Creative and Critical Thinking in Mathematics Through Technology

Abstracts of the Seventeenth
Asian Technology Conference in Mathematics

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Introduction

On the behalf of the Suan Sunandha Rajabhat University, Bangkok, Thailand, members of the International Program Committee of the ATCM conference, and the Institute for Promotion and Science and Technology of Thailand, we are honored to introduce the papers of the ATCM 2012 – "Creative and Critical Thinking in Mathematics Through Technology".

We are fortunate to have presenters from a wide spectrum of scientists and educators, whose presentations and workshops will demonstrate the most current trends in technology for mathematics and mathematics with technology. Papers and presentations address a very wide spectrum of topics and ideas. We can find papers concentrating on using computer software in teaching mathematics, papers on using Internet, multimedia, and other tools for interactive and online mathematics courses delivery, as well as research papers from pure mathematics where technology was used to produce some new results.

Thanks to evolving technological tools, we are able to explore more interdisciplinary areas such as science, technology, and engineering with Mathematics which we could not before. Therefore, integrating technology into mathematics teaching, learning and research will definitely allow us to expand our knowledge horizon in mathematics. We encourage all authors and readers to contribute your new findings to our next ATCM or the Electronic Journal of Mathematics and Technology (eJMT: https://php.radford.edu/~ejmt/).

We would like to express our appreciation to the local organizers, in particular to the Suan Sunandha Rajabhat University for the enormous task of planning and preparation of ATCM 2012 – one of the most enjoyable and instructive conferences in the World. We thank also the members of the International Program Committee and external reviewers for their great contribution in reviewing papers.

Editors of ATCM 2012

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Abstracts for Plenary Talks and Invited Papers

Abstract for 19697

Students Will Excel If They Are Inspired

Authors: Wei-Chi Yang

Affiliations: Radford University

It is well-known that the requirement of teachers' content knowledge in secondary schools (middle or high schools) varies greatly from country to country (see [4] and [5]). It is also debated how much content knowledge a future math teacher should possess before he or she starts teaching. There are states in the U.S. that do not require future middle school teachers to finish the calculus sequence in college; the rationale simply being that middle school teachers do not need to teach calculus. On the other hand, becoming a future math teacher at a secondary school in South Korea virtually requires finishing a B.S. degree in mathematics. In this paper, instead of debating how much is enough, we introduce several examples to demonstrate how technological tools can expand students knowledge of mathematics if teachers can properly inspire them. In order to reach this objective, teachers naturally need to have broader content knowledge.

Abstract for 19700

GEOMETRIC ORNAMENT IN ART AND ARCHITECTURE OF WESTERN CULTURES

Authors: Miroslaw Majewski

Affiliations: New York Institute of Technology, Abu Dhabi Campus

Keywords: geometry, Sketchpad, art

For most of us the word art is a synonym of painting, sculpture and sometimes calligraphy. We consider also music as a form of art. For an average person art has nothing in common with mathematics or even geometry. However, if we will look into the history then we will find that ancient Greeks considered art and mathematics as tightly connected disciplines. There were many artists who have been inspired by mathematics and studied mathematics as a mean of complementing their works. The Greek sculptor Polykleitos recommended a series of mathematical proportions for carving the ideal male nude. Renaissance painters turned to mathematics and many of them became accomplished mathematicians themselves. We can find mathematics in creations of the middle century Islamic artists as well as Gothic masons.

In this lecture I will explore some examples of art from various regions and cultures of the Western World. I will briefly examine the role of mathematics, in particular geometry, in creation of these works of art. My major objective will be to show how geometric constructions were used to create these examples of art. I will start from ancient art and early examples of geometric art, then I will examine some Cosmati designs, and finally I will show the geometry behind the Gothic tracery.

Abstract for 19709

The Other Role of Technology: Communication Between People

Authors: Jonathan Lewin

Affiliations: Kennesaw State University

For the most part, the traditional role of technology in the teaching of mathematics has been focussed on its ability to solve, to evaluate, to produce images and even to guide students through stereotypical working steps that are supposed to be employed in as one works through exercises that appear in the textbooks. But technology has another role that is sometimes neglected. It gives us new and efficient ways to talk with one another. It gives us opportunities to convey mathematics in a much more friendly form than we can find in any ordinary textbook. It allows instructor and student to exchange mathematical ideas even when they are not standing face to face in the same room. It can be a means of communication between people.
In some of my earlier presentations at ATCM and elsewhere, I have emphasized the value of screen capture videos in the creation of mathematical learning materials and the role of video will again be featured this year. I shall refer both to classroom video and to the video in products like my Virtual Calculus Tutor. However, the production of video is not the whole story and I shall not be confining my attention to this topic. My presentation will demonstrate some of the unusual textbooks that I have designed for reading on the computer screen and it will show how, in my two main video products, Virtual Math Tutor and Virtual

Calculus Tutor, a balance between video material and document material can provide a very successful medium for helping students to understand mathematics.
I shall show how an on-screen book can be just as easy to browse through as a printed bound text and provide more help, more solutions to exercises, and more development of the material. It can do so without becoming cluttered and at a modest price. I should add that several of my works are provided for free as public domain items. Some of my products involve coordinated use of on-screen documents and video and I intend to demonstrate how these two media can work with each other to help a student to understand mathematical ideas.

Abstract for 19735

Maximal Twistable Tetrahedral Torus

Authors: Jen-chung Chuan

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In the fascinating book "More Mathematical Activities" Brian Bolt supplies a net for a rotating ring of six tetrahedrons. Based on this net, the model forming a twistable tetrahedral torus can be constructed with patience. In this talk we are to show how such a model can be built with Cabri-3D. With the magic supplied by the dynamic geometry software we are to show how ALL such models can be constructed.

Abstract for 19796

How Integration of DGS and CAS helps to solve problems in geometry

Authors: Pavel Pech

Affiliations: University of South Bohemia

The use of dynamic geometry (DGS) and computer algebra systems (CAS) changed teaching geometry at all school levels considerably. To solve a problem students first visualize it by DGS then by changing parameters the problem is interactively modified and geometry properties like invariant points, lines, circles etc. are recognized. Using these knowledge a conjecture is stated and classically proved or disproved.
But sometimes we do not have a key idea to find a proof (or a locus). Then the use of CAS can help. By the theory of automated geometry theorem proving we are able to prove many such theorems.
Thus the integration of DGS and CAS is useful and helps to solve problems. This approach is demonstrated in many examples of elementary geometry in a plane and space.

Abstract for 19816

INTERCONNECTIVITY of Mathematics & the Educational Software INTERFACE

Authors: Vladimir Nodelman

Affiliations: Holon Institute of Technology

The existing educational software rarely supports investigation and visualization of different subjects and areas of mathematics, which, by the very nature of the discipline, are intrinsically linked. This lack of universal and simple to master virtual tools forces the educators to use random pieces of available software in a nonstandard way to satisfy their varied needs.
Visualization and dynamic modeling becomes one of the central requirements of the mathematics educational software. They should provide an opportunity for broad-range explorations and deeper understanding of mathematics by the student. The positive role of user-friendly software interface, the second after mathematics language the student has to master, cannot be underestimated. As in any bilingual conversation, the richness of languages helps to express the meaning. Unfortunately, except for some dynamic geometry applications, the interface of available software remains cumbersome and unfriendly. Some professional CAS systems allow for a customized interface, but such customization requires an advanced knowledge of the software and is not suitable for mathematics teachers and students. We offer a different option: a simple, natural and universal interface of educational software with perhaps more limited abilities to handle advanced mathematics.
This paper demonstrates some ideas and possibilities of the second approach. We present ''''VisuMatica''''— a tool developed by the author for teaching mathematics in the manner that is integrated, visual and interactive.

Abstract for 19868

Integrating Certain Products without Using Integration by Parts

Authors: Tilak dealwis

Affiliations: Southeastern Louisiana University

In this paper, we will describe a novel method of integrating certain products without using the integration by parts formula. In a calculus class, the standard method of integrating products of functions such as polynomials, exponential functions, logarithms, and trigonometric functions is to use the integration by parts formula. Of course, every instructor teaches that this formula is equivalent to the well-known product rule for differentiation of functions. However, when a student uses integration by parts, the idea behind the product rule usually gets lost during the execution of the method. This probably happens because the student is trying too hard to concentrate on the actual mechanics of the integration by parts formula. In this paper, we will show how to use the product rule for differentiation to integrate a variety of products. We will also use the computer algebra system Mathematica to verify our results, and also to gain some new insights. What we have used is Mathematica version 7.0 on a Windows 7 platform, but any other computer algebra system of reader's choice can be used for the purposes of the paper.

Abstract for 19913

Color Models as Tools in Teaching Mathematics

Authors: Ma. Louise Antonette De Las Penas

Affiliations: Ateneo de Manila University

In the mathematics classroom, a lecture or presentation can be made more interesting and can captivate students' attention with the use of color models and patterns. More importantly, these models can be used as tools in teaching and learning algebraic and geometric theories; and make possible the visualization of abstract concepts and the development of critical thinking.

In this talk we present situations where we use color models in teaching students concepts in geometry and abstract algebra. We highlight the role of technology in making these color models accessible in teaching middle school, high school and undergraduate mathematics.

In the second part of the talk, we present how technology, through dynamic geometry and computer algebra systems, facilitates the use of color models to connect and apply mathematical concepts to other sciences. For instance, we use colored patterns and tilings to establish the presence of geometric and group theoretic concepts in the study of crystal structures and physics of nanostructures.

Abstract for 19928

Mathematical Modelling as a Learning Experience in the Classroom

Authors: Keng Cheng Ang

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Mathematical modelling has been gaining attention and becoming a part of classroom practice in many countries. In Singapore, despite recognizing its importance and relevance, curriculum planners and teachers face various challenges in including and incorporating mathematical modelling in their teaching curriculum. Nonetheless, the recommended practice is to expose students to learning experiences in mathematical modelling whenever and wherever possible. In this paper, a framework which serves a practical guide for teachers in planning instruction in mathematical modelling will be introduced. Examples illustrating the application of this framework by teachers in crafting classroom learning experience in mathematical modelling will be presented. In addition, a learning experience implemented for a group of teachers in an in-service course will also be discussed. It is no coincidence that technology had featured quite prominently in these examples as mathematical modelling in practice would often involve the use of some specific technological tools.

Abstract for 19933

Why should We Use Visualization within Math Science and Math Education?

