the help of graphic software. Each explanation appealed to some students but not to the others. We still need to develop an explanation that appeals to majority of our students.

In this paper, we propose to use a role-playing game as an application for vector operations. The game consists of a tournament, where players compete each other in different kind of battlefields, and the characteristics of the players and the battlefields are expressed by three dimensional vectors. When a battle is played by two players in a battlefield, the strength of each player is calculated by the dot product of the characteristic vector of the player and the vector of the battlefield, and the winner of the battle is decided by comparing the strength of two competitors.

In the lesson we divide the class into several groups, and each group of students design a player of their own by adjusting the characteristic vector; weighing the power of the player in three elements. The characteristic vectors of the battlefields are designed by the teacher and presented with a vague explanation before the adjustment.

We expect our students to learn the use of dot product of two vectors, the calculating procedure, and the graphic representation in observing the process of battles in the tournament.

Abstract for 15296

INTERACTIVE GEOMETRY EDUCATION BY DEVELOPING OF MULTIMEDIA WEB RESOURCES

Authors: Maryam Behnoodi, Jun Moriyama
Affiliations: Kobe University-Japan, Associate Professor, Technology Education Hyogo University of Teachers Education

The purpose of this paper is to develop interactive web resources for high school mathematics, concentrating on Geometry, based on the results of our previous surveys (M. Behnoodi, J. Moriyama ATCM 2006) and (M. Behnoodi, J. Moriyama ATCM 2007).We designed the web resources in eight types of categories. Utilizing video conference, this web site taught 38 first-grade high school students in a city of Japan. Employing the ARCS model, online pre-testing and post-testing was used to evaluate the motivation for mathematics learning and to survey the usability, eagerness and motivation of the students. The results demonstrated the explanation and site structure had a significant positive impact on motivation. Further, although multimedia did not have a substantial impact on students' level of satisfaction, the effectiveness of multimedia design in changing the students' eagerness for usage of ICT was considerable. In light of these results, it is suggested to find the characteristics of visualizing in multimedia to make a meaningful relationship between multimedia and learning.

Abstract for 15300

SOME MATHEMATICS SUPPLEMENTS OF USING GRAPHIC CALCULATOR FOR VOCATIONAL HIGH SCHOOLS

Authors: Ming-Gong Lee, Zwei-Hong Hsiao

Affiliations: Department of Applied Mathematics, Chung Hua University, Hsin Chu, Taiwan

Keywords: Gmathematics supplement, graphic calculator, vocational high school, technology-based learning

In this paper, we showed some mathematics supplements by using capability of graphic calculator to assist learning mathematics for vocational high schools in Taiwan. In the supplement, graphic calculator is used to study how to solve mathematical application problems. Graphic calculator has never been used as a formal tool for vocational high school mathematics course in Taiwan, one of the reasons is that there is no proper supplement for use in the regular course. As a result, we designed a localized reference, which demonstrates how to use functions of graphic calculator step-by-step to solve mathematics problems. Output in the calculator was also converted into a Power Point file to guide first-time users how to operate this tool, most importantly, this supplement also covers part of the contents in the regular course to show how calculator as an aid. A localized webpage was given to demonstrate material that we have developed to help and enhance this technology-based learning environment. Some survey was given to show effectiveness of using this tool in learning and teaching mathematics by graphic calculator, if possible, here in Taiwan.

Abstract for 15306

NUMERICAL DERIVATIVES BY SYMBOLIC TOOLS IN MATLAB

Authors: Ming-Gong Lee, Hsuang-Chi Chang, Rei-Wei Song
Affiliations: Department of Applied Mathematics, Chung Hua University, Hsin Chu, Taiwan, Department of Applied Mathematics Chung Hua University

Keywords: ordinary differential equations (ODEs), numerical derivatives, Computer Algebra System (CAS)

Numerical approaches of ordinary differential equations (ODEs) usually require Jacobian evaluations and sometimes higher order derivatives of system of equations. The evaluation of these numerical derivatives can either use algebraic derivation or by the computer algebra system (CAS), such as MAPLE V, but these derivations may either cause debugging difficulty in programming or memory swell in computation. Finite difference formulas including forward difference, central difference, and backward difference are used to derive the Jacobian with different degree of accuracy. Symbolic evaluation capability of MATLAB is used to enhance fast derivation of numerical derivatives given in this paper. The accuracy of these numerical derivatives shows that the evaluation by symbolic computation from MATLAB is possible to be equipped into a numerical scheme of ordinary equations.

Abstract for 15308

EXPLORING BELIEFS AND PRACTICES TOWARD THE USE OF CALCULATOR AMONG SINGAPORE HEADS OF MATHEMATICS DEPARTMENT

Authors: Yeo Kai Kow Joseph
Affiliations: National Institute of Education

Keywords: Calculator, Beliefs, Heads of Mathematics Department

This exploratory study investigates the heads of mathematics departments' beliefs and practices toward the use of calculator in mathematics instruction. A survey was conducted among the 43 primary schools heads of mathematics department in Singapore. The beliefs and practices toward the use of calculator were measured using Brown et al (2007) survey instrument which consisted of twenty items which were divided into four categories. The categories were Catalyst Beliefs, Teacher knowledge, Crutch Beliefs and Teacher Practices. Descriptive statistics on the four categories were reported. Among the four categories, the perception of calculator use as a catalyst in mathematics instruction was reported the highest. The top three mean scores indicated agreement that students can learn mathematics through calculator use and make mathematics more interesting as well as using calculators in instruction will lead to better student understanding. The survey results shed light on heads of mathematics department self reported beliefs, knowledge, and practices which were consistent with elements of Singapore's Ministry of Education press release statement on the introduction of calculators in Primary 5 - 6 Mathematics in 2007.

Abstract for 15309

ASSESSMENT USING MATLAB - A PROJECT OVERVIEW

Authors: Husain Aftab, Muhammad Qasim, Kahkashan Iqbal
Affiliations: Karachi Institute of Economics & Technology, College of Engineering, Karachi Institute of Economics & Technology

Almost all academic institutes in Pakistan use database software for their students' assessment purposes. The database currently being used at Karachi Institute of Economics & Technology (PAF-KIET) has only two options of sum and average that our teachers use when they record marks in it. We have developed a software as a student project course named Probability & Statistics to improve the functionality and capability of this database. This assessment software uses different basic statistical options that can help educators, especially math educators, to make assessment of their students in general. We have developed it using MATLAB with a graphical user interface to make it user friendly.

Abstract for 15310

A QUIZ GENERATOR EXTENSION INSIDE CMS FOR MATHEMATICS LEARNING

Authors: Ouadi Driouech, Hongjoon Park, Youngcook Jun
Affiliations: Graduate School Sunchon National Univ., CTL at Sunchon National Univ., Dept. Computer Education at Sunchon National Univ.

Keywords: CMS, Joomla, Assessment, Bayesian Networks, Probabilistic Inference, Mathematics Learning

Addressing diagnostic assessments in e-learning projects is an important issue. Diagnostic assessment allows educators to assess student skills and progress. it provides diagnosis of students strengths and weaknesses. We decided to implement an intelligent diagnostic assessment tool for middle school mathematics using Bayesian Networks, since mathematics learning requires an extreme control of the learning process for a better outcome. In fact, the assessment tool is included in a quiz generator that we implemented, a tool that helps for automatic generation of quizzes. The quizzes generated by this tool infer the level of each mathematical skill or ability; therefore the student can follow a learning strategy that is suitable to him/her in order to reinforce his or her weak skills or abilities.

Since quizzes are brief assessments used to measure certain knowledge addressed in lecture materials, we decided to combine lecture materials and quizzes in single software (CMS or Content management System). The integration of the quiz generator in a CMS will not only allow students to easily refer to class material while reviewing for a quiz but also, the CMS will serve as common platform for other mathematical tools that we might integrate in the future. The implementation of such features will make our software more consistent. The present document describes how we implemented diagnostic assessment tool within a CMS using web programming techniques and Mathematica software.

Abstract for 15311

ON THE TESTS FOR UNIFORMLY CONVERGENCE OF SERIES OF FUNCTIONS

Authors: Seyed Ali Kazemipour, Mahdi Teimouri
Affiliations: Islamic Azad University Aliabad Katool branch

Sufficient conditions for uniformly convergence of infinite series of functions fn*gn have been expressed by Abel and Dirichlet's theorems. In this paper, we introduce a new concept of uniformly convergence where, besides above criterions one using this approach can determine whether an arbitrary infinite series of functions fn*gn is uniformly convergent or not. One of the most significant properties of proposed criterion is that the Abel and Dirichlet's measures may be unable to detect that an arbitrary series is uniformly convergent while our proposed introduced approach can.

Abstract for 15313

A VARIANT OF GPBiCG AR METHOD WITH REDUCTION OF COMPUTATIONAL COSTS

Authors: Moe Thuthu, Fujino Seiji
Affiliations: Graduate School of Information and Electrical Engineering, Kyushu University, Research Institute for Information Technology, Kyushu University, Japan

In numerical linear algebra, we have a number of iterative methods based on Krylov subspace method. GPBiCG AR method which we have proposed is an attractive alternative for solving safely linear equations with non-symmetric coefficient matrix. In this paper, we consider a variant of GPBiCG AR method with reduction of computational costs per single iteration. We refer to it as GPBiCGAR 2 method. Through numerical experiments, we will verify improvement of convergence rate of the variant with safety convergence.

Abstract for 15314

CG FRIENDLY PATTERNS OF PARALLELOGRAMS

Authors: Hiroshi Okumura
Affiliations: Maebashi Institute of Technology

A configuration consisting of parallelograms, which is well investigated and well expressed by using computer graphic tools, is constructed. Special cases of this configuration give several poplar figures.

Abstract for 15316

CURVE FITTING AND ANIMATED DRAWING THAI PAINTING

Authors: Nunnapad Toadithep
Affiliations: Department of Computing, Faculty of Science, Silpakorn University, 73000, Thailand.

My work is to develop the software to draw Thai Painting, Kanok is the ancient and at high level of line drawing. Kanok usually use in the Thai Lord way of life from the past time to now, decorate the property in celebration especially for the Royal. Young Thai people only know this art but have no a ability of drawing this arts. My work aims to make young Thai people familiar and appreciate this art. Tool of developing this work are image processing and animation in VPython with Bézier curve fitting. This software mimics the line pattern of Kanok and draw in animation way, showing every step of drawing. This software, an Artificial Artist draws every graphics of Thai Paintings well-done as an artist.

Abstract for 15317

VECTOR AND BIO-INSPIRED OF HAND MODELING ON THAI SIGN LANGUAGE

Authors: Nunnapad Toadithep
Affiliations: Department of Computing, Faculty of Science, Silpakorn University, 73000, Thailand.

My works is to develop the system of displaying Thai Sign Language through the Hand with Bio-Inspired that can do sign language which looked real with animation in VPython. The flexion and the extension of every finger and the other movements being as real as a man's. This work can manage deep to phalanges of every finger in two hands, for example Abduction/Adduction, Pronation/Supination and Lateral/Medial Rotation. Finally put together the sequences of movement show good enough to communicate with the Deaf and other person. With the Vector Object in VPython, make this work possible. VPython have many functions in vector; determine the degree of each vector or angle with 3D-axes.

Abstract for 15318

GRAPHING CALCULATOR ASSESSMENT RESEARCH DIRECTIONS

Authors: Allan White
Affiliations: University of Western Sydney

Keywords: Graphing calculator, Assessment,

Teachers play a key role in the school assessment process through their contribution to the teaching and learning of classroom mathematics and through their choice of assessment goals and instruments. Research points to the influence that knowledge and beliefs of teachers play in the quality of classroom use of graphing calculator. It has been argued that there are five broad categories of teacher behaviour when it comes to the integration of ICTs within their classroom. Teachers tend to view ICT as either: a demon; a servant; an idol; a partner; or, a liberator. These categories are discussed in relation to research findings and their implications for assessment with graphing calculators. This is a theoretical paper which attempts to address the question: In what ways does the graphing calculator expand the range of performances accessible through assessment? The paper concludes with a number of brief directions for designing mathematical questions involving the use of graphing calculators.

Abstract for 15324

CRITICAL THINKING SKILLS IN ONLINE MATHEMATICS DISCUSSION FORUMS AND MATHEMATICAL ACHIEVEMENT

Authors: Seibu Mary Jacob, Hong Kian Sam
Affiliations: Swinburne University of Technology (Sarawak Campus), Malaysia; University Malaysia Sarawak, Malaysia

Keywords: critical thinking, discussion forums, mathematical achievement

Critical thinking in mathematics problem solving sessions is the focus of the paper. This preliminary research study set out to examine the problem solving sessions activated through online Discussion Forums in Mathematics classes in a first year university course supported by the Blackboard Learning System. The study involved a group of 46 participants and has the following purposes: (a) to adapt a model to evaluate critical thinking, at individual level in mathematical problem solving sessions of online Discussion Forums; (b) to examine the relationship between mathematical achievement, as measured by the final examination grades and critical thinking in online Discussion Forums incorporated into a university mathematics course; (c) to check whether there has been a progression of critical thinking skills based on the discussion forum postings from forum 1 (Week 3) to forum 2 (Week 11) of the 14 week-long course. The analysis based on the model showed an overall increase in the total number of messages in forum 2 over forum 1. But lower phase of critical thinking was seen dominant and a slight dependence between mathematical achievement and students communication variables was observed.

Abstract for 15336

EXPLORATIONS AND REASONING IN THE DYNAMIC GEOMETRY ENVIRONMENT

Authors: Zhonghong Jiang
Affiliations: New York University

This article is to describe how the author took full advantage of the exploration feature of the Geometers Sketchpad, a dynamic geometry software package, to help the preservice secondary school mathematics teachers develop their good learning habits such as making and verifying conjectures, as well as their mathematical reasoning and proof abilities. Three examples are presented to show the role of students extensive GSP explorations - helping them discover important, interesting mathematical facts/ideas, which in turn became an impetus for generating proofs; and providing insights for them to come up with proof ideas.

Abstract for 15338

MODELLING WITH CABRI 3D TO ENHANCE A MORE CONSTRUCTIVIST APPROACH TO 3D GEOMETRY

Authors: Jean-Jacques Dahan
Affiliations: IREM of Toulouse

Our purpose in this paper is to show that a training session to Cabri 3D based on a specific modelling task, with specific planned stages can be didactically successful both in the short and in the long term. Our choices are justified by the results obtained by Kate Mackrell and Janet Ainley and Dave Pratt about designing tasks. The concept of geometric working space (GWS) of Alain Kuzniak will help us to justify the didactical importance of these choices. We will be able to observe particularly if the environment chosen by the teacher or the trainer can be adopted or approached by the learner during such training. We will also justify the importance of the choice of a task of modelling a phenomenon coming from real life.

Abstract for 15339

WEB BASED COMPUTER-ADAPTIVE MATHEMATICS MULTIPLE CHOICE ASSESSMENT (CAAS) USING THE NEW NRET SCORING METHOD

Authors: Sie Hoe Lau, Kian Sam Hong, Ngee Kiong Lau, Hasbee Usop
Affiliations: Universti Teknologi Mara Sarawak, Universiti Malaysia Sarawak, Malaysia, Universiti Teknologi Mara Sarawak, Malaysia, Universiti Malaysia Sarawak Malaysia

Multiple-Choice (MC) item is an important component of testing. However, there are many weaknesses related to the scoring of MC items. The conventional Number Right (NR) scoring has been consistently criticized for guessing and failure to credit partial knowledge. In addition, it does not capture the full information available in the responses concerning a student's ability. Although alternative scoring methods such as Confidence Weighting (CW), Probability Measurement (PM) and Elimination Testing (ET) are proposed, none has been widely accepted to replace the NR scoring. The main weaknesses of CW, PM and ET are their complex or confusing test instructions. NRET which is a hybrid of NR and ET are thus proposed as an alternative scoring method for MC items. With the advent of the internet, thus it is proposed in this study to develop and evaluate a web based Computer-Adaptive Multiple Choice Assessment (CAAS) that has the ability to score MCQ using the NRET method. In addition, this study also evaluates its effectiveness as a learning tool. This is an on-going project and this paper presents some initial findings of CAAS. The initial results indicated that CAAS has the potential to assist students in learning.

Abstract for 15341

"PREGUNTA, EXPLORA Y CONSTRUYE": ICT DIVERSIFICATION OF TRAINING OPTIONS

Authors: Edda Jiménez de la Rosa
Affiliations: National Pedagogical University, Sociedad Matematica Mexicana (SMM), Departamento de Matematica Educativa (DME) Cinvestav IPN

Keywords: ICT-enabled learning, Multimedia math activities

In the current communication some components and the first results of a national formative proposal are presented, as a support for teachers in the setup of Information and Communication Technologies, the main goal being fostering significant learning of the school matter of mathematics in the 5th and 6th grades of elementary school in Mexico. The formative proposal: "Pregunta, Explora y Construye. El uso de TIC" (Ask, Explore and Create. The use of ICT), offers teachers and principals of elementary education an activity CD and a printed guide; an interactive website, and a formative programme online; seeking promoting and strengthening the use of Information and Communication Technologies to enhance the handling of curricular subject matter at such levels.

The main purpose is to train and attend teachers in the construction of a particular and different pedagogical means implied in the use of sources, media and digital tools such as: virtuallity, interactivity and hyper textual multimedia. It also aims to enrich the teaching practices in the classroom with the possibilities offered by digital technologies, diversifying approaches and references of cognitive and conceptual construction of students requiring much more than the mastery of technical issues as they impact the subject matter and the ways of learning.

"Pregunta, Explora y Construye" comes from a research done in public schools among 5th and 6th grade teachers, throughout three school periods (2005-2008). The results of the field work allowed us to identify the Mexican teacher's needs on didactic and technological training after the incorporation of "Programa Enciclomedia" (the current educational strategy since 2003-2004, planned to widen the daily work of teachers through the use of Information and Communication Technologies).

Abstract for 15343

TASKS, TECHNOLOGIES AND AESTHETICS: ASPECTS OF ONE APPROACH TO THE "RECONCEPTUALIZATION" OF THE TEACHING AND LEARNING OF MATHEMATICS

Authors: William Higginson
Affiliations: Queen's University

Keywords: Reconceptualization, Tasks, Aesthetics

In December of 2006 participants at the 17th ICMI Study Conference: "Digital Technologies in Mathematics Education- Rethinking the Terrain" heard one of the keynote speakers argue that: "Although the computer hardware and software options have been present for decades, we have still not seen a major shift in pedagogy within our education systems such as was widely predicted... We need to dedicate perhaps 10% of our individual energy and working lives to the exploration of new ways of teaching-of reconceptualizing how it is that we teach and students learn mathematics at all levels". This paper is a response to that statement. Following a brief consideration of the claim, an extended example of a reconceptualized approach is developed. Three central characteristics of this constructive aesthetic approach are rich tasks, conceptual frameworks and powerful ideas.

Abstract for 15345

EXPLORING THE EFFECT OF USING GRAPHING CALCULATOR STRATEGY IN MATHEMATICS LEARNING ON STUDENTS METACOGNITIVE AWARENESS

Authors: Nor'ain Mohd. Tajudin, Rohani Ahmad Tarmizi
Affiliations: Universiti Pendidikan Sultan Idris, Institute for Mathematical Research, Institute for Mathematical research, Universiti Putra Malaysia, Serdang, Selangor, MALAYSIA

Keywords: Graphing calculator, metacognitive awareness

Two phases of quasi-experimental study with non-equivalent control group posttest only design were conducted to investigate the effects of using graphing calculators in mathematics teaching and learning on Form Four Malaysian secondary school students' level of metacognitive awareness. Experiment in Phase I was conducted for six weeks to provide an initial indicator of the effectiveness of graphing calculator strategy on students' metacognitive awareness. Graphing calculator strategy refers to the use of TI-83 Plus graphing calculator in teaching and learning of Straight Lines topic. The experimental group underwent learning using graphing calculator while the control group underwent learning using conventional instruction. Further, experiment in Phase II was carried out for six weeks incorporating comparison on two levels of mathematics ability (low and average) and two types of instructional strategy (graphing calculator strategy and conventional instruction strategy). The Metacognitive Awareness Survey instrument was used in this study. The data for Phase I were analysed using independent t-test and planned comparison test while data for Phase II were analysed using multiple analysis of variance and planned comparison test. The results of experiment in Phase I on analysis of metacognitive awareness of mathematics learners indicated that integrating the use of graphing calculators in teaching and learning of mathematics can improve level of students' metacognitive awareness.

The results of experiment in Phase II supported findings from experiment in Phase I pertaining to metacognitive awareness. The results showed a significant main effect of type of instructional strategy on mean overall level of metacognitive awareness, with large effect size of .73 based on Cohen (1988), implying that the GC strategy was effective in improving students' metacognitive awareness in solving Straight Lines problems. However, the interaction effect between mathematic ability levels and instructional strategy type were not significant. Thus overall, this study shows that the graphing calculator instruction induced higher levels of students' metacognitive awareness in learning of Straight Lines topic for both groups of low and average mathematics ability, thus helping students to achieve in-depth understanding of mathematical concepts and facilitating students in solving mathematical problems.

Abstract for 17501

CASE STUDY IN UNDERSTANDING CONCURRENCIES RELATED TO CEVA'S THEOREM USING THE GEOMETER'S SKETCHPAD

Authors: Chaweewan Kaewsaiha
Affiliations: Faculty of Science and Technology, Suan Sunandha Rajabhat University

Suan Sunandha Rajabhat University (SSRU) has offered Bachelor of Science Program in Informatics Mathematics, Bachelor of Education Program in Mathematics Education, and Master of Science Program in Informatics Mathematics Education. The Informatics Mathematics program focuses on two categories namely mathematics and information technology , Mathematics Education focuses on mathematics education, and Informatics Mathematics Education focuses on three categories namely mathematics, informatics, and mathematics education.

Case study done in this paper was a course content of elementary geometry : Concurrencies and Ceva's Theorem. The purpose of this study is to illustrate the use of the Geometer's Sketchpad (GSP) in rethinking for teaching and learning geometry for Mathematics Education students. The teaching method is cooperative learning approach through model CEDI (Constructing, Exploring, Discussion, and Informal deduction). By developing dynamic activity worksheets that can be readily modified to meet the objectives of content and needs of individual students it should be possible to greatly increase experience in " thinking " at different levels such as visualization, analysis, and informal deduction.

Abstract for 17502

ENHANCING TEACHING AND LEARNING OF AN APPLIED MATHEMATICS MODELING COURSE USING PROJECT-BASED LEARNING

Authors: Phattharawadee Hadkaew, Benchawan Wiwatanapataphee, Yong Hong Wu
Affiliations: Mahidol University, Bangkok, Thailand; Curtin University of Technology, Perth Australia

This paper proposes a project-based learning (PBL) model for the teaching and learning of an applied mathematics course: mathematical modeling of blood flow and drug delivery in the pulmonary tumour-induced capillary bed. In this model, firstly a hypermedia instruction software package, developed using Flash and C#, is used to introduce to students the basic concepts and technologies related to blood flow and drug delivery in the capillary bed. Then the instructors present workshops to analyze the complex phenomena in the vascular system with an emphasis on the pulmonary capillary bed, and to give an overview of recent progress on mathematical modeling in the field. Several projects are then introduced to students with project aims clearly identified. Students are then divided into small groups with 3 to 4 students in each group. Each group chooses one project and works on it as a team. The group activities include design of project, plan, assigning of project elements to each group member, discussion of research problem and etc. Depending on the nature of the project, each student's task may include internet search of literature, construction of models, computing and analysis of results. After all project elements have been completed, members in each group get together to discuss the final results and write up a project report. Finally, each group presents a seminar and defense the report.

Abstract for 17503

TEACHING-LEARNING TOOL FOR INTEGRAL CALCULUS

Authors: Sakda Noinang, Benchawan Wiwatanapataphee, Yong Hong Wu
Affiliations: Mahidol University, Bangkok, Thailand; Curtin University of Technology, Perth Australia

This paper presents an efficient Mathematics teaching-learning tool for integral calculus courses. The tool, consisting of a set of PowerPoint slides with Maple animation and interactive Maplets with Maple worksheets, is developed to help instructors to teach in class and to provide students with best opportunity for self-planned learning and self-assessment. More specifically, the PowerPoint slides with Maple animation help instructors to explain certain concepts and methods more effectively and clearly; while the interactive Maplets and Maple worksheets reinforce students' conceptual understanding of integral calculus.

Abstract for 17504

CASE STUDY IN SOLVING OPTIMIZATION PROBLEMS USING THE GEOMETER'S SKETCHPAD

Author: Ubol Klongkratoke
Affiliations: Department Informatics Mathematics, Faculty Science & Technology, University Rajabhat Suan Sunundha, Bangkok, Thailand.

The purpose of this study, which is a action research, is to study a behavior of the teaching students in the field of Mathematics, who are able to use the Geometer's Sketchpad (GSP) well in solving the maximum and minimum value problems by using GSP and developing models of solving problems properly. The fact found from this study will be used in the study of the first year university students in Science, the Faculty of Science and Technology, Suan Sunandha Rajaphat University, in the future.

Papers with Abstract Only

Abstract for 14955

GEOMETRICAL ACTIVITIES TO DEVELOP THINKING SKILL IN SECONDARY MATHEMATICS USING DYNAMIC GEOMETRY SOFTWARE GEOGEBRA

Authors: Venkataraman Swaminathan
Affiliations: Dunearn Secondary School Singapore, Minsitry of Education Singapore

Keywords: Geometry, Thinking skills, Secondary, Mathematics, Geogebra, DGS

Perhaps most importantly in today's information age, thinking skills are viewed as crucial for educated persons to cope with a rapidly changing world. Many teachers believe that specific knowledge will not be as important to tomorrow's workers and citizens as the ability to learn and make sense of new information (D. Gough, 1991). Thinking skills underpin using and applying mathematics and the broad strands of problem solving, communication and reasoning. Carefully defined geometrical activities will develop pupils'' thinking skills. Used well, this approach can focus pupils'' attention on the ''using and applying'' or thinking skills that they have used so that they can apply these skills more generally in their mathematics problem solving. But the main approach to using and applying mathematics and thinking skills is to integrate them within everyday teaching, thereby helping pupils to make the connections in learning associated with success in mathematics. For example, the geometrical activities described in this paper include some ''using and applying'' objectives. These activities will include applications that extend content beyond what has just been taught, familiar and unfamiliar problems in a real life context, some with a unique solution and some with several possible solutions, activities that develop short chains of deductive reasoning and concepts of proof in geometry and occasional opportunities to sustain thinking by tackling more complex problems. I like to present geometrical activities which will develop the five categories of thinking skills information processing skills, enquiry skills, creative thinking skills, reasoning skills and evaluation skills with the help of a Dynamic Geometry Software Geogebra.

Abstract for 14973

MODELLING WITH CABRI 3D TO ENHANCE A MORE CONSTRUCTIVIST APPROACH TO 3D GEOMETRY (PART 1)

Authors: Jean-Jacques Dahan
Affiliations: IREM of Toulouse

Keywords: paradiggm, GWS, modelisation, procedural, conceptual

One way to understand our real world is to model it. Cabri 3D allows us to use specific tools of space geometry to construct models of phenomena that we can observe. We will use the theoretical framework developed by Alain Kuzniak (G1 and G2 paradigms and the concept of geometry working space, GWS) to understand how “modeling” is a powerful way to build the knowledge of geometry. We will show with prototypical examples how modeling can successfully combine a procedural and a conceptual approach to geometry for teachers and learners. One of these examples is modeling the Cha Cha dance: this will be used to illustrate the changes of GWS during the process of modeling within a 3D DGS environment.

Abstract for 14974

Modelling with Cabri 3D to enhance a more constructivist approach to 3D geometry (part 2)

Authors: Jean-Jacques Dahan
Affiliations: IREM of Toulouse

Keywords: paradiggm, GWS, modelisation, procedural, conceptual

We will present several possible modelling activities with Cabri 3D (in relation with Kate Mackrell's work on this topic).

Some are at a student level (beginner in 3D geometry) showing that the ergonomy of Cabri 3D is well adapted to model reality by using the mathematical tools of construction and transformation.

Some are at a teacher level (beginner in Cabri 3D) showing that it is possible to train teachers in such a way as to progress very quickly from the step by step procedural approach to a conceptual approach in which they use Cabri 3D independently to solve the problem.

Abstract for 14981

AN APPLICATION FOR INTERACTIVE MATHEMATICS TEACHING BY USING INTERNET

Authors: Guner ILICAN
Affiliations: Anadolu University

Keywords: Interactive teaching, traditional method, mathematics education.