Authors: Vladimir Shelomovskii

Affiliations: Murmansk State University, Deoma

Visualization is powerful and effective tool for understanding and in–depth study of mathematics. It helps students to better understand the foundations of mathematics, engineers to calculate complicated geometric constructions, and researchers to find new mathematical regularities. Modern mathematical science presents such complicated events and phenomena, that even the talented scientists often pass by hidden nuances, unobvious mathematical rules, effects and properties in their math research. We show some examples of scientific research of ATCM 2011 and ICGG–2012 authors, based on math visualization provided by GInMA software. We also show the examples of the calculations which have became possible largely due to the fact that the authors were able to observe with GInMA the computational grid behavior, and have compared the observed image and arising calculation difficulties. Visualization is absolutely necessary in math education. Modern students often memorize standard rule for solving a problem and do not understand meaning of the statement standing behind the rule. We demonstrate the examples of the solutions and their visualization using GInMA, which helps to understand meaning of mathematical statements. With the use of GInMA software we construct derived surfaces and curves, pedal curves, caustic curves and surfaces, complicated intersecting solids, such as the solid formed by intersection of an ellipsoid and a sphere, and many other nonstandard objects, which represent the set of interrelated geometric objects.
All the pictures in the electronic version of this paper are interactive. Install GInMA software from the website http://deoma–cmd.ru/en/Products/Geometry/GInMA.aspx
click on the Figures and investigate interactive solutions of the problems.

Abstract for 19940

A FORGOTTEN IMPORTANT TOOL IN THE NEW MATH CURRICULUM: RECURSION

Authors: Antonio R. Quesada

Affiliations: The University of Akron, Depart. of Theoretical & Applied Math., MAA, NCTM

The capabilities of graphing calculators are changing the way we teach as well as the content and scope of what is taught in basic mathematics. In the United States, following recommendations of the NCTM Standards, recursive procedures, traditionally excluded from pre-college mathematics, began to appear at different levels from elementary to introductory college courses. The ability to i) repeat an instruction or a set of instructions with a single keystroke, ii) to make the output of a calculation the input for the next, and iii) to be able to stop and analyze or modify an iterative process provides a tool of great interest from both the pedagogical and the practical point of view. At the elementary level modern elementary calculators, allow to easily define constant operations that can be used to discover patterns, to reinforce basic facts via the "guess and check" approach, to investigate the relations between basic operations or even their rate of growth, etc. It is however at the secondary level where recursive procedures, accessible via graphing calculators, have the potential for a major impact. In this presentation we show examples from different mathematical areas to illustrate (i) some recursive procedures, that can be easily implemented without programming, (ii) associated powerful mathematical models traditionally taught in upper levels to a selected group of students and now accessible at lower levels to most students, and finally (iii) how recursion, in some cases, provides an alternative problem solving approach less dependent on readymade formulas.

Abstract for 19954

The Elements: A Dynamic Perspective on Euclid's Geometry & Geometry's Euclid:

Authors: Nicholas Jackiw

Affiliations: KCP Technologies, Inc., Simon Fraser University

Modern tools—like *The Geometer's Sketchpad*—and modern applications—like fractals and computer graphics—have energized the study of geometry both in school and in research. Yet for millennia, geometry's development has been dominated by "the most famous textbook ever:" Euclid''s *Elements*. In this talk, I'll take a fresh look at the mathematical and cultural origins and impact of the *Elements*, with a specific emphasis on how essential dynamic technologies—both physical and intellectual—have influenced 2,500 years of geometric development.

Abstract for 19958

Angles as turn: A dynamic geometry conceptualisation for the primary grades

Authors: Nathalie Sinclair

Affiliations: Simon Fraser University

The concept of angle is complex and has been shown to be very challenging for learners. In this paper I show how the conceptualisation of "angle-as-turn" can be developed effectively for young children (starting at age 5) through the use of dynamic geometry software. I will describe the design of the set of tasks based on "angle-as-turn." It will also discuss the results of experimental work with kindergarten children (aged 5) using Sketchpad to engage with these tasks.

Abstract for 19962

Perspective drawing... How can Cabri 3D help deeper understanding of perspective?

Authors: Jean-Marie Laborde

Affiliations: Cabrilog, University of Grenoble and CNRS

Perspective drawing has been a challenge for centuries if not millenaries. Different cultures have been taking various approaches and came to different solutions.
Nevertheless the so called central perspective (including its limiting case parallel perspective) plays a dominant role and indeed rules the kind of representation most of cameras tend to achieve.
Using ancient or more recent iconography I will use Cabri 3D for an overview of these various issues.
From this "perspective" I will also look at the mathematically well posed problem of perspective in other dimensions and not just at projecting 3D-objects on a canvas.
For a deep understanding of the concept of perspective we will explore how things work when projecting a planar object on a line and, probably more challenging, 4D-objects into our ordinary space. We will construct and then contemplate the folding of their nets (actually 3D-bodies) back into their original 4D-solids, all this projected in our space — and then onto a flat screen.

Abstract for 19965

GRAPHING CALCULATOR USAGE IN MATHEMATICS ASSESSMENT IN STPM AND MATRICULATION LEVEL IN MALAYSIA

Authors: Noraini Idris

Affiliations: Universiti Pendidikan Sultan Idris (UPSI)

Proponents of graphing calculators generally contend that using such hand-held technology in the classroom will save time on tedious calculations and remaining time can be used for investigation of different aspects of a given problem. It is also argued that the availability of such hand-held technology enables students to access numerical, graphical and symbolic representations of a given problem that will help the students find connections among these representations to make sense of the problem. Graphing calculators should be used in ways which allow students to learn mathematics in practical and meaningful context, using analytic methods together with graphical and numerical techniques. When the use of graphing calculator is allowed in the assessment, syllabus should be drafted in line with the use of graphing calculator. This requires a clear knowledge on the findings to be achieved. A good understanding of graphing calculator is also important so that we can maximize the use of this technology in assessment. Integration of graphing calculator in assessment requires more attention, not just allow students to use in the assessment, even encouraging students to explore the use of data in the real world. In this presentation, presenter will share an overview of graphing calculator (GC) in Malaysia, benefit of GC and finding of various studies.

Abstract for 19966

Can Mathematical Invention be Automated?

Authors: Bruno Buchberger

Affiliations: Johannes Kepler University

The essence of both mathematical research and mathematical education is explanation. Ex-planation means "making complicated things plain or simple". In other words, in mathematics, we attempt at thinking once deeply for understanding the simple principles behind a seemingly complicated situation and, then, we enjoy potentially infinitely many times that we do not any more have to think but can just apply the result of our thinking for potentially infinitely many cases in a completely mechanical way. In modern times, by the

mathematical invention of the universal (programmable) computer principle, this can also be described by saying that the goal of mathematics is the invention and the proof of general knowledge on the basis of which infinitely many instances of a problem can be solved by one algorithm, i.e. a procedure that can be executed on a computer without any insight-in a completely mechanical way.

Mathematical invention does not proceed in one layer, i.e. just by adding more and more knowledge and more and more algorithms for solving more and more problems on classes of mathematical objects like numbers, geometrical figures, graphs etc. Rather, the mathematical formulae (definitions, theorems, problem specifications, algorithms) themselves can be considered as (linguistic) objects in a higher layer for which problems can be formulated and, hopefully, solved by algorithms. Thus, the invention and proof of theorems and algorithms itself can be considered as a mathematical problem - on objects that are formulae - for which we may ask for an algorithmic solution. This area of mathematics is called "automated reasoning" with various variants (automated theorem proving, automated proof checking, automated algorithm synthesis, etc.)

In this talk, we give an overview on the advances of automated reasoning in the past decades. Notably, we report on recent research of the speaker in the area of automated algorithm invention and the computer-support of mathematical theory exploration. The approach developed in this research is based on two natural and powerful concepts:
(a) Formulae schemata (that mimic basic ideas in the formulation of mathematical knowledge and mathematical methods).
(b) Generation of conjectures from failing proofs (that mimic a fundamental heuristic principle of human invention in mathematics).

In the talk we give some typical examples that demonstrate how much of mathematical invention and verification can currently be automated. In fact, it will be shown that what needed the ingenuity of a typical math PhD student a couple of decades ago can now be generated automatically by systematic meta-mathematical procedures. Also, in the talk, we will draw some conclusions from these research results on the future of mathematical education and, more generally, for the "mathematics of the 21st century" in distinction to the mathematics of the 20th and the 19th century.

Abstracts for Full Papers

Abstract for 19705

From Ancient 'Moving Geometry' to Dynamic Geometry and Modern Technology

Authors: Miroslaw Majewski, Jen-Chung Chuan

Affiliations: New York Institute of Technology, Abu Dhabi Campus, NTHU, Taiwan

Ancient Greek and later Medieval Muslim geometers highly valued geometric constructions that can be created using a straightedge, i.e. a ruler without marking, and a compass. However, solutions of a number of problems in geometry of this period of time were not possible to obtain using these traditional and noble, as it was considered, methods. Such problems were, for example: trisection of an angle, construction of a regular nonagon or heptagon, squaring the circle or doubling the cube. Because these problems were fairly important at this time, slightly less noble, but reasonably efficient methods to solve the mentioned problems were invented. One of them is, so called verging constructions method or constructions with compass and marked ruler. Ancient mathematicians used also a number of constructions where by moving a segment, a line or even a larger group of objects, a desired effect was achieved. For example the famous construction of heptagon by Archimedes, commonly considered as the most unique and elegant construction from ancient times, was created by using moving geometry.

Surprisingly verging and other constructions with moving elements resemble activities that are the essence of the dynamic geometry software, e.g. create a geometric construction with a free element (a point, a segment or a line) and then move the free element to obtain a solution or to check if a hypothesis is valid.

In this paper we analyze the origins of dynamic geometry and show how some of the ancient Greek and medieval Islamic moving geometry constructions can be created with Dynamic Geometry software – Cabri, Sketchpad or any other program for geometry. We also show how the idea of moving geometry contributed to the development of modern technology.

Abstract for 19706

Sequences of Integrals in Experimental Mathematics

Authors: Hideshi Yamane

Affiliations: Kwansei Gakuin University

Some sequences of integrals have nice patterns as can be found in CAS-assisted experiments. In the present paper, we present some interesting examples of this kind and explain useful tips about the use of Maple. We also give a proof of a formula in Fourier analysis. It is based on the study of a sequence of integrals and is well suited for experimental mathematics. It can replace a conventional, tricky proof based on a strange lemma.