The purpose of this study is to compare the teaching of "limit" subject with interactive education by using Internet technology with traditional method. The study was carried out with 40 students attending Program in Primary School Mathematics Teaching Faculty of Education Anadolu University, in Eskisehir Turkey. Experimental method was used pre and post test control group. The collected data were analyzed.

Abstract for 14987

VISUAL ANGLE ON THE UNIT SPHERE

Authors: Yoichi Maeda
Affiliations: Tokai University

Let AOB be a triangle in the three dimensional Euclidean space. When we look at this triangle from various viewpoints, the angle AOB changes its appearance, and its ''visual size'' is not constant. This visual angle is realized on the unit sphere centered at O. In this paper, we will investigate the contours of visual size in the unit sphere. Several geometric properties and a stochastic property are presented.

Abstract for 14988

FACTORS INFLUENCING TEACHER INTEGRATION OF THE GEOMETER'S SKETCHPAD IN TEACHING MATHEMATICS

Authors: Warabhorn Preechaporn, Cheah Ui Hock
Affiliations: SEAMEO RECSAM, Penang, Malaysia, SEAMEO RECSAM, Penang, Malaysia

Keywords: The Geometer's Sketchpad, secondary mathematics classroom, ICT, attitude, factor

The Geometer's Sketchpad (GSP) is now being more widely used in the secondary mathematics classroom. However, many mathematics teachers do not seem to use the GSP in classroom, so it appears that further analysis of the factors acting as possible affordances and constraints to use of the GSP is necessary. This research addressed this issue of the potential technology knowledge and constrains for secondary mathematics teachers using the GSP in their classroom. Three major areas where such factors are found are: those emanating from the individual teacher themselves; the experience of the teacher; and attitudes towards Information and Communication Technology (ICT) namely: enjoyment, classroom dynamic, productivity, problem solving, and teachers' belief. In this study we investigate to identify teachers who could be the GSP users in mathematics classroom. We describe and analyze the kind of use that these teachers are making of the GSP in terms of how they use with the students, identify individual, obstacle and constraints that could be assisting or preventing ICT use. From among these factors key variables that seem to be driving successful implementation of using the GSP are identified.

Abstract for 15003

THE USE OF ECASESTUDY IN MATHEMATICS TEACHER EDUCATION

Authors: Ban Har Yeap, Mazlan Hasan, Pratima Majal
Affiliations: National Institute of Education, National Institute of Education Singapore

Keywords: professional development, eCase Study

This paper describes an initiative using ICT to forge a closer theory and practice link in mathematics teacher education. The reality of primary-level mathematics classroom is brought to student-teachers for them to learn key mathematics education principles. With the help of ICT, such realistic cases are made vailabale to the student-teachers more frequently than observing live lessons. This paper documents the project as well as the effectiveness of the eCase Study and technological features that contribute to the effective learning on the part of the student teachers.

Abstract for 15014

EVERYTHING IS EASIER ON A TABLET

Authors: Denise LeGrand
Affiliations: University of Arkansas at Little Rock

Tablet PC's have revolutionized the way we teach mathematics. Lecturing via this digital whiteboard has made the presentation of mathematical material, symbols and equations in particular, accessible through the internet. The material can either be prepared in advance and annotated during the lecture or presented "on the fly? The resulting screen captured videos are then produced and uploaded to the department server as well as the notes so that students may immediately view them either after class (for a traditional classroom) or at their convenience. Maple and virtual calculators can also be recorded on the screen to show step by step instructions. Maple Labs are required in our calculus classes and these can be easily marked and graded using the Tablet PC and then emailed back to the students for almost immediate feedback. Online homework can be copied and pasted into Journal and then worked to provide the students with answers to their questions. We have found the Tablet PC to be such an invaluable tool that all faculty are provided with one and all of our classrooms are tablet friendly, meaning they connect directly to a projector. The many uses of the Tablet PC will be described and demonstrated in this paper.

Abstract for 15016

INTERVAL COMPUTATIONS TECHNOLOGY IN MATHEMATICS RESEARCH: FROM HELP IN THEORETICAL BREAKTHROUGHS TO PRACTICALLY USEFUL RESULTS ABOUT NUMERICAL METHODS

Authors: Roberto Araiza, Olga Kosheleva, Vladik Kreinovich, Pavel Solin
Affiliations: University of Texas at El Paso

Keywords: interval computations, computer proofs, mathematics research using technology, higher order finite element methods

In many practical situations, we are interested in a quantity y that is difficult or even impossible to measure directly. For example, it is difficult to directly measure the amount of oil in an oil field or the distance to a faraway star. To estimate the desired quantity y, we measure auxiliary quantities which are related to y in a known way, and then use the results of measuring these quantities (and their known relation with y) to estimate y. For example, in geosciences, to estimate the density of the material at a large depth, we measure travel times of seismic waves, gravity values at different locations, etc. The corresponding estimation (data processing) is one of the main applications of high performance computers.

Most data processing algorithms result in a numerical estimate for the desired quantity y. In practice, the relation between y and the auxiliary quantities may be known only approximately, and due to inevitable measurement inaccuracies, the results of measuring the auxiliary quantities are also only approximately equal

to the actual (unknown) values of these quantities. It is therefore important to gauge how this uncertainty affects the result y of data processing, i.e., how accurate is the result of data processing.

Textbook approach to processing measurement uncertainty usually assumes that we know the probability distributions of measurement errors. In practice, however, these probabilities are often unknown; we only know the upper bounds on the measurement errors. In such situations, if we know the measurement result X and the upper bound D on the measurement error, then the only information that we can conclude about the actual (unknown) value of x is that x is in the interval [X-D,X+D]. It is therefore desirable to propagate this uncertainty through data processing algorithms and compute the resulting interval of possible values of y. There exist many techniques for such interval computations; see, e.g. http://www.cs.utep.edu/interval-comp. These techniques use high performance computers to estimate the accuracy of y.

Interval computations techniques guarantee certain bounds on the quantity y which is related to known interval-bounded quantities. Thus, they can be also used to prove (guarantee) that certain inequalities hold for all the values within given intervals. This property of interval computations has been successfully used in several recent mathematical breakthroughs such as J. Hass and R. Schlafly''s 1995 solution to the "double bubble" iso-perimetric problem and a more recent T. C. Hales'' solution of the Kepler conjecture about the densest arrangement of spheres in space.

In this talk, we show that interval computations technology can be useful not only in solving open problems of pure mathematics, but also in proving results from applied mathematics. As a case study, we will show how these techniques can be used to prove results about numerical methods, e.g., to prove a discrete non-negativity conservation principle for a certain class of higher order finite element methods.

Abstract for 15019

HANDLING PROVENANCE, INCLUDING MATHEMATICAL PROOFS, IN CYBER INFRASTRUCTURE-ORIENTED DATA PROCESSING

Authors: Ann Gates, Olga Kosheleva, Vladik Kreinovich, Sa-aat Niwitpong, Paulo Pinheiro da Silva, Leonardo Salayandia
Affiliations: University of Texas at El Paso, King Mongkut's University of Technology North Bangkok

Keywords: cyber infrastructure, provenance, statistical analysis of decentralized data, decentralized proofs

Traditionally, computations used to be several orders of magnitude faster than communications. As a result, to avoid the drastic slowdown caused by communications, researchers tended to bring all the data into a central location and process this data there. For example, NASA maintained a central depository of satellite images, US Geological Survey tried to collect and store all geophysics-related data, etc.

Centralized data storage also enabled researchers to take care of the fact that different instruments at different locations produce data in different formats; the centralized storage enabled the researchers to pre-transform all the data into a standard format. The downside of this pre-transformation is that it is very time consuming; as a result, by the time the existing data is transformed, a large amount of new data appears.

Lately, web communications have become much faster -- to the extent that it is often much faster to get the results from a nearby computer than from your own disk space. Thus, it makes sense to avoid time-consuming data transfer and data transformation, to keep all the data in their original storage place and in their original format -- and to design cyber infrastructure enabling the automatic on-demand transfer and format transformation. Such cyber infrastructure has been successfully developed for astronomy, bioinformatics, geology, and many other applications. Our NSF-supported CyberShare center aims at expanding this successful technology to other application areas.

Cyber infrastructure brings new aspects to the important questions of accuracy and reliability of the results of data processing. To answer these questions, we must keep track of the origin (provenance) of the data and of the algorithms that are used for pre-processing the data. For gauging accuracy and reliability of data, we must modify the existing statistical techniques so that they can easily handle decentralized data and decentralized algorithms.

For handling algorithms provenance, we need to handle different types of such provenance ranging from expert opinion on heuristic techniques to experimental confirmation of semi-heuristic numerical methods to formal proofs of algorithm correctness. In line with the main ideas behind cyber infrastructure, it is desirable to combine and process these provenances without moving them to a central location. This necessitates, e.g., a need to keep the proof of correctness of the combined algorithm de-centralized, with proofs of component correctness stored at local machines. In this talk, we describe techniques and algorithm for handling such provenance issues in cyber infrastructure.

Abstract for 15030

ENHANCING CONCEPTUAL UNDERSTANDING OF INTEGRATION USING AN INTERACTIVE MULTIMEDIA COURSEWARE

Authors: Hong Eng Ding
Affiliations: Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia

Keywords: Integration, Teaching Courseware

Integration is one of the Form 5 topics in Malaysian Additional Mathematics Syllabus. In this topic, the concepts of Integration, and its application to find the area and volume are introduced. Students usually find the concepts in this topic abstract especially determining areas under the curves and volumes of revolution. The Ministry of Education, Malaysia has developed a teaching courseware to facilitate the teaching and learning of Additional Mathematics. This paper presents how an interactive multimedia environment can be created using the courseware to enhance the conceptual understanding of Integration and its applications. Multimedia interactive lessons based on mathematical learning models and learning styles of students are used to enhance the understanding of concepts and mastering of skills. Vivid three-dimensional simulation examples are displayed to arouse the students' interest and capture their attentions. Interactive exercises are provided to achieve the learning objectives and outcomes. The effective use of the teaching courseware has transformed abstract and difficult lessons on Integration to stimulating sessions where students can visualize the concepts and enhance their problem solving skills.

Abstract for 15035

FUZZY INVENTORY MODEL WITH DETERORATING ITEM WITH CONSTANT DEMAND RATE.

Authors: Maheswari Ramachandran, Nagoor Gani
Affiliations: HOLY CROSS COLLEGE, DEPARTMENT OF MATHEMATICS, Jamal Mohamed college Department of Mathematics

Keywords: inventory, EOQ, constant and finite dependent demand rate

In this paper an infinite line horizon inventory model has been developed for deteriorating item assuming the demand rate to be constant for some time and then as a linear function of time. Ordering cost, carrying cost and demand rate, imprecise in nature are considered as fuzzy parameters. Representing all these by fuzzy number, using Function Principle the optimum order quantity is calculated. This model is illustrated with a help of numerical method.

Abstract for 15038

IMPLEMENTING CREATIVE AND ACTIVE LEARNING ENVIRONMENT IN MATHEMATICS EDUCATION CLASSES FOR FUTURE TEACHERS THROUGH INCORPORATION OF TABLET PC TECHNOLOGY

Authors: Olga Kosheleva
Affiliations: University of Texas at El Paso

Keywords: mathematics teaching, learning and assessment using technology, mathematics pedagogy, pre-service teachers'' education

We will present innovative technological approaches utilized in mathematics education classes at the University of Texas at El Paso. Mobile Lab of Tablet PCs has been used for several semesters in mathematics education classes for future teachers. The technology-enhanced mathematic methods course for pre-service teachers was designed in the following way. During their senior year pre-service elementary teachers were enrolled in mathematics content and mathematics methods as well as in internships at local elementary schools. Mathematical content study involved series of rich, discovery-based mathematics investigations. During mathematical methods class students had the in-depth discussions on topics in the methods textbook. Future teachers discussed and prepared innovative technology-enhanced mathematical lessons. Students used Tablet PCs to conduct explorations and investigations; they researched and created unique virtual manipulatives, interactive games to be used in the mathematical lessons. This technology's wireless capabilities allowed students to receive a fast evaluation feedback through the WebCT discussion and "Discourse" software. Students taught mathematical lessons in local elementary schools during their internship, in the after-school mathematics program for gifted and talented children, and during community Parent Power Nights (PPN) events organized several times during semester. PPN activities were designed with the purpose of engaging parents, community members and pre-service teachers in meaningful technology-enhanced investigations of mathematical concepts.

This approach helped bring active learning and creative approaches to teaching and learning mathematics in mathematics education of future teachers. Evidence of future teachers' improvement of mathematical conceptual understanding through examples of students'''' works, reflections, and pre/post-test will be discussed.

Abstract for 15077

THE PROTOTYPICAL EXPERIENCES THAT ARE NECESSARY FOR UNDERSTANDING MATHEMATICS

Authors: Shin Watanabe
Affiliations: Tokai University

It is difficult to understand abstract mathematics. If students have some prototypical experience in life, students can learn and enhance their mathematical understands better. With technological tools such as graphic calculators, students understand more complex mathematics. They can visualize the definition and the differentiation of the trigonometry function with the concrete method. Next we can understand them using the body with CBL. In this presentation, we will see the abstract definitions of the trigonometry function on the graphic calculator, and we use the CBL with real life problems to understand the definition of the trigonometry of two valuables of a function, which are the time and the distance. We want to explore all variables by using the technology. The prototypical experience is very important to understand mathematics. We demonstrate the composite function y=sin(2x), with y=2x and y=sin(x). Furthermore, we demonstrate the differences between y=sin(2x) and y=2sin(x), and their respective derivatives.

Abstract for 15142

USING GRAPHING CALCULATOR IN TEACHING AND LEARNING MATHEMATICS

Authors: Nittayaporn Bunyasiri
Affiliations: IPST

Keywords: Handheld, Teaching Mathematics.

Graphing Calculator is another good instrument for teaching and learning mathematics in high school level. With this tool, the students have an opportunity to prove many theorems or to solve mathematics problems by themselves. With Power Point presentation, we will talk briefly about why and how do we use TI ?graphing calculator in the mathematics classroom. And we will use TI-Flash Debuggers to show how to use graphing calculator to calculate, draw interesting graphs and how to use application programs. Included in the presentation, practical examples in using Calculator for investigating activities to solve higher-order thinking

problem in teaching and learning Mathematics will be discussed. It's also good for Cooperative learning approach.

All participants will get hand-outs and TI-Flash Debuggers software.

Abstract for 15211

EXAMPLES OF MATH ASSIGNMENTS USING MATLAB AND INTERNET

Authors: Sarwar J. Abbasi, Kahkashan Iqbal
Affiliations: Karachi Institute of Economics & Technology, Department of Mathematics, University of Karachi, Karachi, Pakistan

In 2007, we had concluded in [1] after studying a sample of 75 students' responses at under /and post graduate levels in Karachi, Pakistan that math teaching can be made interesting by dedication of the math teacher, by giving the students logical and concrete examples and by equipping students with know-how of math software and technology. In this paper, we extend our work by combining the last two effective [1] ways. That is, we examine some math assignments for creating good examples for students' learning of Mathematics while with the assistance of technology. These assignments were given to the engineering students of PAF-KIET in the course of "Vector Analysis and Multivariable Calculus" at undergraduate level in supervision of the second author. These examples include construction of polar flower, geometric designs by polar equations and graphing space curves traced by the position vector r using Matlab and plotting z = f (x, y) surfaces using live math software and internet.

Abstract for 15214

THE FOURIER SPECTRAL METHOD FOR THE SIVASHINSKY EQUATION

Authors: Abdur Rashid, Ahmad Izani Md. Ismail
Affiliations: University Sains Malaysia, Penang, Malaysia

Keywords: Sivashinsky equation, Fourier Spectral Method

In this paper, a Fourier spectral method for solving the Sivashinsky equation with periodic boundary conditions is developed. We establish semi-discrete and fully discrete schemes of the Fourier spectral method. A fully discrete scheme is constructed in such a way that the linear part is treated implicitly and the nonlinear part explicitly. We use an energy estimation method to obtain error estimates for the approximate solutions. We also perform some numerical experiments.

Abstract for 15225

THE IMPACT OF VIRTUAL MANIPULATIVES ON THIRD GRADERS – LEARNING OF PERIMETER AND AREA

Authors: Yuan Yuan
Affiliations: Chung Yuan Christian University

Keywords: virtual manipulatives, third grader, perimeter, area

The researcher developed a web-based virtual manipulative (Magic Board) and used it to design an instructional material for third grade teachers¡¦ teaching of perimeter and area unit. A pretest-posttest quasi-experimental design was used to examine the effectiveness of using this instructional material to introduce concepts of perimeter and area. The study involved 63 students in two different classes of an elementary school at Hsinchu city in Taiwan. The classes were randomly assigned to two methods of instruction; a virtual manipulative group and a traditional group. Equivalency of treatment groups was determined by independent t-test on pre-test scores. A posttest was conducted to measure immediate treatment effect. To measure retention, the posttest was used again two weeks after the posttest was first administered to students. For an in-depth comparison between the two groups, the classroom climate and interactions among students and teachers were also investigated.

Research results showed that the virtual manipulative group outperformed the traditional group in the posttest and retention test. The use of Magic Board did help students' learning of the concepts of perimeter and area. It was observed that Magic Board provided clear images for teachers to explain concepts, and students paid more attentions on learning materials. Students were happy to learn mathematics in this interactive environment. It is believed that Magic Board can be an instructional aid in designing instructional materials.

Abstract for 15255

PREPARING THE 21ST CENTURY WORKFORCE BY BUILDING BRIDGES OF MATHEMATICAL UNDERSTANDING

Authors: Premjit Singh
Affiliations: Dept. of Mathematics, Ohio University

Keywords: Mathematical understanding

To remain competitive in the world it is absolutely necessary that our students not only satisfy mathematics requirements to graduate, but have a true understanding of mathematical concepts and their real-life applications.

My presentation will provide a framework for what math educators can do to prepare their students to be successful in the increasingly competitive 21st century workforce

Abstract for 15266

STORIES WITH SKETCHPAD: NARRATIVE THINKING IN DYNAMIC MATHEMATICAL REPRESENTATIONS

Authors: Nathalie Sinclair
Affiliations: Simon Fraser University

Keywords: Dynamic Geometry, Narrative, Paradigmatic, Functions, Behaviour

In his work on human cognition, Bruner (1996) distinguishes between narrative and paradigmatic modes of thinking. While the latter is closely associated with mathematics, Bruner's writings indicate the former contributes non-trivially to the learning of mathematics. In this paper, we argue that the very nature of dynamic geometry—being intrinsically temporal, occurring over time—offers very different opportunities for narrative thinking than do the traditional static diagrams and pictures usually available to learners. Using examples from our research, we analyze these opportunities both in terms of their potential for enhancing understanding and of their relation to the kind of paradigmatic thinking that usually constitutes mathematical knowledge.

Abstract for 15290

AN EXPLORATION OF STUDENTS' EXPERIENCES IN THE LEARNING OF MATHEMATICS MEDIATED BY COMPUTER ALGEBRA SYSTEMS

Authors: Jeevasundarie Periasamy
Affiliations: University of Johannesburg

Keywords: activity theory, mathematical learning

In this paper, I explore the practical experiences of engineering students towards using Computer Algebra Systems (CAS), namely, MATLAB to learn numerical methods. The students were registered for vocational programmes in mechanical and electrical engineering at a South African university. I examine data obtained from interviews and screen recordings of three case study students from an activity theory perspective. More specifically I drew on the theory as outlined by Leontiev (1981) to interpret this data. Leontiev's three-level scheme of an activity the activity level, the action level and the operation level provides different lenses for

analysis. At the global level, Leontiev distinguishes activities on the basis of motives. Activities comprises of actions which are goal-oriented. Actions comprise of operations and at the operational level the use of tools, algorithms and unconscious aspects are highlighted. I discuss and compare certain actions that students consciously adopt across two different learning activities: when they learn mathematics (without a CAS) and when they solve differential equations using MATLAB.

This study is important to inform educators (as well as curriculum planners) about the various experiences of students when they learn to use a CAS in mathematical learning. It will assist us in understanding how and why students use CAS in the manner that they do.

Abstract for 15293

USING WEBWORK AT QATAR UNIVERSITY

Authors: Mahmoud Alrefaei
Affiliations: Qatar University, Jordan University of Science and technology

WeBWork is a free open-source, easy to use system for delivering mathematics assignments over the web. It was developed at Rochester University and has been adapted by Mathematical Association of America MAA (http://webwork.maa.org/wiki/Main_Page). The WeBWork generates, deliver, and automatically grade homework problems. It provides immediate feedback for students so they can keep trying until they correct their answers. It contains thousands of problems in mathematics courses. It also prevents cheating by providing individualized problems. In this talk, we provide our experience in using WeBWork at Qatar University for support teaching calculus courses. We also give details about its features and guide interested instructors how to create accounts and how to install the WeBWork on their local systems. Finally, we refer the audience to some sources and where they can seek help for the WeBWork.

Abstract for 15295

POLYHEDRA WITH CABRI 3D: STELLATIONS, TRUNCATIONS AND OTHER VARIATIONS

Authors: Kate Mackrell
Affiliations: Institute of Education, University of London, UK

Keywords: Cabri 3D

It is possible to create quite stunningly beautiful polyhedra using Cabri 3D. This talk will demonstrate a means to relatively easily create the stellations of an icosahedron by means of a variation on the Schumann procedure for creating an articulated dodecahedron. Some interesting possibilities for dynamic “truncations” of various polyhedra and for the creation of geodesic domes and flexible polyhedra will also be shown.

(Please note: I simply haven’t had time to write a full paper before 30 July. I would be happy to send screenshots, etc, to give a better idea of what I propose to talk about, however.)

Abstract for 15298

A SUFFICIENT CONDITION FOR STARLIKENESS BY USING MATHEMATICA 3.0

Authors: Marjono Marjono
Affiliations: Mathematics Department, University of Brawijaya

Keywords: univalent function, starlikeness, mathematica 3.0

In this paper, we will consider a problem posed by Miller and Mocanu. The question is to find the maximum value of A such that for f is analytic in D, |f''(z)/f'(z)|

Abstract for 15302

CLASSIFYING AND MATCHING PATTERNS IN GENETIC CODE USING FINITE AUTOMATA AND MATLAB WITH AN APPLICATION TO BETA-THALASSEMIA

Authors: Rapin Sunthornwat, Elvin James Moore, Yaowadee Temtanapat
Affiliations: Department of Mathematics, King Mongkut's University of Technology North Bangkok, Department of Mathematics King Mongkut's University of Technology North Bangkok Bangkok Thailand 10800, Department of Computer and Information Science King Mongkut's University of Technology North Bangkok Bangkok Thailand 10800

Keywords: Genetic code, Symmetric Group, Finite State Automaton, Beta-thalassemia

Beta-thalassemia is a common disease in peoples of the Northern and Northeastern regions of Thailand. The general causes of the disease are mutations in the £]-globin gene. In Thailand, the most common genetic causes of the diseases have been found to be a nonfunctional mRNA mutation, an mRNA processing mutation and a transcription mutation. The genetic information in DNA is contained in sequences of the four bases guanine (G), cytosine (C), thymine (T) and adenine (A), whereas in RNA the base uracil (U) replaces the thymine. The information is organized into triplets of bases called codons which code for specific amino acids. The mutations common in Beta-thalassemia result in replacement in specific codons of bases G and/or C by T (DNA) or U (RNA). In this paper we develop methods that can be used for classifying and matching codon mutation patterns that commonly occur in Beta-thalassemia patients in Thailand. The classification is carried out using group theory methods and the pattern matching is done using finite automata theory and regular expressions. A MATLAB program based on a finite automaton is developed that can rapidly search for mutation patterns that are characteristic of Beta-thalassemia in Thailand.

Abstract for 15312

WEBQUEST IN THE PURSUIT OF PROBLEM-BASED LEARNING

Authors: Teoh Boon Tat, Warabhorn Preechaporn
Affiliations: SEAMEO RECSAM, Penang, Malaysia, SEAMEO RECSAM, Penang, Malaysia

Keywords: WebQuest, Problem-Based Learning, PBL, Scenarios, Role play

WebQuest is an interesting learning tool in the pursuit of information on the web. Problem-based learning (PBL) provides the environment for that pursuit. To enhance the effectiveness and efficiency of the PBL learning environment, real life problem situations, rich task scenarios and stakeholdership are among the crucial criteria.

In this paper, a PBL activity making use of the WebQuest was designed with great emphasis on the above criteria. The activity called 'Back to the Future' required the students to role play as Fund Managers. They were transported to different time periods in the various scenarios. They made informed decisions in order to maximize profit in their investments. Their product was an investment report. Various assessments were conducted.

Abstract for 15315

EXISTENCE AND UNIQUENESS OF A NONLINEAR INTEGRAL EQUATION FROM BCS

Authors: Janpou Nee
Affiliations: Chenh-Kuo Technology

Keywords: existence and uniqueness of positive solutions, system of integral equations

We prove the existence and uniqueness of positive nontrivial solution to the system of nonlinear integral equation arising from the model of anisotropic multiband BCS Gap Equations of superconductivity. Moreover, we show that the critical temperature of the occurrence of superconductivity can be determined through the first eigenvalue of the kernel function of the system of the nonlinear integral equation. Thus the critical temperature of a multiband BCS Gap equation is in fact determined by a singleton equation.

Abstract for 15321

THE UNIQUENESS AND EXISTENCE OF CHERN-SIMON EQUATION

Authors: Janpou Nee, Tsang-Hwai Hwang, Wei-Ling Liu
Affiliations: Chenh-Kuo Technology, Lecturer

Keywords: Ricci flow, uniqueness and existence of solution, symmetry solution

We use the idea of Ricci flow to show the uniqueness of Chern-Simon equation with Dirichlet or Neumann boundary condition. On the other hand, the nonzero boundary condition yields existence of the equation. To explore the behavior of the solution, we study the behavior of the symmetry solution under certain positive boundary condition. Our results indicate that the symmetry solution is monotone and remain constant sign in the whole domain.

Abstract for 15323

DISTANCE LEARNING SYSTEM FOR TEACHING MATHEMATICS IN CAMBODIA: PROBLEMS AND SOLUTIONS

Authors: Chan Roath
Affiliations: Ministry of Education

Capacity building for teachers and students is one of the major key which affects to the economic development in Cambodia. Ministry of Education Youth and Sport (MoEYS) acknowledges that the use of Information Technology is the primary tool to provide the quality of education especially in the field of mathematics.

In 2007, a research project named "Distance Learning System for Teaching Mathematics in Cambodia: problems and solutions" was conducted for the first time in Cambodia in order to improve the quality of mathematics teachers at all provincials through a distance learning system. This project was intended to learn the impacts of the distance learners related to the mathematics content, evaluate the use of Information Communications Technology (ICT) for mathematics training, and learn about the attitudes of learners with the distance learning method in Cambodia.

The main goal of this project was expected in using hybrid learning method to fulfill the weakness of face-to-face mathematics learning in Cambodia which is lack of quality, and waste a lot of budget and time. In addition, we aimed to identify other crucial factors which were needed to achieve by hybrid learning method to teach mathematics effectively and sustainability.

We found that the great emphasis was given for setting up ICT infrastructure and providing computer literacy in learning mathematics. A specially designed policy on educational innovations is needed in order to support the use of ICT in education and mathematics. Furthermore, it is crucial to integrate ICT issues with the curriculum of mathematics education. So this could replace traditional teaching methods by using new teaching tools and technology. However currently, we haven't had adequate experiences yet on computer and technology based training especially in the field of mathematics. Therefore teaching mathematics using ICT, the main attention should be paid not only to technical provision of tools but also the account of the ICT impact on students' mentality, their abilities to construct their own knowledge, teacher-student relationship, and inclusion to the curriculum of mathematics.

Abstract for 15326

SOFTWARE FOR DYNAMICALLY VISUALIZING INTERSECTIONS OF QUADRATIC CURVES IN THE TWO-DIMENSIONAL COMPLEX SPACE

Authors: Akihiro Matsuura, Tohru Iijima
Affiliations: Tokyo Denki University, Nippon Information Corp.