Abstract for 19725

Monounary algebras and functional graphs in upper secondary school mathematics.

Authors: Helena Binterová, Eduard Fuchs, Marek Šulista

Affiliations: Pedagogical Faculty of the University of South Bohemia in Èeské Budìjovice, Faculty of Science of Masaryk University in Brno – associate professor of the Institute of Mathematics and Statistics, Faculty of Economics and the Faculty of Economics of the University of South Bohemia in Èeské Budìjovice – assistant at the Department of Applied Mathematics and Informatics

In the paper alternative descriptions of functions are demonstrated with the use of a computer. If we understand them as mono-unary algebraic functions or functional graphs, it is possible, even at the school level, to suitably present many of their characteristics. First, we describe cyclic graphs of constant and linear functions, which are a part of the upper-secondary level educational curriculum. Students don''t expect to see the surprising characteristics of such simple functions which can not be revealed using traditional Cartesian graphing.
The next part of the paper deals with characteristics of functional graphs of quadratic functions, which play an important role in school mathematics and in applications, for instance in the description of non-linear processes. We show that their description is much more complicated.

In contrast to the case with functional graphs of linear functions, it is necessary to use computers. Students can find space for their own individual exploration to reveal lines of interesting characteristics of quadratic functions, which give students a new view on this part of school mathematics.

Abstract for 19728

Determination Stability Ray of a Decision Making Unit in Definition of the Right and Left Returns to Scale

Authors: REZA Shahverdi

Affiliations: Department of mathematics , Qaemshahr Branch, Islamic Azad University, Qaemshahr , Iran

This paper calculates stability ray of a decision making unit , which the right and left its returns to scale , is given, such that its RTS characteristic, in the RTS classification remains.
With regarding to definable hyperplanes of the right and left RTS and classification of DMU, models for measuring stability ray, are proposed.

Abstract for 19744

Visualization of the Cross Ratio and its Geometric Application

Authors: Yoichi Maeda

Affiliations: Tokai University

Cross ratio is a special number associated with an ordered quadruple of points. This number can be visualized in the three-dimensional hyperbolic space as a configuration of two geodesics. Using this visualization, we can show that the angle between two geodesics in the hyperbolic space is a simple function of the cross ratio. Furthermore, we will see that this angle has a relation with the triangle inequality in the Euclidean geometry.

Abstract for 19789

The MCY-Activities:Constructing and Sharing Three Types of Pattern

Authors: Han Hyuk Cho, Ji Yoon Lee, Chul Ho Kim, Dong Hun Lee

Affiliations: Mathematics Education, Seoul National University, Mathematics Education Seoul National University, Hana High School

In recent years, an increasing number of viewpoints hold that students should be engaged in a learning environment where understanding and knowledge transfer take place. This study introduces Mathematics Created by You (MCY)-mentoring program, which allows students to construct pattern artefacts to explore and share. This program is Web 2.0 online-based and so can be shared by several people and mathematics leaning takes place through interactions within this carefully designed environment. In addition, this studies the activities about three types of patterns and three types of mathematical patterns (building block pattern, motion graph pattern and recursive and probabilistic pattern) included in the activities, which are currently taking place for a project that builds an amusement park called i®Mathlandi¯ as a part of MCY-mentoring program. It is observed that the symbol expression and pattern that students designed to create their pattern artefacts in the context of play were progressed from a personal expression to a mathematical expression.

Abstract for 19790

Calculators and the mathematics curriculum

Authors: Barry Kissane, Marian Kemp

Affiliations: Murdoch University

Developers of mathematics curricula make choices regarding the kinds of technology that are to be used by students, which in turn influences the work of both students and teachers to learn and teach mathematics. This paper analyses the potential relationships between calculators and the mathematics curriculum, drawing implications for what can be learned through student access to different levels of calculators. Three different levels of calculators are considered in detail in the paper: scientific calculators, advanced scientific calculators and graphics calculators. Significant consequences of these choices are described and exemplified through a consideration of a number of mathematical topics that are commonly taught in many curricula in Asian countries.

Abstract for 19795

Applications of CAS to analyze the step response of a system with parameters

Authors: Takuya Kitamoto

Affiliations: Yamaguchi University

Recently, Computer Algebra System (CAS) such as Maple and Mathematica increases its popularity in the community of education, mathematics, sciences and engineering, because they can treat symbols, which conventional numerical software packages can not.
In this paper, we apply CAS to the control engineering where CAS are quite useful, since symbols can represent unknown values such as unknown dynamics, design parameters and modeling error in a natural way.

We focus on a system with linear differential equation x''(t) = A x(t) + B u(t), y = C x(t)
where A, B and C are matrices whose entries are polynomials in parameter k. We examine the behavior of the step response of the system, which is expressed by y(t) = C (e^{A t} - E) A^{-1} B,
where e^{A t}, E and A^{-1} denote the matrix exponent of matrix A t, the unit matrix and the inverse of matrix A, respectively.
To analyze the behavior of y(t), we approximate e^{A t} with matrix Pade approximation, and compute a rational function approximation of y(t).
This enables us to examine various properties of y(t). For example, we can compute approximations of the peaktime and the peakvalue explicitly as a rational function of k, which makes clear the relations between those values and parameter k. We present some analysis and design examples of the system, utilizing these computations.

Abstract for 19805

Exploring Pattern Generalization in the Logo-based Microworld

Authors: Han Hyuk Cho, Chul Ho Kim, Dong Jo Shin, Ji Yoon Lee

Affiliations: Seoul National University

This paper aimed to design learning activities for pattern generalization in the Logo-based JavaMAL microworld. We focused on figural pattern activities using polycube pattern, included in the elementary school mathematics textbooks in Korea. We designed web 2.0 based JavaMAL microworld so that students can create and explore pattern objects interactively, and provided students with virtual manipulative and expressive tools to support their thought process for pattern generalization. We analyzed studentsi¯ algebraic thinking based on their symbolic pattern expressions and responses in the pre-test and post-test. The results suggested that studentsi¯ pattern reasoning became more structured and sophisticated, and the JavaMAL microworld was very useful to support studentsi¯ algebraic thinking for pattern generalization in the context of pattern manipulation and construction.

Abstract for 19808

Special Pythagorean Triangles and Pentagonal Numbers

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Keywords: Pythagorean Triangles, Pentagonal numbers, Mathematica
Abstract:The objective of this paper is to show that how research in Mathematics can be facilitated by the use of softwares. In this paper, Special Pythagorean Triangles, in terms of their perimeter to be Pentagonal numbers, are obtained with the help of Mathematica. Cases, when one leg and a hypotenuse are consecutive, are also discussed. A few interesting results are observed. 3D graph of corresponding Pythagorean triplets is plotted using software Mathematica.

Abstract for 19872

Effectiveness of the Smart Board Technology on Growth of Mathematics Achievement and Critical Thinking Skills among Fifth Grade Students

Authors: Mamdouh Soliman

Affiliations: Kuwait University

The value and importance of critical thinking is clearly established as an preliminary step to achieve the most important goal of the teaching of mathematics; the challenge for instructors lies in successfully promoting students'' critical thinking skills within the confines of a traditional classroom experience. Since instructors are faced with a number of students who are differ in their abilities in achievement and thinking , they have to change their policy to meet their instructional objectives and facilitate learning, they are often forced to make instructional decisions between content coverage, depth of understanding, and critical analysis of course material. This study examined whether smart board technology increased growth in mathematics performance and critical thinking of fifth grade students. A descriptive–qusi survey approach was used in this study. The sample consisted of 117 students randomly selected from four elementary schools for girls. Two of the schools used smart board during mathematics instruction, and two schools did not use smart board technology. All students were taught the mathematics curriculum according to the Kuwait ministry of education directions. Sample examined twice in mathematics achievement test and filled also twice in a closed questions in critical thinking. Reliability and validity of both instruments were determined by using Cronbach's Alpha and Kuder Richardson Formula 21 respectively (á=0.89 for achievement test & 0.91 for the critical thinking scale). Descriptive and inferential statistics were used to analyse the data using SPSS Win19. Results showed that there was no significant difference among two groups of students regarding the development of critical thinking, while there was a significant statistical difference regarding mathematics achievement in favour of the smart board technology group. The smart board significantly improved students'' critical thinking skills, which could be solving many mathematical teaching problems.

These findings suggest that using smart board technology could not be an effective pedagogy to enhance students'' critical thinking skills, while could be an effective to enhance students'' mathematics achievement.

Due to this limitation, further research regarding the use of creative technologies to stimulate and challenge the ordinary learners is warranted.

Abstract for 19885

Bias of ML Estimator for Multivariate Regression Model with Vector AR(1) Noise

Authors: Wai Kwong Cheang

Affiliations: National Institute of Education, Nanyang Technological University

This paper considers the use of technology to assess the adequacy of a theoretical bias result in the maximum likelihood (ML) estimation of multivariate regression model with vector autoregressive AR(1) noise. We develop a relatively explicit and conveniently computable approximation for the bias of the ML estimator of the AR parameters. This bias estimate can be used to obtain a bias-corrected ML estimate. To assess the adequacy of our bias approximation, R/S-PLUS programs are written to calculate the theoretical biases and simulate the empirical biases for polynomial regression. Simulation results suggest that the theoretical ML bias approximations are in reasonable agreement with the empirical biases when the mean is unknown. In the presence of a linear or quadratic trend, a longer series length is needed for the bias approximations to be adequate.

Abstract for 19892

Teaching finite fields with open-source CAS

Authors: Alasdair M

Affiliations: Victoria University, Melbourne Australia

Finite fields have long been studied for their intrinsic interest, and more recently for their uses in the definition of some modern cryptographic systems. The Advanced Encryption Standard is based on the cryptosystem Rijndael~\cite{daem02}, which makes extensive use of finite fields in its computation. We have taught a cryptography course to students both locally, and interstate using the medium of the Access Grid~\cite{acce12}. Many of these students have limited exposure to modern abstract algebra, and the use of a Computer Algebra System has been vital to aid their
understanding and assimilation of the material. Over the years we have used Maple, Maxima, Axiom and Sage. This article concentrates on our use of the last three, and shows that for abstract algebra, the open source systems are far superior to the alternatives.