Keywords: quadratic curves, intersections, visualization, complex space, dynamic software

In the real plane, two circles do not necessarily intersect; however, when the coordinates are allowed to be complex, they always intersect at two points in the two-dimensional complex space when a double root is counted twice. Then, where are the intersections actually located in the complex space and how do they behave when the circles are moved in the real plane? Furthermore, how about the cases of the other quadratic curves? We develop mathematical software which dynamically visualizes the intersections between two arbitrary quadratic curves, i.e., ellipses, parabolas, and hyperbolas, in the two-dimensional complex space. Generally, there are at most four intersections between two quadratic curves. In our software, these intersections are drawn using two complex planes which correspond to the x- and y-coordinates. Users can decide the types and parameters of the quadratic curves, modify or move them in the real plane, and observe the intersections and the loci drawn in the two-dimensional complex space. We show a variety of examples of the pairs of quadratic curves for which intersections and the loci are worth being mathematically investigated and are also visually appealing. Our software provides learners a new way of looking at mathematical forms in the complex space which are originally invisible (in the real plane). The dynamic and interactive aspects of the software would also help learners to make mathematical experiments by themselves and to derive general statements. To evaluate the efficiency of the software should be our future work.

This work was partially supported by Research Institute for Science and Technology of Tokyo Denki University Q06J-09 / Japan.

Abstract for 15333

DATA ANALYSIS FOR MATHEMATICS LEARNING USING TI-NSPIRE AND FATHOM

Authors: Steve Rasmussen
Affiliations: Key Curriculum Press

The latest release of TI-Nspire, the new handheld mathematics learning platform from Texas Instruments, includes data analysis capabilities based on the multiple representation and dynamic manipulation tools found in Fathom. In this session, we'll explore ways to exploit both environments to enhance mathematics teaching and learning.

Abstract for 15344

Teaching in elementary school with technology: how teachers use innovative online resources in their mathematics and science lessons?

Authors: Olga Kosheleva, Pilar Gonzalez
Affiliations: University of Texas at El Paso

Keywords: Mathematics Education, Technology, Online Learning.

In this study we qualitatively analyzed electronic discourse in the online graduate course "Mathematics and Science Concepts in Elementary Childhood". The purpose of this study was: a) to identify the teacher's attitudes towards using Internet resources, and b) to motivate teachers to integrate the use of technology and c) to study how in-service and pre-service teachers find, access, and use technology resources. Teaching graduate class about basic mathematics and science concepts online leads to natural incorporation of activities including exploration of mathematics and science resources available online.

Students were provided with modules that were intended to be covered on a weekly basis. The main activities were to 1) read chapters from textbooks, 2) post a personal reflection on the chapter, 3) search and critically assess the companion websites, 4) read their classmates' reflections, 5) and complete Thematic Unit consisting of several technology-enhanced mathematical and science integrated lesson plans. We assessed students'' success, participation in class and use of online resources through personal reflections, surveys and semi-structured interviews. The preliminary results of this study indicate that 1) developing advanced strategies for searching online resources are appropriate and effective activities for an online mathematics/science education class, 2) chapter readings provided good content knowledge about reform, innovative, constructivist pedagogy that helped develop strategies for Internet searching, 3) as evidenced by final surveys, most of the students became more active and efficient in finding relevant and meaningful online resources for teaching mathematics and science in elementary grades.

Abstract for 15376

A CONCEPTUAL VIEW OF MATHEMATICS EDUCATION IN INTERDISCIPLINARY CONTEXT

Authors: Mohamed Nouh
Affiliations: Faculty of education, Alexandria University

Mathematics is a language of communication, reasoning and modeling. It has multi-faces; logical, intuitive, social. Interdisciplinary is a critical concept in science and education. The current intention is to understand the influences of interdisciplinary on the scientific, social and educational changes - today and in the future. Interdisciplinary is a '' scientific unity '' between sciences and arts. The goal is for ''sensing future''. In the academic picture; interdisciplinary is a '' common academic position '' that focuses on common concepts between sciences and opening up the discipline-as mathematics- across the others, for making sense of future.

Mathematics in interdisciplinary context means reflecting mathematical power across science, society, environment, and economics,....The essential mathematical concepts and abstractions -as number, function equation...and ration-are powerful tools for making ''integrating thinking''. Interdisciplinary presents the ''living meaning" of mathematical abstractions. The internal issues about mathematics are critical considerations to reflect mathematics across multi - disciplines. The Full paper presents a conceptual schema about math education in interdisciplinary context.

Abstract for 15393

THE ESSENTIAL PARTS OF ON-LINE LEARNING

Authors: Ameen Alawneh, Mahmoud AlRefaei
Affiliations: Jordan University of Science & Technology, Qatar University

The popularity of Internet culture among young people in the world gives a good motivation and environment to adapt on-line learning projects. In this paper, we discuss the essential parts of on-line learning project and the steps needed to been taken to accomplish its success. We also discuss the development of on-line learning in the last decades and its advantages and disadvantages.

Abstract for 15404

LINKING GEOMETRY AND ALGEBRA: A MULTIPLE-CASE STUDY OF UPPER-SECONDARY MATHEMATICS TEACHERS' PRACTICES OF GEOGEBRA IN ENGLAND AND TAIWAN

Authors: Yu-Wen Allison Lu
Affiliations: University of Cambridge, UK, Queens College, Cambridge, UK, Faculty of Educatin, Cambridge, UK

The idea of the integration of dynamic geometry and computer algebra and the implementation of open-source software in mathematics teaching underpins new approaches to studying teachers¡¦ thinking and technological artefacts in use. This study opens by reviewing the evolving design of dynamic geometry and computer algebra; teachers' conceptions and pioneering uses of GeoGebra; and early sketches of GeoGebra mainstream use in teaching practices.

This research has investigated English and Taiwanese upper-secondary teachers' attitudes and practices regarding GeoGebra. More specifically, it has sought to gain an understanding of the teachers' conceptions of technology and how their pedagogies incorporate dynamic manipulation with GeoGebra into mathematical discourse. Moreover, the impact of teachers' conceptions of GeoGebra with respect to their practices has been explored. In order to answer the research questions, a multiple-case study has been followed, involving two English and two Taiwanese teachers. For data triangulation purposes, various methods have been employed. These include: documentation, expert interviews with observation of the teachers using the software, and informative interviews with the GeoGebra creator and one of the advanced users.

According to the results of this study, some teachers tended to perceive GeoGebra not merely as a tool but rather an environment for teaching and learning mathematics. They viewed GeoGebra as serving the purpose

of supporting pupils learning, performing the functions of visualising and conceptualising their mathematical understanding. The study also found that the teachers employed a wide variety of strategies to integrate GeoGebra into their teaching practices, such as preparation for teaching materials, presentation of mathematical content and concepts, classroom activities for interaction with pupils and investigation of mathematics. Their practices regarding GeoGebra integration have many weaknesses, but there has been evidence of some good examples of GeoGebra teaching being applied. The findings also suggest that teachers' teaching practices are considerably influenced by their understanding of GeoGebra in relation to mathematical knowledge and their cultural traditions.

Abstract for 15440

TECHNOLOGY-BASED ACTIVITIES WHICH PROMOTE STUDENT-CENTERED LEARNING

Authors: Jumela Sarmiento, Ma. Louise Antonette De Las Penas, Debbie Marie Bautista
Affiliations: Ateneo de Manila University, Ateneo de Manila University Philippines

Keywords: Student-centered Learning, Technology-based activities

In this talk, we will discuss our work on how technology may be used to enhance student-centered learning, an integral part of the way of teaching advanced by our university.

In particular we will present an interactive website for the study of Algebra and Trigonometry where students gain additional learning experiences by performing mathematical investigations and studying real world problems outside the classroom. Each applet in the website comes hand-in-hand with guide questions to facilitate student explorations and student-centered learning.

Abstract for 15443

MATHEMATICS ASSESSMENT IN CHINA

Authors: Jiyan Wang
Affiliations: East China Normal University

What is mathematics? What is the relationship between technology and mathematics?

Mathematics is a lively and interesting subject which has rich culture glamour, it is never a mixed object simply by many form of symbols, digits and figures.

The permeability of modern information technology, for example CASIO fx-82ES and 991ES, will contribute to make mathematics become useful tool and powerful assistant for students solving mathematics problems. In mathematics assessment of many districts in China, the students have been permitted to use the scientific calculators. For example in 2007 almost half districts of the mainland of China the students were permitted to bring and use the calculators to solve the mathematics problems in their entrance examinations. In Shanghai, from 2000 the entrance examination of university some interesting mathematics problems which can be solved by some calculators have given rise to attention of many teachers and students.

Especially, CASIO fx-82ES and 991ES have been playing an important role in mathematics teaching, learning and assessing. We are deeply convinced that more and more teachers and students can use the scientific calculators or graphing calculators to teach and learn mathematics in the near future.

Abstract for 15446

THE GAME FOR THE GREAT MATHEMATICIAN

Authors: Nunnapad Toadithep
Affiliations: Department of Computing, Faculty of Science, Silpakorn University, 73000, Thailand.

Some suitable or appropriate games can make children improve their thinking in a numerical way or in a mathematical way. This may be the way to create the Great Mathematician. This paper shows a conceptual thinking in playing a Pick1-2-3 game. This game needs 2 players to take turn in picking either 1, 2, or 3 balls in

their turn. In this game, the last player who picks the last ball will lose the game. One thing to remember is to not leave 4 or less balls to the competitor.

Abstract for 15455

THE EFFECT OF CABRI GEOMETRY FOR DEVELOPING THE PROVING SKILLS OF THE OMANI HIGH SCHOOL STUDENTS

Authors: Reda Abu-Elwan
Affiliations: Sultan Qaboos University

Keywords: Cabri geometry, secondary students, proof, dynamic geometry

Students find many difficulties in approaching geometric proofs. Identifying new tools in order to support students in proving activities is needed. This study focuses in particular on the potentialities of dynamic geometry software (Cabri II+) with respect to geometric proofs. Cabri II consists of an environment for constructing and manipulating figures in the context of Euclidean geometry, it contains primitives for drawing the fundamental objects of geometry, and geometrical primitives such as commands, which allow student to construct new geometrical objects starting from the fundamental ones. The purpose of this study is to investigate the construction of proofs within a dynamic geometry environment: Cabri II+. In Oman, it was first time to use such software of Cabri II with 10th grade students, one experimental group of 34 female students have worked in geometric proof using Cabri II, just to prove Circle theorems while another group of 30 female students studies the same theorems proofs as it is shown in their textbooks. There was a tentative training for experimental group of using Cabri in a proper ways. An achievement test on geometric proof has been developed and applied for both two groups after the teaching of Circle unite in geometry. Results of this quasi-experimental study showed that there are statistical significant differences between the experimental group and the control group for the favorite of the experimental group. This paper presents a new vision of geometric proof using Cabri geometry for students that they used it for the first time in their learning.

In this study, I did develop a Circle unit (theorems, proofs, and geometric problems) to be used with Cabri in learning proof skills. There was a positive attitude toward the using of Cabri software.

Abstract for 15497

THE ELECTRONIC SPREADSHEET AS A RECURSIVE THINKER

Authors: Thomas McMillan, Jim Fulmer
Affiliations: University of Arkansas at Little Rock

The electronic spreadsheet is a natural computational tool for solving recurrence relations numerically. At the beginning of a Discrete Mathematics course, before learning techniques for solving recurrence relations, we introduce students to discrete modeling with recurrence relations. In this approach, students learn to represent discrete processes using recurrences, concentrating on developing models rather than trying to apply the latest method for solving recurrence relations. A problem can be presented independent of the techniques used to solve the resulting recurrence, enabling students to focus on building a valid model without having to worry about finding a closed form solution. After developing the recursive model, students discover that the electronic spreadsheet is a powerful computational tool for finding numerical solutions and plotting results. An advantage of this approach is that students develop the art of thinking recursively before studying methods for solving recurrence relations. Another advantage is that students can solve discrete problems even if they are not amenable to the methods yielding closed form solutions. Our presentation illustrates this approach by presenting problems from probability, analysis of algorithms, combinatorics, and financial mathematics. We also illustrate how the spreadsheet can be used to illustrate steps in the derivation of closed form methods.

Abstract for 15803

SOLID GEOMETRY IN A TWO-DIMENSIONAL ENVIRONMENT

Authors: Vladimir Dubrovsky
Affiliations: Moscow State University, 1C Software Company

We present diverse examples of 3D models and activities created by means of 2D dynamic geometry systems, such as The Geometer's Sketchpad and MathKit, a new system of this kind recently released by 1C Company (Moscow). Although specialized 3D software such as Cabri 3D allows us to construct more complex and more realistic models, we believe that in many respects, activities created on the two-dimensional basis can often be more useful and instructive, especially at early stages of teaching solid geometry in high school. The variety of models includes puzzle-like activities intended to develop 3D imagination, constructions of cross-sections, applications of apt-projection technique, metric computational problems disguised as constructional ones, etc. Most of these activities are borrowed from a series of projects carried out as components of a large-scale Informatization of Educational System national program, in particular from the MathKit-based Constructive Geometric Activities collection released this year. This program per se will also be outlined in the presentation.

Abstract for 15869

RESIDUALS AND RESIDUAL DIAGNOSTICS IN NON-LINEAR MODELS

Authors: Ali Ageli
Affiliations: Al Fateh Uni

Keywords: Diagnostic, Influence, Leverage, Hat matrix, Ordinary residuals, Projected residuals

This paper investigates the behavior of the ordinary and projected residuals in order to determine which type of residual provides a better regression diagnostic for non-linear models. Since it is not possible to compare the two types of residuals mathematically, simulation studies were conducted based on 1000 data sets each four different types of non-linear regression models are considered. Diagnostic statistics based on the model comparison method and simulation results were derived.

Simulation studies confirm that both types of residuals have sampling distributions, which are approximately normally distributed with mean zero. Furthermore, using the ordinary residuals in diagnostic analysis for the four non-linear models under consideration is superior to using the projected residuals in terms of leverage (measure of the influence each data point has on each fitted value), the ratio of the variance of the it-h fitted valued to that of the it-h residual (i= 1,2,…n), Cook's D influence statistic and the power and type I error of Cook's D influence statistic. The projected residuals give good results theoretically, but the ordinary residuals are computationally simpler and performed much better in the simulation study

Abstract for 15887

CG FRIENDLY PATTERNS OF PARALLELOGRAMS

Authors: Hiroshi Okumura
Affiliations: Maebashi Institute of Technology

Keywords: self-made CG tool

A configuration consisting of parallelograms, which is well investigated and well expressed by using computer graphic tools, is constructed. Special cases of this configuration give several popular figures.

Abstract for 15960

STUDENTS' EVALUATION OF LESSONS IN COLLEGE ALGEBRA USING FRACTAL ITERATION AND THE EFFECT ON THEIR ACHIEVEMENT

Authors: Carmelita Ragasa

Affiliations: University of the East Manila, Philippine Normal University, MATHTED, Inc., Philippine E-Learning Society

Keywords: Fractal Iteration, College Algebra, Achievement

This paper aims to identify topics in college algebra where fractal iteration could be used, to see if the students evaluate the lessons in college algebra using fractal iteration positively and to find out if there is a significant difference in comparing the pretest and posttest of the students' achievement. Specifically the following were the topics discussed for two months and one week or 27 hours of classes: Definition of fractals and examples of classical fractals; the iterated function system and its meaning; the Cantor set or Cantor dust; the Sierpinski triangle or Sierpinski gasket; the Pascal's triangle used to introduce the coefficients of a binomial (x + y)n ; the Koch curve; dimension of fractals; complex and continued fractions; the golden ratio; square roots computed as simple continued fraction; the Fibonacci numbers; algebraic iteration procedure; concept of function; and the population function. The researcher presented each lesson using a power point presentation. Each topic was followed by a sufficient number of exercises. The subjects of the study were 37 students, consisting of 25 female and 12 male in the school year 2006-2007. The mean score of the pretest is 9.0286 while that of the posttest is 12.0286. This result shows that the achievement pretest and posttest are significantly different which means that the students taught with fractal iterations had significantly higher scores after the lessons. The students claimed that they had a wider view of college algebra when fractals were used to teach it. For these students fractions became easier to deal with after applying it to fractals. They liked to see the images and saw it as pictures that described a story. They are attracted to the images of fractals and thus became eager to learn algebra. They claimed that fractals motivated them to solve problems too. Those who did not like studying mathematics in the past felt they had a chance to learn at the same time enjoyed mathematics. For them fractals was a lot of fun. They suggested that learning college algebra should be like this in the future because it really helped them a lot. The evaluation of the lessons was positive. 64% evaluated the lessons in college algebra using fractals as either evidently or very evidently relevant, interesting and self-motivating and that the lessons were arranged into logical sequence based on the intended topics included in the syllabus. They also believed that the presentation of the lessons was within the student's level of comprehension and that the subject matter was accurately discussed.

Abstract for 16153

EXACT SOLUTION TO THE SINE-GORDON-TYPE EQUATIONS

Authors: Lazhar Bougoffa
Affiliations: Al-imam University

Keywords: sine-Gordon -type equations

We present a direct method for finding exact solutions of the sine-Gordon type equations, including single sinh-Gordon equation, single sine-Gordon equation, double sinh-Gordon and double sine-Gordon equations.

Abstract for 17505

INTEGRATION OF HP GRAPHING CALCULATOR INTO THE PROPERTIES AND APPLICATIONS OF FUNCTIONS

Author: Min Wang , wm1053@sina.com
Affiliation: No. 22 Secondary School of Beijing, Beijing, China

In China the use of any kind of calculators including graphing calculators is not permitted in the formal examinations until now. However, many teachers supported by their schools are willing to use technology such as Maple 10, Mathematica, Geometry SketchPad, and Graphing Calculator etc. in their teaching. No. 22 secondary school of Beijing is one of the base schools of GCE (Graphing Calculator Experiment) team constructed jointly by the Basic Education Curriculum Center of Ministry of Education of China and Beijing Normal University. The team is trying to introduce HP graphing calculator into China's mathematics curriculum in middle school. More and more teachers and students join in this project and are motivated great interest. Through utilizing the graphing calculator, teachers can increase their teaching efficiency accelerate teaching

progress, students can carry out all kinds of experiences to help them understand the mathematical concepts well and save their investigation time. In this paper, two lessons are designed for integration of HP graphing calculator into the properties and application of functions. The first lesson indicates that the visual process of constructing graphs of power functions quickly and conveniently reduces the teaching hours, increases the students' conceptual understanding and also strengthens their ability to draw graphs of functions by hand. In the second lesson, students experience a process of transformation from real world problem to mathematical one, of creating a mathematical model by making some simplification or assumptions and of getting a function formula at last. The functions are and, which are much more difficult for students to solve. While the use of graphing calculator helps students to avoid the difficulties taken by their unfamiliarity of new type of functions what they get, and spans the gap for lack of further knowledge successfully. In both classes, students do their investigation through collaboration actively. The design of these two lessons fully considers the knowledge held by students of year 10 (age 15 years), inspires enthusiasm towards graphing calculator, and makes a positive and tentative integration of graphing calculator into mathematical curriculums in middle school.

Abstract for 17506

GRAPHING CALCULATOR EXPERIMENT (GCE) IN CHINA

Author: Cao Yiming
Affiliation: Ph.D.Professor of School of Mathematical Sciences Beijing Normal University, Deputy Director of Education Development Committee of China, Secretary-General, Chinese Commission on Mathematical Education

It has been more than 10 years since the graphic calculator came into use in China. In order to promote the implementation of New Curriculum and to realize the conformity of information technology and New Curriculum, the Center of Elementary Education Curriculum, Ministry of Education, entrust the Key Laboratory of Mathematics and Complicated System of Ministry of Education, Beijing Normal University, with the research of "Conformity Experiment GCE of Handhold Technology and Middle School Math New Curriculum". The project is planned to carried out from 2008 to 2011, and 80 experiment schools in 12 experiment zones will do the teaching experiment research in two batches.

The goals of this research are to gain a better development of the means by which teachers carry out the views, designs and practice of mathematics teaching. And a progress of students' ways of doing mathematics, learning mathematics and using mathematics is also one of the goals. Meanwhile, the practice of this project can also provide some specific examples, experience and lessons to the implementation of the views of the conformity of IT and Curriculum in New Curriculum. Now, research has come into practice in 12 experiment zones, and preliminary achievement is obtained.

Abstracts for Hands-on Workshops

Abstract for 14538

INTEGRATING MULTI MEDIA INTO THE MATHEMATICS CLASSROOM

Authors: Jennifer Wathall
Affiliations: Island School, English Schools Foundation

Objective Look at alternative ways of presenting mathematics to students which involve multi media to enhance learning for the digital native or e generation.

To equip teachers, educators with practical skills to incorporate multi media into the mathematics classroom. The main areas of focus will be the use of presentations, video, sound and animation as a tool to enhance the teaching and learning of mathematics. These include E portfolios, multi media slideshows, Interactive storybooks, research presentations and film making when teaching mathematical topics such as trigonometry, calculus, statistics, geometry and projects on Pi. The level of mathematics covered in the workshop is high school- from year 7 up to 13

Abstract for 14753

DISCOVERING AND PROVING THEOREMS WITH GEOMETRY EXPRESSIONS

Authors: Philip Todd
Affiliations: Saltire Software

In this workshop we will use Geometry Expressions to discover and prove a number of theorems in elementary geometry, both familiar and less familiar. We will learn how to define basic geometric figures involving points, lines and circles using a constraint based geometry system. We will observe how sophisticated conjectures are facilitated by the symbolic nature of the program. We will use Geometry Expressions both on its own and in conjunction with a CAS to make conjectures, to prove theorems automatically and to suggest traditional pencil and paper proofs. We will start by proving simple circle angle identities. We will continue by proving identities involving incircles and excircles, and finally look at mixtilinear incircles and excircles.

Together, we will explore the role of this new technology in the mathematics classroom of the future. No experience with Geometry Expressions is necessary.

Abstract for 14754

CONICS AND PARAMETRIC CURVES WITH GEOMETRY EXPRESSIONS

Authors: Philip Todd
Affiliations: Saltire Software

In this workshop, we will explore the use of the Geometry Expressions software in the study of curves. First, we'll look at two ways of drawing an ellipse: Archimedes Trammel (which gives principal axes directly), and the string and pin method, (which gives foci and major axes directly). We will use Geometry Expressions to work out what length string to use, and where to put the pins to replicate the curve drawn by a specific trammel. Bothe geometric and algebraic representations will be used, and insight will be gained from each.

Secondly, we'll look at involutes, caustics and other derived curves both in the context of specific and general given curves. We'll learn how to examine implicit and explicit curve equations, how to specify the parametric location and observe the Cartesian location of a point on a curve, and how to work with generic curves. We may even prove a differential geometry theorem.

No experience with Geometry Expressions is necessary.

Abstract for 14755

APPLIED PROBLEMS WITH GEOMETRY EXPRESSIONS

Authors: Philip Todd
Affiliations: Saltire Software

In this workshop we will address two applied problems using Geometry Expressions:

1. Finding the focal surface of a parabolic reflector. Light parallel to the axis of symmetry of a parabolic mirror reflects to a precise focus. The reflected rays of parallel beams of light which are incident at an angle to the mirror's axis do not meet at a point. However, they are concentrated by the mirror in a specific region. We use Geometry Expressions to model the geometric optics; we apply appropriate mathematical approximations, and derive the focal surface of the mirror.

2. Creating a cam profile for a given follower motion. Cams are used in mechanical engineering. An off-centered circular cam with a reciprocating flat face follower produces sinusoidal output. We model this in Geometry Expressions, and then find out what happens if the flat face is replaced by a roller follower. We then work out what shape of cam will recover the original sinusoidal motion. Some experience with Geometry Expressions or participation in one of the beginner workshops is recommended, as advanced Geometry Expressions techniques will be explored.

Abstract for 14800

INTRODUCTION TO GRAPHICS CALCULATORS SUITABLE FOR ALL TEACHERS OF JUNIOR AND SENIOR HIGH SCHOOL AND TERTIARY LEVELS

Authors: Christopher Longhurst
Affiliations: Educalc.net, Hewlett Packard

This workshop will focus on the teacher who has not used this technology before. An Informative handout featuring screenshots and an overview diagram will be given to each participant.

Using a PowerPoint presentation, participants will be guided through how to form equations, draw graphs and solve equations with a practical example using the Grand Bazaar in Istanbul, Turkey.

Once this orientation is successful participants will work though some more examples using the "quadratic explorer' program which allows students to visualize transformations on the number plane. This is accompanied by an investigative worksheet. Finally a look at the statistics applet through practical examples of bi-variate and uni-variate data will enable the participants to see a wide range of uses of the graphics calculator.

All teachers will be supplied with a CD containing a HP 40gs calculator fully workable emulator and teaching resources for classroom use for graphic calculators and CAS.

Abstract for 14801

USING GRAPHIC CALCULATORS IN THE CLASSROOM – SUITABLE FOR ALL TEACHERS OF JUNIOR AND SENIOR HIGH SCHOOL AND TERTIARY LEVELS

Authors: Christopher Longhurst
Affiliations: Educalc.net, Hewlett Packard

This workshop will target teachers who have seen graphic calculator technology or attended workshop 1.

The workshop will begin with a brief explanation of the function applet (graph) and the solve applet. The participants will work through the process of downloading applets from the internet and use the power of transferring downloaded and saved applets to other members of the class (this is also a practical application of a geometric progression).

Finally, a practical investigation using the power of the calculator will be worked though using the finance applet.

This is a practical workshop that will allow the participants to further their knowledge of using technology in the classroom and provide an insight into the power and useful nature of this hand held technology. Worksheets, investigations and website references will be provided to participants.

All teachers will be supplied with a CD containing a HP 40gs calculator fully workable emulator and teaching resources for classroom use for graphic calculators and CAS.

Abstract for 14802

USING CAS IN YOUR CLASSROOM (SUITABLE FOR ALL TEACHERS OF JUNIOR AND SENIOR HIGH SCHOOL AND TERTIARY LEVELS)

Authors: Christopher Longhurst
Affiliations: Educalc.net, Hewlett Packard

CAS stands for Computer Algebra Systems. Some countries are currently using CAS in their classrooms, mainly for senior grades eg. Australia (Victoria and Western Australia), Germany, Scotland, Austria to name a few and in the junior high school eg. New Zealand.

This workshop will assume that the teacher has knowledge of the use of the graphic calculator. However, the workshop will also cater for teachers who are interested in pursing knowledge about what CAS is and how it can be used in the mathematics classroom. This hands-on workshop will guide the participants step by step the calculator steps in using CAS. Each participant will be given a document with steps on how to perform basic CAS functions in relation to basic algebra. The presenter will constantly refer to how this powerful and useful technology can be used in the classroom for all secondary levels. Some investigations and worksheets specifically designed for CAS will be given and used.

All teachers will be supplied with a CD containing a HP 40gs calculator fully workable emulator and teaching resources for classroom use for graphic calculators and CAS.

Abstract for 14818

AN INTRODUCTION TO CABRI 3D WITH PROBLEMS WHICH USE PURE GEOMETRY TOOLS

Authors: Jean-Jacques Dahan, Kate Mackrell
Affiliations: IREM of Toulouse, Queen's University Kingston Ontario Canada

We will explore the principal features of Cabri 3D through a series of problems ranging from creating polyhedra and their nets to modelling motion such as that of a character on a swing. Participants will gain a general overview of the software and become familiar with the use of Euclidean construction tools and also transformation tools.

Participants are not expected to have any previous experience of Cabri 3D. Materials and support will be provided to extend the expertise of those who already have some experience in this area.

Abstract for 14820

AN INTRODUCTION TO CABRI 3D WITH PROBLEMS WHICH USE MEASUREMENT AND COORDINATE GEOMETRY TOOLS

Authors: Jean-Jacques Dahan, Colette Laborde
Affiliations: IREM of Toulouse, University Joseph Fourier DIAM-LIG

This session will focus on using measurement and coordinate geometry tools to solve problems concerning volume and area and also coordinates, vectors, lines and planes in 3D space. Participants will gain a general

overview of the software and become familiar with the use of trajectory, measurement, coordinates and equations and calculation tools.

Participants are not expected to have any previous experience of Cabri 3D. Materials and support will be provided to extend the expertise of those who already have some experience in this area

Abstract for 14821

CONNECTING SYNTHETIC AND ANALYTIC GEOMETRY: EXPLORING CONICS WITH CABRI 3D

Authors: Jean-Jacques Dahan, Kate Mackrell

Affiliations: IREM of Toulouse, Queen's University Kingston Ontario Canada

We will solve the problem of creating conics as the intersection of planes and cones and then we will reverse this problem: given the conic, can we find the plane and the cone? We will prove the relationship between conics, planes and cones using Dandelin's theorem and will show some astonishing and little-known results.

Participants are expected to have attended one or both of the introductory workshops or to have some previous experience with Cabri 3D. In addition, materials and challenges will be provided for those with substantial prior experience.

Abstract for 14895

HANDS-ON AUTOGRAPH WORKSHOP TRAINING SESSIONS- 1

Authors: Douglas Butler
Affiliations: iCT Training Centre (Oundle School), UK

Workshop for local teachers of students of age 11 – 16, ATCM 2008, Mon, 15 Fri 19 December 2008, Bangkok, Thailand. Three sessions. Each session will be 90 minutes, aimed at Thai teachers who are new to Autograph. The language of instruction will be English, but the software will be run in the Thai language.