Abstract for 19893

Interactive Worksheets for Learning the Connection Between Graphic and Symbolic Object Representations

Authors: Hitoshi Nishizawa, Takayoshi Yoshioka, Martti E. Pesonen, Antti Viholainen

Affiliations: Toyota National College of Technology, University of Eastern Finland

Learning the close relation between graphic and symbolic object representations is a key to conceptual understanding of mathematical functions and vector equations. For learning such a relation, it is valuable that students manipulate the graphs of functions, and transform the graphic objects directly with observing the simultaneous change of related equations. Here is the need for tailored worksheets, preferably embedded into a www-based learning-support system.
Interactive worksheets concerning linear algebraic concepts like vector operations, basis, linear functions and eigenspaces in the plane were tested in university courses during the last decade. Such worksheets allow direct interaction between the student and the dynamic figure containing geometric objects. Each figure is accompanied by problems to be solved when exploring relationships in the figure. The students' and teachers' positive feedback encourages extending the idea to three-dimensional linear algebra.
Next implementation of the worksheets shows graphic objects as the targets that students move and reshape their own objects to overlay. The simultaneous change of graphic and symbolic objects provides the students with opportunities to recognize their relations. This paper describes how the worksheets are designed, implemented into www-systems, and what reflections they received from students and teachers.

Abstract for 19897

Effects of Technological Gadgets Utilization in Teaching College Algebra

Authors: Thelma Abajar, Patrick Galleto, Craig Refugio

Affiliations: Negros Oriental State University, Jose Rizal Memorial State University

This study investigated the effects of technological gadgets utilization in teaching College Algebra at Jose Rizal Memorial State University System, Philippines. Quasi – experimental design utilizing the Pretest – Posttest Nonequivalent Group Design was used in the study.
Based on the findings, it is concluded that the knowledge students possessed in both the control and the experimental groups on the topics included in the experiment is equivalent or comparable before the intervention. The study also discloses that the experimental group performs significantly better than the control group after the intervention. It is deduced further that there is a significant variation between the performance of the students who were taught using the traditional method of teaching and those who were taught using the technological gadgets in teaching and learning College Algebra. In addition, the study concludes that both the interventions, traditional method of teaching and technological gadgets in teaching and learning College Algebra, made improvement in College Algebra performance of the students or that students performed better during the posttest than during the pretest. Moreover, the College Algebra performance of the students in the experimental group is greatly influenced by the technological gadgets used by teachers and students in College Algebra class which finally means that students in the experimental group perform better than their counterpart.

Abstract for 19898

The Effects of a Portable Computer Algebra System (CAS) on Pre-university Students' Attitudes towards CAS

Authors: Wee Leng Ng, Yee Dat Sun

Affiliations: National Institute of Education, Nanyang Technological University, Anglo-Chinese Junior College

The main objectives of this study were to investigate the effects of a portable computer algebra system (CAS) on students' attitudes towards CAS and find innovative ways of teaching mathematics using the portable CAS. An intact class of second year pre-university (Year 12) students in Singapore participated in this study. The participating students were each given access to a CAS calculator for approximately six months and underwent a CAS Intervention Programme (CASIP). The CAS Attitude Scale (CASAS) was administered on three separate occasions to the participating class to measure students' attitudes towards CAS. The CASAS comprises four subscales of 10 items to measure students' sense of Anxiety, Confidence, Liking and Usefulness in regard to the CAS. Based on paired-sample t-tests, even though the second and third surveys indicated improvement in all four subscales and the overall scale, with the exception of the liking subscale in the first comparison, the results were not statistically significant.

Abstract for 19901

STUDENTS' SKILLS IN MATHEMATICAL COMPUTATION

Authors: Patrick Galleto, Craig Refugio

Affiliations: Negros Oriental State University, Jose Rizal Memorial State University

This study sought to find out the students' skills in mathematical computation using graphing calculator in teaching Mathematics among freshmen College Algebra students of the College of Education of Jose Rizal Memorial State University, Philippines. The skills that the students possessed in both the control and the experimental groups on the topics included in this experiment is equivalent or comparable before the intervention. The study also concludes that the experimental group performs significantly skillful than the control group after the intervention. It can be deduced further that there is a significant variation in the students' skills in mathematical computation between the control group with the traditional method of teaching and the experimental group with the used of graphing calculator in teaching and learning Mathematics. In addition, the study concludes that both the interventions, traditional method of teaching and using graphing calculator in teaching and learning Mathematics, make improvement in the students' skills in mathematical computation. This means that students perform skillfully better during the posttest than during the pretest. However, students' skills in mathematical computation in the experimental group are greatly influenced by the graphing calculator used by teachers and students in College Algebra class. This concludes that students in the experimental group perform skillfully better than their counterpart.

Abstract for 19908

Connecting Probability to Statistics Using Simulated Phenomena

Authors: Theodosia Prodromou

Affiliations: PME, MERGA, ICME, CERME

This article addresses the use of probability to build models in computer-based simulations, through which exploring data and modelling with probability can be connected. The article investigates students' emerging reasoning about models, probability, and statistical concepts through an observation of grade 9 students, who used TinkerPlots to model a sample simulation based on probabilistic models of populations and tested models by comparing their behaviour with the generated data. Results from this research study suggest that students' use of probability to build models in computer-based simulations helps students to conceive of objects as comprising a set of data and the data distribution as being a choice made by the modeller to create approximations of real or imagined phenomena, where approximations depend on signal and variation.

Abstract for 19909

Visualization of a Mathematical Model of Computation

Authors: Pradip Dey, Gordon Romney, Mohammad Amin, Alireza Farahani, Hassan Badkoobehi, Ronald Gonzales

Affiliations: National University, School of Engineering, Technology and Media, National University, School of Engineering, Technology and Media

Mathematical models of computation such as Turing Machines, Pushdown Automata, and Finite Automata are useful in modeling real world computational problems. This paper presents dynamic visualization of some Turing Machines which clarify computational problem-solving aspects of these models. The design and implementation of the dynamic visualization are performed in an iterative process making improvements through successive iterations. The dynamic visualization is available at the following website: http://www.asethome.org/math/. An example of static visualization of one of the models is presented for consideration of the relative advantages and disadvantages of both visualization techniques.

Abstract for 19911

Cognizable, Learnable, Expressible, Accessible, and Reasonable Model in Mathematical Thinking, Reasoning and Problem Solving

Authors: Hsiu Ju Chang

Affiliations: Department of Education, National Chengchi University, Taipei County Shu-Lin High School

By means of dynamic visualization, learners have multiple cognitive channels to participate knowledge and information acquisition. However, the acquisition and internalization processes may dependent on the

cognitive load of individual learners. The analogy algorithm of dynamic and visual aid learning objects will lead individuals to make concept projections and infer specific analogical and relational conceptions during mathematical problem thinking, reasoning, and solving processes. The Cognizable, Learnable, Expressible, Accessible, and Reasonable Model (CLEAR Model) is to identify the core objectives of mathematic concepts and operations into visible, comprehensible, and recognizable presentations. The transactional analysis, inference, and analogy processes can express the essential conceptions and eventual conceptualizations in thinking, reasoning, and solving mathematical problems. In other words, the analogy algorithm of dynamic and visual aid learning objects usually take ownership and share leadership of instruction processes. In mathematical learning, the expressions of conception may formulate by individuali¦s psychological order reasoning or generate by mathematical logic reasoning. In this paper, we show the parallel learning objectives in 1) two sides of two angles are parallel each other, 2) two sides of two angles are perpendicular each other, and 3) two sides of two angles are one side parallel and another perpendicular each other within using the CLEAR model to evaluate the analogy algorithm of learning objects and try to build an adaptive and reasonable learning paths for individuals to build their mental image.

Abstract for 19914

A Didactical Transposition of the Perspective Theorem of Guidobaldo Del Monte with Cabri 3D

Authors: Jean-Jacques Dahan

Affiliations: IREM of Toulouse

The parallel perspectives used to represent 3D figures in 2D have the great advantage to respect the "parallelism" property, which is an enormous help for those who use these figures in 3D geometry problem solving. But these representations do not give a realistic impression. They do not display what our eyes see. At the beginning of the 15th century Guidobaldo (1545-1607) solved this problem mathematically in Perspectivae Libri Sex. He was the first ([8]) to give the proof of the positions of the vanishing point of a direction with respect to the position of the observer. Kirsti Andersen considers him as the father of the mathematical theory of perspective ([1]), We will see how Cabri 3D can help to understand what this theorem states. The principal aim of this paper is to show how I rediscovered this theorem using an experimental process ([11]), how I have discovered a more general form of it, especially that which includes the angle between the plane of the representation and the vertical plane parallel to the plane of the eyes (and the chin) of the observer. Vanishing points arose to help us understand the geometry of buildings, which we photograph with our cameras. This work started with a special task I had to achieve: help middle school students to understand the obtaining artistic results with their cameras before a competition focused on "the mathematics in the city". So, we can use the stages of this discovery as the base of an approach of the teaching of the conical representations. Back to the parallel perspective we will give some results never published about the coefficient of such perspectives with respect to the angles of their direction.

Abstract for 19917

Multiple Suggestions for Interactive SDE Estimation

Authors: Ryoji Fukuda, Hiromi Yokoyama

Affiliations: Faculty of Engineering Oita University

We are developing educational software to estimate the parameters of stochastic differential equations (SDE) using a single set of time series data. Our target equation is a linear SDE with constant coefficients, which is determined by four real parameters. In our previous version, for a single set of data, we obtained a single set of estimated parameters and suggestions to change them. In this study, we propose a method to give several set of estimated parameters, assuming several situations for the first estimation. Then, we will be able to find closer set of parameters, and the interactive estimation will be improved.

Abstract for 19918

Improvements and Evaluations of Tactile Graphical Viewer for the Visually Impaired

Authors: Ryoji Fukuda, Akihiro Miura

Affiliations: Faculty of Engineering Oita University

Our tactile graphical viewer recognizes the type of a handwritten input curve and displays it on a tactile display. We propose new recognition method and change function for input curves. With this recognition method, we propose a procedure to add new curve types. Using the change function, we are able to reduce the time taken to create the required curves. This system has functions to provide some graphical information as a tactile images. We present some evaluations for receiving the information and understanding the underlying properties.

Abstract for 19925

Blending of Traditional Approach and Internet Technology to Teach Engineering Mathematics

Authors: Vipul Shah, Rajesh Sanghvi

Affiliations: G H Patel College of Engineering & Technology, Vallabh Vidyanagar, Anand, Gujarat, India, G H Patel College of Engineering & Technology, Anand, Gujarat Technological University, Gujarat

Mathematics is an integral part of the study of engineering regardless of which branch of engineering is chosen. In this article, we suggest a blending of analytical approach and use of internet technology for interactive teaching of computationally oriented undergraduate engineering mathematics. In recent years, an increasing number of web sites have offered significant material which is publically available. We believe that integrating the traditional method, such as with chalks and black board, with screen projections from the web pages for better visualization surely increases depth of content knowledge and pedagogy through inquiry and reflective practices.
In this paper, we shall discuss how internet technology is useful for some of the topics like differential equations, linear algebra, numerical methods, of engineering mathematics while teaching in a class. There are numerous sites explaining the concepts in depth as well as providing examples related to field in different branches of mathematics. Students can learn the material themselves also. Video lectures delivered by experts in the field to the students of recognized institutes are also available on the internet. Many e-books are also freely downloadable.

Abstract for 19991

Creative Learning of Analytic Geometry through NC Programming with a Virtual Lab Application

Authors: Pongrapee Kaewsaiha

Affiliations: International College, Suan Sunandha Rajabhat University, Thailand

This paper presents the use of NC programming as a part of learning activities in analytic geometry class, with the use of a developed virtual lab application. The aim of the designed learning activity is to enhance the creativity of students in learning analytic geometry by visualizing the relationship between course materials and a real application in manufacturing industry.

Abstract for 19992

Expanding Plane Geometry Using The Geometer's Sketchpad

Authors: Chaweewan Kaewsaiha

Affiliations: International College, Suan Sunandha Rajabhat University, Thailand

This paper describes a very broad meaning of "expandable plane geometry". It includes any plane geometry that transforms by using the tessellation transformation concept, a two-space expansion. The symbols used to describe the tessellation forms (regular and semi-regular) use naming conventions by choosing a vertex, then look at one of the polygons that touch that vertex. How many sides does it have? The notation of a regular tessellation of triangles has six polygons surrounding a vertex, and each of them has three sides: the symbol used to describe is "3*3*3*3*3*3" or "3^6" means there are six triangles at each vertex. A semi-regular tessellation is a set of regular polygons of two or more kinds so arranged that every vertex is congruent to every other vertex.

Abstract for 19993

Elementary proof of Sejfriedian properties

Authors: Michael Sejfried, Vladimir V. Shelomovskii

Affiliations: METAL UNION, Czestochowa, Poland; Murmansk State University, Russia

In this paper we investigate a new type of symmetry for an arbitrary triangle, so called Sejfriedian, and we show an elementary proof of selected properties of Sejfriedian. This type of symmetry was obtained by Michael Sejfried in 2008(?). Sejfriedian is a pair of triangles inscribed into a circle, the circle and the set of lines coming out of all vertices of the given triangle. It has many interesting properties. Sejfriedian gives students an opportunity for in-depth study of the properties of stereographic projection and spatial inversion and combining of mathematical expressions.

Abstract for 19994

e-Teaching and e-Assessment of Minimum - Maximum Problems using Maple

Authors: Bill Blyth

Affiliations: School of Mathematical and Geospatial Sciences, RMIT University, Australia

Computer Algebra Systems, CAS, are now mature. For years, we've used Maple, a leading CAS, in weekly computer laboratory sessions: a component of an otherwise traditional first semester university calculus course. The Maple topics come from the senior school curriculum, but with innovative approaches to curriculum, pedagogy and assessment. A major objective is that students have a positive attitude

to using Maple.

First year calculus repeats some senior school calculus, for example "Word problems" which students have always found difficult. This presentation focuses on "Maximum" problems. Our Maple topics have no lectures: students work collaboratively in small groups.

We demonstrate an explicit Polya approach to maximizing an area problem, with an assignment on the Norman window problem that's individualized for each student group. We discuss a variety of assessment methods: paper submission (marked by hand), Maple file submission (e-Marked by annotating each Maple file with text or Digital Ink), Computer Aided Assessment (CAA: automatic marking of the symbolic answer using Maple – which MapleTA can also do). Alternatively, MapleTA can be used to mark student work done by hand with just entering the result into MapleTA. Within Maple, we have implemented a procedure to mark plots (which no other Computer Aided Assessment can do). Surveys show students really like immediate automatic marking. We demonstrate materials for a following session introducing multiple representations and multiple solution methods: graphical (zoom-in), animation, proof without calculus and with calculus; with an accompanying parameterized assignment. Students are engaged, active and collaborative learners with these Maplesessions.

Abstracts for Papers with Abstract Only

Abstract for 19702

UNION DISTINCT FAMILIES OF SETS, WITH AN APPLICATION TO CRYPTOGRAPHY

Authors: Mausumi Bose, Rahul Mukherjee

Affiliations: Indian Institute of Management Calcutta, Indian Statistical Institute

A family of sets is called K-union distinct if all unions involving K or fewer members thereof are distinct. If a family of sets is K-cover-free then it is K-union distinct. In this paper, we recognize that this is only a sufficient condition and, from this perspective, consider partially cover-free families of sets with a view to constructing union distinct families. The role of orthogonal arrays and related combinatorial structures is explored in this context.

The results are applied to find efficient anti-collusion digital fingerprinting codes which aim at deterring unauthorized utilization of multimedia content by a coalition of users. These have been of considerable recent interest. It is seen that our construction leads to an improvement over the existing ones in the sense of accommodating more users for a given resiliency.

Abstract for 19704

Impact of Using Scientific Calculator In Examination Of Engineering Mathematics

Authors: Wei Ching Quek, Chew Peng Kok-Mak

Affiliations: Singapore Polytechnic

Advanced Scientific Calculators such as CASIO fx991-ES has been available and approved for Singapore Polytechnic Examinations for many years. However, many students are not aware of the capabilities of these calculators, especially the first year engineering students who are still used to the scientific calculators approved for O-level examinations. The author believe that the "newly" available features in advanced scientific calculators can help students to speed up tedious computations and improved accuracy during examinations. The authors decided to explore methods of enhancing students' understanding of such humble tool. In addition, it is hoped that through these research, teaching staff will get to reflect on curriculum and assessment.

Abstract for 19730

CLASSIFICATION OF WALLPAPER IN ISLAMIC ARTS FOUND IN SINGAPORE AND MALAYSIA

Authors: Wei Ching Quek, Jiewen Kam

Affiliations: Singapore Polytechnic, SIM University

The presentation will introduce a wallpaper pattern mathematically using the concept of wallpaper groups. The authors have visited museums and mosques in Singapore and Malaysia and will share their findings on classification of two-dimensional islamic arts based on wallpaper groups. The author will also share some wallpaper designs activity worksheets produced with Geometer's Sketchpad® for upper primary students.

Abstract for 19732

Technological Tools and Chinese College Entrance Exam Problems

Authors: Qiuxia Li

Affiliations: Xi'an Senior High School

As stated in the Problem Corners at the eJMT (https://php.radford.edu/~ejmt/ProblemCorner.php): "Many mathematics teachers present an answer to a problem too quickly before allowing students to grasp the key concept behind the problem." In this presentation, we will describe some general obstacles students face when they solve a typical college entrance problem, and we will show how technological tools can enhance their understandings not only on solving one particular problem but also on general related concepts too Since examinations play important roles in Chinese education system, it is important to stress the knowledge

competency not only in math content and but also the use of technological tools. Consequently, teachers' training programs are essential.

Abstract for 19737

Using Spreadsheets to create different rug patterns

Authors: Maryanne Bagore

Affiliations: Divine Word University

A spreadsheet is a powerful mathematical tool that is widely used by math educators and learners to comprehend and solve many mathematical problems. This paper will illustrate an innovative way on how Excel can used to create different artistic rug designs or patterns using the concepts of Geometry, Algebra and Calculus in a Spreadsheet Application. Mathematical models are created to show how a particular rug patterns or designs can be created in Excel. My examples of rug patterns or designs would be taken from the traditional Papua New Guinean mats and/or rugs which are made mostly from the pandanas and coconut trees. In addition to PNG mat/rug designs, other examples will include rug patterns or designs from different countries and cultures such as the 'kilim' from Turkey. Through my examples, the main point is on how Excel can be seen as an application that can used to create interesting, creative or odd things and not just for the fun of doing mathematics. The concept of this paper can be used in both the classroom teaching and teacher development.

Abstract for 19743

SPICE UP MATHEMATICS LESSONS WITH KODU

Authors: ROHAIZA RAMLI

Affiliations: JPNWP KUALA LUMPUR

This presentation will discuss the role of kodu, in highlighting the role of ICT as an evaluation steps in learning and teaching of mathematics. Kodu is a powerful visual programming system invented at Microsoft Research to allow creation of games and simulations in an intuitive way within a richly detailed 3D world as to make learning more engaging and it is the link to creativity and innovative ideas. This paper particularly centers on lab activity that produced kodu games with simple programming language to enhance effective learning of mathematics. The use of kodu could be a catalyst variable to engage the students' interest in studying mathematics whereby rich graphic designed and 3D environment allow students to become creative and innovative.

The discussions are based on the finding from a group of students at secondary level in Malaysia. The objective of the study is to assess students' understanding after learning Coordinate Geometry using kodu as a more mobile (stress-free) way of assessment approach. The findings indicated that the exposure of kodu as a mean of evaluation is stimulating as the students demonstrated a deep interest and total immersion as well as enjoyment while carrying out the activity. Since kodu offers very simple, easy to understand icon-based programming, some students took it to a higher level by starting to create their own version of game activity. At this point, a teacher may play a role to guide students to tailor-made their game to reflect more on specific learning tasks that was intended.

Abstract for 19777

Teaching Graduate Statistics Through SPSS

Authors: Craig Refugio, Ma. Elsa Ilona Bulado, Evelyn Lazalita

Affiliations: Negros Oriental State University

This paper presents how a graduate statistics course is being taught using SPSS in an ordinary state university classroom. A pretest was given before the teaching-learning process was conducted. Data analysis and interpretation were the main focus and the respondents were first taught about appropriate research design and data collection as well as appropriate selection of statistical tools.

Detailed,step-by-step hands on teaching was utilized on how to enter data and obtain valid results. Interpretation of outputs and on how to present the results in a research report were also emphasized.