Each teacher will receive a copy of the TSM Resources CD .This contains a large number of sample Autograph files, some fascinating data sets, and a range of mathematically interesting images to import.

Abstract for 14898

HANDS-ON AUTOGRAPH WORKSHOP TRAINING SESSIONS - 2

Authors: Douglas Butler
Affiliations: iCT Training Centre (Oundle School), UK

Workshop for local teachers of students of age 16, ATCM 2008, Mon 15 Fri 19 December 2008, Bangkok, Thailand. Each session will be 90 minutes, aimed at Thai teachers who are new to Autograph. The language of instruction will be English, but the software will be run in the Thai language.

Each teacher will receive a copy of the TSM Resources CD .This contains a large number of sample Autograph files, some fascinating data sets, and a range of mathematically interesting images to import.

Abstract for 14899

HANDS-ON AUTOGRAPH WORKSHOP TRAINING SESSIONS - 3

Authors: Douglas Butler
Affiliations: iCT Training Centre (Oundle School), UK

Workshop for local teachers of data handling, probability and statistics at ATCM 2008, Mon 15, Fri 19 December 2008, Bangkok, Thailand.

Each session will be 90 minutes, aimed at Thai teachers who are new to Autograph. The language of instruction will be English, but the software will be run in the Thai language.

Each teacher will receive a copy of the TSM Resources CD .This contains a large number of sample Autograph files, some fascinating data sets, and a range of mathematically interesting images to import.

Abstract for 14971

INTRODUCTION TO MAPLE AND ITS INTERFACE

Authors: Douglas Meade
Affiliations: Department of Mathematics, University of South Carolina, Industrial Mathematics Institute, USC

Maple is a computer algebra system that can change the way you teach mathematics. This happens when you both (i) know how to use some of the many built-in features and (ii) have the confidence to create new interfaces. The first session in this workshop, which assumes no prior experience with Maple, is a general introduction to Maple with specific attention given to making use of the numerous tutors and task templates provided in Maple. The second and third workshops in this series will focus on using Maple to create customized interfaces for topics of interest to the participants. This will include the use of tables, embedded components, maplets, task templates and other Maple elements to create customized interfaces for problems of interest to the participants.

Abstract for 15039

CALCULUS AND A GRAPHICS CALCULATOR

Authors: Barry Kissane, Marian Kemp
Affiliations: Murdoch University, Teaching & Learning Centre Murdoch University Murdoch AUSTRALIA

The availability of graphics calculators in mathematics classrooms allows students to have different experiences than would otherwise be the case. This workshop will focus on introductory calculus to illustrate and encounter some of these different experiences in a hands-on way. The emphasis will be on informal and intuitive approaches to important concepts in calculus, especially those concerned with derivatives, continuity and limits. The key idea is that the calculator allows the user to develop a good understanding of the key ideas involved.

Participants can include newcomers to this technology, who will be supported in its use in the workshop, although the focus will be on the educational consequences of the technology, not on the mechanics of using calculators.

Abstract for 15065

CONSTRUCTION OF RHOMBIC POLYHEDRA WITH CABRI 3D

Authors: Jen-Chung Chuan
Affiliations: National Tsing Hua University

A polyhedron whose faces are rhombi is called a rhombic polyhedron. A large number of interesting rhombic polyhedral have been constructed using Cabri 3D:

http://sylvester.math.nthu.edu.tw/d2/Rhombic%20Polyhedra/

In this tutorial we wish to guide the participants through the actual construction of these interesting geometric objects. Software Required: Cabri 3D 2.1.2 (or newer). Maximum Number of Participants: 40

Abstract for 15143

HOW TO USE GRAPHING CALCULATOR IN TEACHING MATHEMATICS

Authors: Nittayaporn Bunyasiri
Affiliations: IPST

Graphing Calculators have existed for more than 10 years. They were promoted as another way for teaching and learning mathematics. In this workshop, we will begin with a brief explanation of how to use TI graphing calculator to calculate, draw graphs of functions, graphs of sequences and how to use application programs. We will explore many investigative worksheets and many activities in teaching mathematics, for example, graphs of conditional functions, graphs of in-equation, limit of sequences and linear programming problem. Finally, the teachers will gain a general overview of the graphing calculator usage and become familiar with the use of this tools as well as TI- Flash Debuggers in teaching mathematics in the classrooms. This workshop will provide guidance for teachers to use TI graphing calculator in their lessons.

All teachers will have hand-on experience to use the calculators and will get hand-outs from the workshop as well as TI–Flash Debuggers software. (40 persons only)

Abstract for 15236

INSIGHTS FROM X^N -1

Authors: Wei Ching Quek
Affiliations: Singapore Polytechnic

Recent research in Computer Algebra System (CAS) technology has shown many evidences that such tools can be used effectively, even with younger students. The workshop will share with teachers how CAS technology can enhance the learning of algebraic technique and algebraic concepts

This workshop is consists of three activities

(i) Getting started with Classpad, a popular handheld CAS calculator. Teachers will learn to use Classpad to examine and verify the pattern, and the number of factors of x^n-1. No prior knowledge of the Classpad is required.

(ii) Interesting exploration on values of $P(x)=x^n$ -1, the Eisenstein criterion of irreducibility, linking results learned with theory of finite cyclic groups.

(iii) Discuss and demonstrate possible development of a lesson plan which integrate the CAS technology and e-activities of ClassPad.

Abstract for 15299

CROSSING THE MATH/STAT BOUNDARY IN THE CLASSROOM WITH FATHOM DYNAMIC DATA SOFTWARE

Authors: Steve Rasmussen
Affiliations: Key Curriculum Press

In this workshop, you will experience a gentle introduction to Fathom software as a tool for immersing students in data to improve their understanding of algebraic, geometric, probabilistic, and statistical concepts. Learn how to use Fathom as a collaborative problem solving tool and for classroom presentation of mathematical concepts. No prior experience with Fathom software is required.

Abstract for 15304

CASIO TRAINING WORKSHOP (THIRD OF 3): ADVANCED MATHEMATICAL TOPICS

Authors: Marian Kemp, Barry Kissane

Affiliations: Murdoch University

This is the last in a set of three hands-on workshops, focused on the use of the CASIO fx-9860G graphics calculator for secondary school mathematics. This session will focus on the use of the graphics calculator in teaching and learning some more advanced aspects of the mathematics curriculum, such as introductory calculus, matrices, complex numbers and sequences and series. Participants will be assumed to have attended the previous two workshops in this series, but to otherwise be beginners with this particular calculator. They will be supported to use the calculator efficiently and to explore some of the ways in which this technology can be used in the mathematics curriculum. While the focus will be on secondary school, the workshop will also be relevant to teacher educators and to those teaching mathematics in the early years of college. A key aspect of the workshop will focus on the role of the calculator to represent some advanced mathematical concepts, such as differentiation, limits, continuity, complex numbers and matrices and use these representations to undertake computations and to understand the mathematical ideas involved. Participants will be provided with significant resources to enable them to continue developing these ideas after the workshop.

Abstract for 15305

CASIO TRAINING WORKSHOP (FIRST OF 3): NUMBER AND ALGEBRA

Authors: Barry Kissane, Marian Kemp
Affiliations: Murdoch University

This is the first of a set of three hands-on workshops, focused on the use of the CASIO fx-9860G graphics calculator for secondary school mathematics. This first session will focus on the use of the graphics calculator as a computational device and its role in teaching and learning aspects of elementary algebra, including functions, graphs and equations. Participants will be assumed to be beginners with this particular calculator. They will be supported to use the calculator efficiently and to explore some of the ways in which this technology can be used in the mathematics curriculum. While the focus will be on secondary school, the workshop will also be relevant to teacher educators and to those teaching mathematics in the early years of college. A key aspect of the workshop will focus on the role of the calculator to represent various kinds of elementary functions numerically, symbolically and graphically, and use these representations to understand the mathematical ideas involved. Participants will be provided with significant resources to enable them to continue developing these ideas after the workshop.

It is assumed that participants will be involved in each of the next two workshops in this series, so that training can continue over the three days.

Abstract for 15327

SKETCHPAD: A GENERAL INTRODUCTION (ENTRY LEVEL 1)

Authors: Nicholas Jackiw, Steven Rasmussen
Affiliations: KCP Technologies, Inc., Simon Fraser University, KCP Technologies Key Curriculum Press

This workshop aims to introduce teachers to Sketchpad, a versatile software tool for teaching and learning geometry, algebra, and many other school mathematics subjects where mathematical visualization is relevant. This workshop is intended for teachers with little or no prior experience in Sketchpad, and will focus on a broad introduction to the program's tools and techniques, with an emphasis on teaching geometry at the secondary-school level. Many example activities will be distributed on disk and on paper. The language of the workshop will be English, but participants will have the choice of using either English or Thai versions of the software.

Abstract for 15328

INTRODUCTORY SKETCHPAD WORKSHOP: TESSELLATION IN EUCLIDEAN AND HYPERBOLIC GEOMETRY (ENTRY LEVEL 2)

Authors: Nicholas Jackiw, Steven Rasmussen
Affiliations: KCP Technologies, Inc., Simon Fraser University

This workshop offers a self-contained introduction to modern geometries in a treatment of planar tessellation in Euclidean and Hyperbolic geometry. Using The Geometer's Sketchpad as a visualization and learning environment, participants will construct fundamental tiling polygons in both geometries, tessellate with them, and calculate the conditions of tessellation for each geometry. A mathematical curiosity but no prior Sketchpad or advanced geometry experience is needed for this workshop (though prior experience will not hurt!)—the focus here is primarily on the mathematics, and only less on the software. The language of the workshop will be English, but participants will have the choice of using either English or Thai versions of the software.

Abstract for 15330

ITERATION IN SKETCHPAD (INTERMEDIATE LEVEL 3)

Authors: Nicholas Jackiw, Nathalie Sinclair
Affiliations: KCP Technologies, Inc., Simon Fraser University

Mathematical iteration refers to the act of performing of some mathematical process—a computation, algorithm, or construction—on some initial value, and then repeating that process on the result. Iteration appears across mathematics, from the simplest arithmetic operations (such as counting) to very recent ideas about fractals and chaos. In the school curriculum, iterative processes may show up in arithmetic procedures (for example: counting, long division), sequences and series, calculus (limits and approximations), fractals and chaos, optimization, geometric art and design, differential equations and dynamical systems, and so on. In this workshop, participants will learn how to express iterative processes in The Geometer's Sketchpad, and will investigate many of these mathematical contexts using iterative structures. Some prior Sketchpad experience (such as an Entry Level workshop) is beneficial. The language of the workshop will be English, but participants will have the choice of using either English or Thai versions of the software.

Abstract for 15362

TINKERPLOTS DYNAMIC DATA EXPLORATION

Authors: Steve Rasmussen
Affiliations: Key Curriculum Press

TinkerPlots Dynamic Data Exploration software is specifically designed to get students in grades 4? excited about what they can learn from data. You will use TinkerPlots to investigate new ways to introduce, reinforce, and extend geometry concepts, algebraic thinking, and data analysis skills. Sharpen your skills:

Experience projects that involve all the strands of the mathematics curriculum and interdisciplinary units

Make your own graphs that help you pose and answer questions about group differences and relationships

Discuss methods of maximizing the impact of technology, classroom management, and appropriate assessment techniques

Abstract for 15369

GEOMETRIC EXPLORATIONS WITH THE AID OF TECHNOLOGY

Authors: Ma. Louise Antonette De Las Penas
Affiliations: Ateneo de Manila University

In this workshop, we will examine interesting questions in geometry, where participants will explore a given problem from different perspectives to see how parts of the hypothesis are related; leading to a solution and proof. We illustrate the activities with the aid of interactive geometry software, Casio's Classpad 300 Plus which has unique interactive workbook features which allow one to functionally link its different applications with one another: numerical and algebraic calculations, graphical as well as tabular presentations and dynamic geometry- making the study of geometric problems accessible and enjoyable.

The problems we will look at will be suitable for investigation by students in upper high school or first two years of university.

Abstract for 15370

FUNCTIONS AS MATHEMATICAL MODELS WITH THE AID OF CLASS PAD 300

Authors: Ma. Louise Antonette De Las Penas, Wei Ching Quek, Wei Chi Yang
Affiliations: Ateneo de Manila University, Singapore Polytechnic, Radford University

One way to encourage and inspire students to study mathematics is to provide them with opportunities to interpret the mathematics that appears every day in the world around them. In this workshop, we explore different types of functions and investigate real world problems that give rise to mathematical models involving functions. We will look at how a clever interface available on the Class Pad 300 will help teachers and students work with numeric, algebraic and geometric representations of the various mathematical models.

Examples of activities will be chosen to suit the learning of algebra and trigonometry in upper secondary and first year university levels. Previous experience with the technology will not be assumed.

Abstract for 15372

EXPLORING STATISTICS WITH CLASSPAD

Authors: Wei Ching Quek, Wei-Chi Yang, Ma. Louise Antonette N. De Las Peñas
Affiliations: Singapore Polytechnic, Radford University, Ateneo De Manila University

With the emergence of new technology, many tools are available to assist students to visualise and explore statistics which in the past are impossible or prove to be difficult. One of the latest technologies is the ClassPad.

This workshop is a hands-on session intended for those interested in secondary/Junior College Statistics teaching.

The workshop is consists of three activities

1. Introduction to the basic features of ClassPad. You will learn how to input and edit, organise, present and summaries, compare data
2. Solve typical statistics problems with ClassPad
3. Create simple e-activities such as lessons and quizzes to experiment which will help students visualize mathematics and consolidate understanding.

Participants are assumed to have no prior experience of the Classpad

Abstract for 15375

EXPLORING CALCULUS AND BEYOND WITH THE HELP OF CLASSPAD

Authors: Wei-Chi Yang, Ma. Louise De Las Penas, Wei Ching Quek
Affiliations: Radford University, Ateneo De Manila University, Singapore Polytechnic

It is known that evolving technological tools have prompted us to rethink the way teachers teach and students learn mathematics. In this workshop, we will have some hands-on experiences on some Calculus examples such as:

1. Geometric approaches of finding the derivatives for some trigonometric functions, exponential functions and implicit functions.
2. A shrinking circle problem.
3. Approximate area bounded by a curve and a slanted line y=mx+b.
4. Finding general inverses for a graph with respective to y=mx+b.