Post-test showed that the respondents gained significant knowledge in graduate statistics at 5% level of significance.

Abstract for 19778

GRAPHING INEQUALITIES AND SYSTEM OF INEQUALITIES THROUGH TI 84

Authors: Craig Refugio, Ma Elsa Ilona Bulado, Evelyn Lazalita

Affiliations: Negros Oriental State University

This study was conducted to the randomly selected freshman college students of Negros Oriental State University, Main Campus 1, Dumaguete City and sought to let students graph inequalities and system of inequalities using the Texas Instrument (TI 84) after learning the paper and pencil way of graphing those inequalities with an endview of letting students understand the connections between technology and mathematical concepts. Results showed that students understood that it is good, many times necessary to graph inequalities/system of inequalities through TI 84 and that most of the time TI 84 does not "find" answer" but merely helps to find appropriate solutions to the problem. It is further showed by the students that if one does not understand how to interpret the information that TI 84 provides, then it is of no use at all.

Abstract for 19797

Teaching ANOVA Through MINITAB

Authors: Craig Refugio, Ma Elsa Ilona Bulado, Evelyn Lazalita

Affiliations: Negros Oriental State University

This paper presents the teaching of ANOVA using Minitab software in an undergraduate Statistics class in Negros Oriental State University, Dumaguete City, Philippines. The students were taught on how to enter data in minitab and on how to run ANOVA. Interpretation of the output, post hoc analysis and on how to present the results in a research report were emphasized. Findings revealed that students found it easy and enjoyable in analyzing data using ANOVA through minitab. With the many examples explored by the students, they turned to be experts in analyzing data through ANOVA.

Abstract for 19798

Exploring Flipped Classroom Pedagogy in Teaching and Learning of Sec 2 Mathematics in 1-to-1 Computing Environment

Authors: Luis Tirtasanjaya Lioe, Chik Leng Tan, Chin Wen Teo, Sharon Lee

Affiliations: Nanyang Girls' High School

In recent years, there is a pedagogical trend among educators around the world to capitalise on video technologies and the Internet in teaching and learning of various subjects across educational levels. An increasingly-popular pedagogy is the flipped classroom model that includes reversing activities in class and at home where lesson videos are used outside of class time and more student-centred activities are conducted during lesson time. In 2012, Nanyang Girls' High School (NYGH) adopted a 1-to-1 computing programme across the whole Secondary 2 level (Grade 8), where all students and teachers are equipped with an iPad for greater engagement and collaboration in teaching and learning. Supported by this school initiative, the team of six Sec 2 Mathematics teachers explored the use of flipped classroom to teach 3 units of lessons to all Sec 2 NYGH students (n = 406). The team adopted a semi lesson study model where all teachers came together to plan, prepare, study, and evaluate their research lessons. Two research cycles were carried out. The first cycle was completed in February 2012. All teachers in the team collaboratively created video lessons using applications of their choice to go through concepts and examples on Solving Simultaneous Equations involving Two Variables (2 weeks) for students to watch outside lesson time. Students were taught two consecutive topics Proportions & Variations (1 week) and Pythagoras' Theorem (1 week) in the second cycle held in May 2012. Based on the feedback and evaluation of the first cycle, the instruction is refined in the second cycle to include videos and lesson materials from Ace-Learning (http://ace-learning.com.sg). The study adopts a mixed design approach where teachers' qualitative surveys were conducted three times (before 1st cycle, in-between the two cycles, and after the 2nd cycle) and students' mixed quantitative and qualitative perception surveys were conducted after each cycle. The full paper will discuss the emerging flipped classroom model of instruction from the two phases, challenges that teachers experienced, and findings from teachers' and students' surveys.

Abstract for 19829

Fostering creativity in science amongst kinaesthetically-inclined students through a simple mathematics-based toy in Design & Technology (D&T) lessons

Authors: Nazir Amir, Subramaniam Ramanathan

Affiliations: Ministry of Education, Singapore, National Institute of Education, Singapore, National Institute of Education, Nanyang Technological University

This article describes an action research study conducted in a secondary school in Singapore to show how a mathematical exhibit that is used to demonstrate Pythagoras Theorem in the Singapore Science Centre has been interpreted by a class of less-academically inclined students as they set out to fabricate it in a creative manner during their Design & Technology (D&T) lessons. By harnessing on the design and fabrication skills and fundamental physics concepts that these students pick up in their D&T and science lessons respectively, a platform is created for the hybridization of mathematics to D&T and science through this toy.

Results from this study show that this simple mathematics toy can be a useful D&T project as it offers an opportunity for the less-academically inclined students to better understand the concept of Pythagoras Theorem and at the same time offers opportunities for these students to make creative use of physics principles to add value to the functionality of the toy. Students in the study developed positive attitudes towards studying mathematics, D&T and science after the project.

The study shows that it is possible to link mathematics to D&T and science in a simple way that is within the school D&T curricula and one that places focus on creativity in science as an outcome of curricula interaction.

Abstract for 19874

Teaching Calculus with WebCT Vista and Maple Software

Authors: Bakhodirzhon Siddikov

Affiliations: Professor of Mathematics, Department of Mathematics, Ferris State University, Big Rapids, Michigan, USA

For the last fifteen to twenty years there has been wide exploration of innovative approaches to classroom instruction: the use of the computer in teaching science courses. The results of those explorations have proven that the use of the computer in teaching Calculus courses enhances the students' understanding. It is well known fact that students have difficulty understanding Calculus, when it is taught in the traditional way: with chalk and blackboard. The traditional method of instruction lacks the advantages of the latest technology to demonstrate the applications of Calculus in the real world.

In 2010, Ferris State University funded my sabbatical leave to develop computerized Maple interactive teaching software for the Calculus 1 course. The purpose of the project was to improve students' understanding of the course by using mathematical and scientific abilities of the latest technology. I developed the web-enhanced Calculus 1 course, which is taught entirely on-campus and uses WebCT Vista learning management system and Maple software as a supplement. WebCT Vista software has been used to make the instruction platform more accessible, and Maple software has been used to make the teaching software more interactive and dynamic.

This talk is about the results of the development and implementation of the computerized teaching platform for the Calculus 1 course. I will discuss advantages of designing computerized tests, quizzes, lecture notes, and homework problems. I will emphasize on the abilities of Maple software to guide the students to solve complex calculus problems. I will share with the audience my experience of overcoming difficulties of the development and implementation of the computerized Maple interactive teaching software.

Abstract for 19896

Free vibration of symmetric angle-ply laminated annular circular plate of variable thickness under shear deformation theory

Authors: Viswanathan Kodakkal Kannan, Saira Javed, Zainal Abdul Aziz

Affiliations: Universiti Teknologi Malaysia

In this paper, free vibration of symmetric angle-ply laminated circular plates of variable thickness is studied. First order shear deformation theory is included to derive the equilibrium equations of the annular circular plate. Using the stress-strain and strain-displacement relations, the equilibrium equations are simplified to obtain the coupled differential equations in terms of displacement and rotational functions. These functions are approximated using the Bickley splines and then applied the collocation procedure to obtain the generalized eigenvalue problem. The effect of transverse shear deformation and rotary inertia on the

frequency parameter with respect to the cone angle, thickness variation, radii ratio, ply-angles and various types of material properties and boundary conditions have been discussed.

Abstract for 19905

Contributing to mathematics education by enabling community engagement with the GeoGebra software

Authors: Zsolt Lavicza, Balazs Koren, Markus Hohenwarter

Affiliations: University of Cambridge, Eotvos Lorand University, Budapest, Johannes Kepler University, Linz

GeoGebra (http://geogebra.org), a free, open-source, dynamic mathematics software, is rapidly gaining popularity in the teaching and learning of mathematics around the world. Currently, GeoGebra is translated to 62 languages, used in 190 countries, and downloaded by approximately 400,000 users in each month, and clearly making an impact on mathematics education in most countries. This increased use compelled the establishment of the International GeoGebra Institute (IGI) that serves as a virtual organization to support local GeoGebra initiatives and institutes. There are already 106 institutes in 75 countries, which pursue training and support of teachers, develop teaching materials, and carry out research projects. In this talk, we will outline the directions of GeoGebra software development of versions 4.0, 4.2 and 5.0; its extension to STEM subjects; activities of its community; and the work of GeoGebra Institutes.

Abstract for 19910

2015 Mathematics Curriculum reform with using technology in Cambodia

Authors: Chan Roath

Affiliations: Department of Scientific Research, Ministry of Education, Youth and Sport, Cambodian Mathematical Society

The Education System in Cambodia has reformed in the last 20 years. According to the recommendation of Royal Government of Cambodia, Ministry of Education, Youth and Sport plan to include the usage of Scientific Calculator in the curriculum of mathematics in 2015. Since 2009, Cambodian Mathematical Society has been do the pilot project on using Scientific Calculator in Mathematics classroom in four Institutions with 200 students, the result almost students are satisfies. After that we start to wrote the supplementary text book for students grade 11 and grade 12 included the method using of scientific calculator for solving critical and difficult exercises.

Key word: mathematics curriculum, supplementary text book, scientific calculator, reform, critical and difficult exercises.

Abstract for 19915

Using Scientific Calculator in Supplementary text book and in Mathematics Classroom Grade 11 in High School in Cambodia

Authors: Ngeth Youdarith

Affiliations: Khemarak University

The Mathematics curriculum varies from country to country. One fact, however, is that with the advent of technology. Using Scientific Calculator in supplementary book and in mathematics classroom for students in grade 11 have been used for solving some exercises are difficult to calculation and for two years ago. In this talk, I will presented the properties of using on buttons and their use in the formulation of general computation, trigonometric function (identities and exact value), Statistic in one variable (mean and standard deviation). The aim of this note is to explore various properties of the mean and standard deviation with the aid of a scientific calculator. Value table (Value of the other functions), to explore how to make use of scientific calculator in finding the area by curve.
Key word: mathematics grade11, statistic , mathematics properties, computation, classroom grade 11.

Abstract for 19927

Identification of Potential Instructional Hazards & Design-based Countermeasures in Virtual Manipulatives

Authors: William Speer

Affiliations: Research Council on Mathematics Learning, University of Nevada Las Vegas

In the Principles and Standards for School Mathematics (NCTM, 2000), the National Council of Teachers of Mathematics states that electronic technologies are "essential tools for teaching, learning, and doing mathematics" (p. 24). More specifically, NCTM suggests that "work with virtual manipulatives... can allow young children to extend physical experience and develop an initial understanding of sophisticated ideas like the use of algorithms" (p. 26-7). Virtual manipulatives are among several web-based technologies being used by teachers of mathematics. The development of virtual manipulatives is often an effort to enhance the effectiveness of physical manipulatives and related tools by addressing or overcoming limitations of access, cost, and adaptability. These materials are of importance for the mathematical training of both in-service and pre-service teachers.

Research on the assessment of virtual manipulatives in mathematics instruction is limited. There is some suggestion that students who use virtual manipulatives experience higher achievement or conceptual understanding in mathematics than those using associated physical manipulatives or no manipulatives (Kieran & Hillel, 1990; Schackow, 2007; Smith, 1995; Thompson, 1992). Other studies suggest that students who use both virtual and physical manipulatives show an increase in conceptual understanding (Ball, 1988; Olson, 1988; Terry, 1996, Izydorczak, 2003). Still other studies found no statistically significant differences in achievement for students using physical manipulatives, virtual manipulatives, a combination of both physical and virtual manipulatives, or no manipulatives (Kim, 1993; Nute, 1997; Pleet, 1990, Drickey, 2001).

While research into the use of emerging technologies must continue, there are numerous variables to consider when measuring the effects of virtual manipulative use. For example, studies that show evidence of increased achievement were administered when classroom teachers believed they fit in with the natural flow of the curriculum. Studies with no noticeable increase in student achievement were administered at times that interrupted the normal curriculum. Research design, sampling characteristics, and the type of manipulative used may influence achievement. Other variables include: previous experience with computers, grade level, mathematical topic, treatment length, student attitudes toward mathematics, and computer-to-student ratio.

Abstract for 19935

Some Thoughts on Mathematics Teaching, Learning and Assessment by Using Information Technology

Authors: Jiyan Wang

Affiliations: East China Normal University

With the rapid development of science and technology, it has become a great concern of mathematicians, mathematics educators, mathematics teachers and students in our country to make full use of information technology and Internet technology in mathematics teaching, learning and assessment in order to meet the demands of the times.
In fact, the integration of mathematics with information technology has been considered as a basic concept in our countryi¯s mathematics curriculum standards.
In more and more classrooms information technology, include scientific calculator and graphing calculator, has become a powerful tool for teachers and students in mathematics teaching, learning and assessment. For example, the information technology can be used to:
1) Effectively simplify the mathematics operations on matrix and determinant, solve the general triangles and so on;
2) Understand in death the mathematics concepts such as the existence of irrational numbers, the behavior of the general functions;
3) Explore the existence of solutions of mathematics problems.
We surely believe that the integration of mathematics and the information technology will improve the students'' ability to learn and students can be better cultivated in the world of mathematics.

Abstract for 19936

Analysis of kinds and roles of technology presented in Korean secondary mathematics textbooks

Authors: Hee-Chan Lew, Min-Shik Cho, Young Ran Choi, Seo-Young Jeong

Affiliations: Korea National University of Education

Most curricular documents throughout the world including Korea now emphasize integrating technology with mathematics. Examples of various use of technology have been presented across a broad range of mathematics textbooks to reflect this curricular. In this paper, we categorized all kinds of technology presented in Korean secondary school mathematics textbooks into 8 groups (GC-COM, GC-CAS, GC-GPS, CAS, SP, GPS, DGS, others) and analyzed the role of them in mathematics teaching and learning according to our framework. We examined the frequency and purpose of technology use in these textbooks. Although technology can be used for exploration, conjecture, verification and generalization purposes, most of the textbooks employ technology just for exploration. We try to get pedagogical implications for using technology into mathematics teaching and learning effectively through results of this study.

Abstract for 19941

Technology-based Instruction in Statistics for Graduate Students

Authors: Rebecca Tolentino, Cayao Erlinda

Affiliations: University of the City of Manila

The National Council of Teachers of Mathematics contends that technology is an essential tool in 21st century mathematics education and that teachers should maximize its potential in increasing proficiency in Mathematics. This study is an attempt to explore the application of Technology-Based Instruction in Statistics for graduate students. Respondents were students enrolled in the Master's programs of a chartered university in the Philippines. Two classes in Statistical Methods were used in the study. The first class was taught to statistically analyze data with the use of a Statistical software while the second class used calculators in data processing. This study used mixed method research design. Quantitative data were collected from the scores of the students in the examinations. Qualitative data were gathered from the cases submitted by the students as well as from informal interviews conducted from both groups.

Abstract for 19947

Interactive Learning and Teaching using MathDisk

Authors: Ajit Kumar, Mohamed Jaffarali

Affiliations: Mathdisk Technologies, ICT, Mumbai

This presentation discusses new advances in technology for teaching and learning through MathDisk (www.mathdisk.com) for the development of e-learning for High school and College mathematics. MathDisk, which is designed specifically for educational purposes, can help students to experiment and explore mathematics, both in the classroom and at home using web. What distinguishes MathDisk from the rest of the numerous other graphing tools currently available is the approach and philosophy. In almost all the Math tools, trying to do anything beyond graphing a simple 2D function would require writing code using the tool''s own programming language. MathDisk on the other hand allows the users to express equations as they see it in their textbooks, be it is Vector, Matrix, algebraic expressions, differential symbols etc. There is no artificial layer that stands between the user and the native math expressions. Students never feel any disconnect, as they can instantly recognize and correlate the content with their textbook material. The equal emphasis to both the symbolic and visual representations of Mathematics makes MathDisk an ideal tool to create online interactive textbooks for teaching mathematics. MathDisk also uses Integrated Rigid body dynamics which will help students understand the abstract nature of mathematical structures using simulated physical objects. MathDisk also allows teachers to build models and simulations to improve the cognitive abilities of their pupils in Math and Physics. Users of MathDisk can also use scripting based on the syntax of popular "processing" language to produce amazing math and physics models enabling MathDisk to become truly open ended and infinitely extensible. Unlike desktop based applications which dominate the world of Mathematical software, MathDisk allows users to share their individual resources and their entire working space over web, a key feature in today's interconnected world.

Abstract for 19950

DEVELOPING PRIMARY SCHOOL STUDENTS' SPATIAL ABILITIES THROUGH TRANSFORMATIONAL GEOMETRY: A COMPARISON OF THE EFFECTS OF TWO INTERACTIVE DYNAMIC SOFTWARE

Authors: Xenia Xistouri, Demetra Pitta-Pantazi

Affiliations: Department of Education, University of Cyprus

For a number of years, a critical issue in the field of mathematics education has been the role of spatial abilities (SA) in geometrical understanding, and the importance of finding effective ways for their development. Due to the obvious connection between SA and transformational geometry, a number of researchers have claimed that work with the latter can have a positive impact to the former (Clements & Battista, 1992). Although there have been many research attempts to provide evidence for this position, the relationship is still unclear. One possible reason for this may be that most of these studies consider SA as a unitary construct. This study draws on a theoretical framework from the field of psychology which discriminates three SA sub-components: Spatial Orientation, Spatial Visualization and Spatial Relations (Lohman, 1988). Moreover, since the evolution of multimedia technologies, a number of studies concentrated on the prospective of dynamic geometry software (DGS) training SA. However, there have been some considerations regarding the potential of some DGS in the development of student's spatial and cognitive abilities. Hence, the aim of this paper is to compare the potential of two similar transformational geometry instructions, one with the use of a discrete dynamic DGS and one with a continuous DGS (Moreno-Armella, Hegedus, & Kaput, 2008), to develop primary school students' SA. Two groups of approximately 40 sixth-grade students (total of 79) received a twelve-session instructional program on transformational geometry concepts, with the same activities, but each with a different type of software – a discrete motion software or a continuous motion software. Students' SA were measured before and after the instructional program. The results suggest that the group which used the discrete dynamic software program had a significant increase in the Spatial Visualization factor, whereas the continuous dynamic instruction group had a significant increase in the Spatial Visualization and Spatial Relations factors, as well as in their overall Spatial Abilities. Comparisons between the two groups' post-test means suggest that the continuous dynamic instruction group significantly outperformed the discrete dynamic instruction group in their mean performance in Spatial Relations and overall Spatial Abilities. This suggests that instruction of transformational geometry concepts with a continuous DGS may have more potential for developing primary school students SA.
ACKNOWLEDGMENTS
This work falls under the Cyprus Research Promotion Foundation's Framework Programme for Research, Technological Development and Innovation 2009 -2010 (DESMI 2009-2010), co-funded by the Republic of Cyprus and the European Regional Development Fund (Grant:PENEK/0609/57).

Abstract for 19951

Globally Asymptotic Stability of Impulsive Neutral Type Neural Networks with Delay

Authors: Haydar Akca

Affiliations: Abu Dhabi University, College of Arts and Science, Department of Applied Science and Mathematics, Abu Dhabi POB 59911, UAE

Neutral-type neural networks model is generalized with presence of impulsive afect. Existence and uniqueness of the equilibrium as well as globally asymptotic and exponential stability neutral type neural networks with impulses are derived.

Abstract for 19952

Visualization of linear transformation with animation

Authors: Shigeki Ogose

Affiliations: Kawaijuku

Visualization works well for teaching geography, and it works as well for lineartransformation-especially when it is combined with animation.
Here I''d like to show how animation help students to understand the idea of linearity, rotation, expansion and jordan forms of linear transformation on a plane.

Abstract for 19955

PERFORMANCE PATTERNS IN CALCULUS BASED ON THE INTERACTIVE FACTORS OF LEARNING FOR CURRICULAR FRAMEWORK DEVELOPMENT

Authors: Maria Isabel Lucas

Affiliations: Pamantasan ng Lungsod ng Maynila

This study sought to analyze the relationship of the interactive factors of learning—curriculum, instruction and performance. The researcher considered the interactive process of these elements of learning based on the framework developed by Howell, Fox and Morehead (2003).

The focus of this paper is on the performance patterns of selected students in Calculus under the integrated and subject-centered curricular approaches. It also aimed to look into the performance of students in the two curricular approaches and looked into how teachers assess their present curricula and teaching instructions.

Four (4) universities in Manila that offered Calculus were selected in the study. The population consisted of students who had already taken three Calculus subjects and faculty who have taught these subjects. The researcher used both purposive sampling and cluster sampling.