The general approach is to use graphical and geometrical animations to bring out the natural conjectures from a learner and later prove or disprove the conjectures analytically with the help of a computer algebra system (CAS). It is natural to use graphical and geometrical representations to make mathematics more accessible to more learners, which in turn gives motivation to solve a problem analytically. Once learners capture the essence of solving a problem, complicated manipulations can be done with the help of CAS.

Abstract for 15379

CASIO TRAINING WORKSHOP (SECOND OF 3): STATISTICS AND GEOMETRY

Authors: Barry Kissane, Marian Kemp
Affiliations: Murdoch University

This is the second of a set of three hands-on workshops, focused on the use of the CASIO fx-9860G graphics calculator for secondary school mathematics. This session will focus on the use of the graphics calculator for teaching and learning aspects of statistics, probability and geometry. Participants will be assumed to have attended the first workshop in this series, but to otherwise be beginners with this particular calculator. They will be supported to use the calculator efficiently and to explore some of the ways in which this technology can be used in the mathematics curriculum. While the focus will be on secondary school, the workshop will also be relevant to teacher educators and to those teaching mathematics in the early years of college. A key aspect of the workshop will focus on the role of the calculator to record, summarise and represent data, including data that have been generated at random as well as data from other sources. In addition, the use of the calculator for aspects of geometry will be explored, using the calculator's geometry module. Participants will be provided with significant resources to enable them to continue developing these ideas after the workshop.

It is assumed that participants will also be involved in the following workshop in this series, so that training can continue over the three days.

Abstract for 15385

EXPLORING CONCEPTS AND APPLICATIONS OF MATHEMATICS USING CASIO 9860 GRAPHICS CALCULATOR

Authors: Jonaki Ghosh
Affiliations: Delhi Public School R K Puram, Delhi University, Casio India Company

Handheld technology in the form of graphics calculators has truly revolutionized the teaching and learning of mathematics by providing dynamic interactive working environments. The last two decades has witnessed extensive research in this area. Mathematics educators have been investigating various ways of integrating these devices with classroom teaching in order to enhance visualization, conceptualization and to make mathematics accessible to students of varying levels of ability. The computer-like features and easy portability of these calculators provide significant advantages over computer ?aided software packages.

Although the integration of technology in mathematics education is a common phenomenon in many countries across the world, in India it is the traditional 'chalk and board' method, which is prevalent in majority of the schools. While using technology for mathematics teaching is not the general practice, the CBSE (Central Board of Secondary Education in India), has recommended that every school set up a Mathematics Lab to encourage activity based mathematics learning. The author, a practicing teacher as well as a teacher educator, has been keenly interested in integrating various forms of technology in mathematics lab activities that encourage 'learning by discovery?

This workshop session will focus on the use of the CASIO 9860G graphics calculator as tool for exploring important mathematical concepts at the secondary school level. The use of this device as a teaching tool in the

classroom as well as an investigatory tool for conducting modeling activities in a mathematics lab will be demonstrated. Participants will be given a hands-on experience on the calculators as well as the 9860 manager+ software. Activity worksheets and help sheets and will also be provided during the workshop.

Abstract for 15392

ENHANCING UNDERSTANDING IN STATISTICS WITH FATHOM

Authors: Krongthong Khairiree

Fathom is a friendly user program in enhancing students to investigate and discover statistics concepts in particular data presentation and data analysis.

Abstract for 15420

USING VIRTUAL CALCULUS TUTOR TO ENHANCE THE TEACHING AND LEARNING OF CALCULUS

Authors: Jonathan Lewin
Affiliations: Kennesaw State University

The purpose of this hands-on workshop is to explore some exciting new possibilities for the teaching and learning of calculus that are provided by the brand new book and video bundle, Virtual Calculus Tutor.

Virtual Calculus Tutor consists of two main ingredients:

1. A book form of the product that is a complete self-contained textbook on calculus of one real variable provided in a sophisticated hypertext and designed for reading on the computer screen.
2. An extensive set of videos (total playing time about 55 hours) that gives the option of entering a virtual classroom and attending an actual classroom lecture at any chosen point in the material.

The workshop will demonstrate techniques for browsing both the book and video forms of Virtual Calculus Tutor to enable students and instructors to identify the material that matches the requirements of their calculus courses. Then it will suggest some techniques of teaching pedagogy that can take advantage of the special features of Virtual Calculus Tutor.

Each participant in the workshop will receive a complimentary 120 day trial version of Virtual Calculus Tutor. For more information about Virtual Calculus Tutor, please go to

http://www.math-movies.com/vct.html

Abstract for 15422

PROFESSIONAL DEVELOPMENT WORKSHOP FOR MIDDLE SCHOOL TEACHERS:

Authors: Inder Kumar Rana
Affiliations: I. I. T. Bombay, India, ATCM, AMS

The aim of the workshop is to exhibit to inservice/preservice middle school level teachers a method of developing interactive math lab sessions.

Abstract for 15760

ENHANCING UNDERSTANDING AND CONSTRUCTING KNOWLEDGE IN MATHEMATICS WITH MATHEMATICAL MAGIC

Authors: Janchai Yingprayoon, Poh Yew Teoh
Affiliations: Sunandha Rajabhat University, Creative Wizard Pte. Ltd.

Appropriate mathematical magic, stimulate intellectual curiosity, develop problem solving skills, promote discovery and thinking skills, as well as unleash creativity. These tricks appear magical in nature but they are actually based on sound mathematical concepts. While trying to figure out how these tricks works, students actively participate in discovering or deciphering the hidden principles underlying each trick and in the process construct their own knowledge of mathematics. The mathematical principles learned are not imposed on them but come about as a result of their own mental construction that involves the fitting of new information with what they already know. The learning generated in using these recreational activities is constructivist in nature. It is based on opportunities to develop and exercise mathematical reasoning and problem solving activities that promote active meaningful knowledge construction among the students.

This hands-on workshop also stress on the need for excitement to encourage mathematical thinking. Mathematical magic can serve as an effective means of motivation at almost all levels of instruction. The major purpose of its use in the classroom is to enable students to discover that mathematics is easy and interesting, and thus stimulate interest in their further study of mathematics.

Abstract for 15796

SAYING HELLO TO TI-83+

Authors: Ye Yoon Hong, Mike Thomas

Affiliations: Suan Sunantha Rajabhat University, The University of Auckland Mathematics Education Unit

The aim of this workshop is to achieve the followings: (i) To improve teacher confidence in making reasonable decisions on when to use a technological tool in a classroom.

(ii) To provide creative ideas to exploit calculator technology fully and to assist teachers to build insights for integrated technology implementation. (iii) To assist teachers to overcome the steep learning curve required.

The workshop will cover basic understanding of the TI83Plus, the most popular model allowed in exams. This will include introduction to menus, key strokes, and basic functions. It will also cover how to make use of many calculators' features when solving problems in all levels of mathematics. We will cover graphing techniques, algebra, elementary calculus, trigonometry, linear programming and others.

There will be discussion on the learning of core mathematical concepts with calculators.

Abstract for 16110

UTILIZING QUASI-SYSTEMATIC MODEL TO PROMOTE DYNAMIC LINKS BETWEEN MATHEMATICAL REPRESENTATIONS

Authors: Lenni Haapasalo
Affiliations: University of Joensuu

The workshop is linked to author's plenary Perspectives on Instrumental Orchestration and Assessment - from Challenges to Opportunities.

The participants have opportunity to put into action the framework of the MODEM Project (Model Construction for Didactic and Empirical Problems of Mathematics Education) and see how this quasi-systematic model can be utilized also when designing instrumental orchestration for ClassPad calculator and interactive applets, for example.

Abstracts for Poster Sessions

Abstract for 14982

WEB-BASED AN APPLICATION SUPPORTING TO LEARN ON THE MATHEMATICS TEACHING: SIBERMATIC

Authors: Bulent Gaytanli, Guner ILICAN
Affiliations: Anadolu University, Prog. in Primary School Mathematics Teaching, Faculty of Education, Anadolu University, 26470 Eskisehir TURKEY

Web-based technologies and powerful internet connections provide various new possibilities for the development of educational technology. The aim of this study is to establish a web-page (was named "Sibermatic" which is web-based supporting to learn on the mathematics teaching. It is thought that Sibermatic effects on the student's achievement and rate of mathematics learning.

Abstract for 15329

SOFTWARE FOR DYNAMICALLY VISUALIZING INTERSECTIONS OF QUADRATIC CURVES IN THE TWO-DIMENSIONAL COMPLEX SPACE

Authors: Akihiro Matsuura, Tohru Iijima
Affiliations: Tokyo Denki University, Nippon Information Industry Corp.

In the real plane, two circles do not necessarily intersect; however, when the coordinates are allowed to be complex, they always intersect at two points in the two-dimensional complex space when a double root is counted twice. Then, where are the intersections actually located in the complex space and how do they behave when the circles are moved in the real plane? Furthermore, how about the cases of the other quadratic curves? We develop mathematical software which dynamically visualizes the intersections between two arbitrary quadratic curves, i.e., ellipses, parabolas, and hyperbolas, in the two-dimensional complex space. Generally, there are at most four intersections between two quadratic curves. In our software, these intersections are drawn using two complex planes which correspond to the x- and y-coordinates. Users can decide the types and parameters of the quadratic curves, modify or move them in the real plane, and observe the intersections and the loci drawn in the two-dimensional complex space. We show a variety of examples of the pairs of quadratic curves for which intersections and the loci are worth being mathematically investigated and are also visually appealing. Our software provides learners a new way of looking at mathematical forms in the complex space which are originally invisible (in the real plane). The dynamic and interactive aspects of the software would also help learners to make mathematical experiments by themselves and to derive general statements. To evaluate the efficiency of the software should be our future work.

This work was partially supported by Research Institute for Science and Technology of Tokyo Denki University Q06J-09 / Japan.

Abstract for 15331

HOW ATTRACTIVE THE CURVES ARE

Authors: Nunnapad Toadithep
Affiliations: Department of Computing, Faculty of Science, Silpakorn University, 73000,Thailand.

This paper aims to show you and make you happy to see a beautiful curve with VPython. Because VPython is the Visual , 3D, and animated view of seeing. There are many 3D-objects in VPython, curve is the one of them. VPython gives the flexibility of manipulating of curves. With Object-Oriented Programming: objects have attributes or properties and methods to act with, for example method append of curve appends the other point into curve. Work together with transformation matrix: rotation, scaling, shearing, and reflection matrix

will make the interesting curve. Also the parametric equation curve, with parametric t (between 0..1) and with rate command in VPython make an animation curve plotting possible.

Abstract for 15403

INTEGRATING DYNAMIC GEOMETRY AND COMPUTER ALGEBRA SYSTEM WITH GEOGEBRA

Authors: Yu-Wen Allison Lu, Zsolt Lavicza, Markus Hohenwarter
Affiliations: University of Cambridge, UK, Queens College, Cambridge, UK, Faculty of Educatin, Cambridge, UK, Universiy of Cambridge, UK, Florida Atlantic University, USA

GeoGebra (www.geogebra.org) is open-source, multi-platform dynamic mathematics software with rapidly growing worldwide popularity. The fundamental philosophy of the software is to join dynamic geometry software (DGS) and computer algebra systems (CAS), which other packages often treat separately, into a single easy-to-use package. It provides a bidirectional combination and close connection between visualisation capabilities of CAS and dynamic changeability of DGS. It can be used for learning and teaching mathematics from the elementary up to the university level. GeoGebra not only is free but it also offers the powerful opportunity for teachers to create interactive online learning environments which have led many teachers to foster experimental and discovery learning for their students. An extensive self-supporting user community shares interactive teaching materials on the GeoGebraWiki, supports fellow users through a user forum, and has translated GeoGebra into 40 languages. In addition to offering free software, the first steps towards establishing an International GeoGebra Institutes (IGI) have been made to offer structured training and support for teachers who are ready to integrate GeoGebra into their classrooms. Furthermore, IGI aims to organize and coordinate GeoGebra research projects to enhance the development of training and support materials. Currently, 8 GeoGebra Institute sites (4 in the US and 4 in Europe) are in the process of development. In the long run we intend to collaborate with more colleagues and set up other institutes in various locations all around the world. By establishing IGI sites we hope to contribute to the professional development of teachers, conduct research on GeoGebra, and continue to improve high quality software that is freely available for everyone. In this poster presentation, applications of the software and plans for future development of IGI will be presented. Moreover, some of the implications of technological developments such as GeoGebra for the pre-service education and in-service professional development of teachers of mathematics will be raised.

Abstract for 15447

THE GAME FOR THE GREAT MATHEMATICIAN

Authors: Nunnapad Toadithep
Affiliations: Department of Computing, Faculty of Science, Silpakorn University, 73000, Thailand.

Some suitable or appropriate games can make children improve their thinking in a numerical way or in a mathematical way. This may be the way to create the Great Mathematician. This paper shows a conceptual thinking in playing a Pick1-2-3 game. This game needs 2 players to take turn in picking either 1, 2, or 3 balls in their turn. In this game, the last player who picks the last ball will lose the game. One thing to remember is to not leave 4 or less balls to the competitor.

Abstract for 16162

CONSTRUCTING THE WORLD CULTURE DESIGNS THROUGH THE USE OF MATHEMATICAL PROGRAM

Authors: NamHee Kim
Affiliations: Jeonju University

NCTM and Korea's mathematics curriculum proposes the utilization of technology in mathematics education, recommending the use of calculators and computers. We need to encourage our students to apply the mathematics to various areas through the use of technology. In this study, we conducted a design-making

activity using mathematics on a computer program. Our research subjects are freshmen who entered the mathematics education department, a teacher¡¯s college, Jeonju University in Korea. The technology that was used in this study is Grafeq program. Classroom activity is to construct real-world designs with functions and graphs. Especially, we focused on constructing the world culture designs.

In this study, we observed students¡¯ cognitive ability and affective attitude are enhanced. Our activity in this study can be applied in mathematics classes at secondary school. Mathematics teachers may utilize the works of mathematical designs to aid the teaching and learning of functional graphs. They can find, in the design works, the mathematical formulas related to what they are currently teaching and use them to induce the students¡¯ interest in the introduction part of the classes. It is also possible to guide the students to mathematically analyze the formulas and conditions used in the works. Then, student can study a second art mathematics actively and understand mathematical concepts deeply. Moreover they can learn a new method of applying mathematics.