The study employed descriptive method of research. It also used the correlation method. Two types of instrument utilized in this study were: the instrument for curriculum assessment was a researcher-made patterned with Characteristics of Effective Curricula by Kentucky Academic Performance Standards (Missouri MSIP Performance Standards); and the researcher-made instrument following the instructional model identified by Robert Marzano (2000).

Abstract for 19957

Teachers'' Conjecturing and Proving with Sketchpad

Authors: Zhonghong Jiang

Affiliations: Texas State Univesrity, NCTM, SSMA

This presentation will discuss how high school mathematics teachers develop their own conjecturing and proving abilities and their mathematics knowledge for teaching through participating professional development workshops offered by a research project. Interviews with three teachers provided evidence that teachers in the dynamic geometry group were very competent in using the software to conduct geometric explorations, and then make and test conjectures. However, as to proving their conjectures, teachers varied considerably. From the proving activities, we learned the following ideas related to professional development: (1) It is by no means easy to really increase teachers' mathematics content knowledge. To develop effective strategies to achieve this goal is a long-term task. (2) To take full advantage of the dynamic features of Sketchpad to verify whether a conception is true before using it in the reasoning process is an important learning habit, which many teachers didn't have. We should spend enough time and energy to help teachers develop this habit.

Abstract for 19963

Improving Performance of Intrusion Detection Systems using Artificial Neural Network

Authors: Jamal Hussain

Affiliations: Mizoram University, Aizawl, India

The dependence of computer systems in today's world on networks and internet has made security of these systems crucially important. In order to increase the accuracy of intrusion detection systems, false alarms need to be highly reduced. This paper presents an approach to minimize false alarm in intrusion detection based on artificial neural network. Different neural network structures are studied to find the most suitable neural network. An early stopping validation method is applied in the training phase to eventually minimize false alarms and also increasing the generalization capability of the neural network.

Keywords: Network security, Intrusion Detection, Artificial Neural Networks, Optimization, Training Strategies, False Alarm

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Abstract for 19978

Seeing the beautiful mathematics with technology

Authors: Shin Watanabe

Affiliations: The Mathematics Certification Institute of Japan

Many mathematicians think that it is most beautiful formura exp(ipai)=-1. In this formula has basic numbers, pai and e. These number are infinte pai=3.14 and e=2.71. We want to see these numbers are beautiful. Why numbers are beautiful? We use the grahpic calculator and see them.
We have two units on angle, degree and radian. First time we use the unit degree and next changing the unit radian. Why its change is important? The number pai is good on differential. And other number is same.
We show the expansion of numbers, we see 0,1 and i. The operations, adding and multiplication are defined by operations. So we can see the beautiful number i.

Abstract for 20100

To Fulfil Track Simulation With HP39GS

Authors: Liu Chengyang

Affiliations: Quanzhou No.7 Middle School Fujian, China

In this presentation, we investigate the program inside APLET of HP39GS; we break the limit of static function of HP39GS; fulfil dynamic stimulation of conic curve (part of track). We consider actual education situation in China and design more applicable APLET for students to explore.

As teachers, before a class, we can send students the APLET stimulator which was edited earlier, and create a case to guide students personally to observe and test the running of stimulator. This is to ensure students understanding "Track Concept" more vividly and factually. In addition, this is to inspire students' desire of doing research, and explore mathematics questions actively and forwardly. The stimulator which is mainly described in this paper, i.e. track issue of conic curve, intend to let students find and reveal internal relation of conic curve by themselves with HP39GS, and have a more essential understanding on "Track Issue".

Abstract for 20101

Some Analogous Forms For Locus - convenient way for students to deepen their understandings on locus

Authors: Liu Chengyang,Yang Jianyi

Affiliations: Quanzhou No.7 Middle School, China

We investigate HP39GS program APLET, break the limit of static function of HP39GS, fulfil dynamic stimulation of conic curve (Part of locus), and finally design more applicable APLET in line with the actual education situation.

Teachers can send students the APLET stimulator before a class, which was edited earlier, and create a scenario to lead students to observe and test the program of stimulator, so as to ensure students understand "the concept of locus" completely, and inspire the desire of research and explore mathematics questions (see [1]) actively. We notice students prefer this way of teaching style and allowing students to explore mathematics with HP39GS makes a positive impact on teaching. In this paper, we describe three ways of exploring locus: Program, Sequence APLET, and Statistics APLET. The objective is to encourage students learn independently find and yet to stimulate a more natural understanding on locus.

Abstract for 20102

Discuss the Eccentricity of the Conic Section With HP39GS

Authors: Rao Zhenping

Affiliations: Quanzhou No.7 Middle School Fujian, China

One of the conic section is an important content of high school mathematics, as well as a mathematical difficulty of college entrance examination. Eccentricity of the conic section reflects the essential characteristics of conic sections, revealing the geometric nature of the condition. Also the study of conic sections regarding the nature of the geometry theories.is an important characterizations conic section shape parameter, we can generally determine opening size of the flat level of the ellipse and Hyperbola.

In this article we use HP39gs graphic calculator features and graphics capabilities to show unity equations of conic sections, and to show readers the relationship between eccentricity and an ellipse, a hyperbola and a

parabola. Graphic calculator is a wonderful tool to clearly reveal the connections among the three kinds of cone curves.

We hope readers appreciate graphing calculator as a wonderful learning tool to better consolidate and enrich the mathematical knowledge, understanding the inherent laws of mathematics, mathematical knowledge the intrinsic link between the points, and thus can be creative learning and development, better adapted to the changing world, and innovation to transformation of the world.

Abstract for 20103

Make Analogical Inference From A New Angle

Authors: Wu Min

Affiliations: Jiyan Junior High School Fujian, China

Abstract: Among research methods in junior mathematical problems, there is a method which specializes in "from reasonable inference to deductive inference". Meanwhile, the ability to think from individually to commonly, inference ability and how to develop the students' ability of analogical inference and deduction are specifically demanded in the Seven Methods of Mathematical Thoughts. In this article, author will introduce a new method, with which the students can find, compare and solve the problems by using HP39GS under the guidance of the teacher. This new method will offer the average students and those who are weak in mathematics a more proper tool to think and research the problems from a new angle. The teacher will give respective examples of sequence, orbit and triangle, etc. in this article.

Abstract for 20104

Help students learn new plausible reasoning methods-A new attempt Under the MCL environment

Authors: Wu Min, Yang Jianyi

Affiliations: Fujian Quanzhou Jinjiang Jiyan Middle School; Quanzhou No.7 Middle School

In the junior middle school education in mainland China, a very important task is to enable students to acquire the "plausible reasoning". And there is a section devoted to "from plausible reasoning to deductive reasoning"; ''the math exam outline'' for high school and ''examination notes in Fujian province'' had also clearly proposed 7 general methods "from the special ones to the ordinary ones", and the capacity of "reasoned argument", and develop students ' analogical reasoning and deductive ability. This article describes a new approach, under the guidance of teachers, and in the MCL environment, students use the graphing calculator, with the aid of HP39GS, to make an independent discovery, analogy and solution of problems. Allowing students to study from new angles and make a research on the issues, may provide a more appropriate tool in favor of the students at medium or less advanced level. This article will give the examples from tree aspects including arithmetic progression, trajectory, and Delta, one by one

Abstract for 20105

HP39gs graphing calculator in mathematics teaching effect

Authors: Li Jianhua

Affiliations: Beijing city in the first secondary school in the one nine, China

With the new curriculum standards and the aid of the graphing calculator, it examines students' mathematics learning style change; as a teacher in teaching methods, and to inspire. Along with our country basic education reform, mathematics education is committed to " take the student as the main body ", " to foster the spirit of innovation and practical ability as the core ", " information technology and curriculum integration for the bridge" the new education concept change. The subjects of physics, chemistry, biology and other disciplines are classified as experimental classes, that may be one reason why majority of the students like to learn these courses, and mathematics has always been considered a "dry ", and an "abstract " subject, which may be one reason many students stopped pursuing. Today with the graphic calculator, one can make mathematics teaching a positive impact on students' learning and understandings.

Abstract for 20106

Graphing calculator expand the students' learning space About "SSA" further exploration

Authors: Li Haiying

Affiliations: Beijing Tuan Jiehu No. 3 Middle School

This paper introduces “”SSA" further exploration that is based on the Hp39gs graphic calculator in the junior middle school geometry congruent triangles. We propose some ideas to improve Hp39gs graphing calculator "Triangle Solver" Aplet through this exploration. With the implementation of the new course standard, student's beginning ability, inquiry ability, innovation ability concerned, in order to further enhance the junior middle school students experience, explore mathematics study level of knowledge, the development of mathematics cognitive domain, deepen "hand technology and the new curriculum standards of junior high school mathematics teaching integration" topic research, especially with plane geometry knowledge integration, our school positive response HP calculator facing the whole country carried out based on the Hp39 series of geometry application design competition, this paper explores some of the research achievements and ideas in this activity of my class teachers and students.

Abstract for 20107

Explore graphing calculator and discover mathematics

Authors: Li Yu

Affiliations: NO.12 Middle School of Taiyuan City, Shanxi Province, P.R.C

Abstract: This paper uses "HP 39gII graphing calculator to explore natural logarithmic with base number of e" and "students' autonomous exploration graphing calculator built-in functions". Through the description and analysis of these two cases, we can explore how to guide students to use GC exploration and discovery mathematics and how to explore development graphing calculator built-in function. Our goal is to let students understand how to master a technological tool to discover more mathematics.

Abstract for 20108

The HP graph calculator brought us exploration and innovation opportunities

Authors: Liu Ping, Wang Bin

Affiliations: Beijing No.94 Airport Branch Middle School

Abstract: In this paper, I will show some ways which direct us to make use of HP39gs.When we first encountered the graphing calculator, students and teachers all felt very strange, we didn’t know where to start. Furthermore, we didn’t have any confidence at first. But students and teachers kept trying our best to study the capability of graphing calculator. Later we discovered many interesting ways of using it and understanding a complex mathematical concept.This is our first work, we’ll continue to research using HP graphics calculators in our classrooms.

Abstract for 20109

My Perspective On The Effect Of The Graphic Calculator In Training Junior High School Students' Autonomous Learning Ability

Authors: Guo Shuangshuang

Affiliations: Beijing’s 80th Middle School, China

Graphic calculator is an advanced tool for education which makes students much more active and initiative in the procedure of practice. From passive study to positive study, the autonomous learning ability of students can be well developed and their comprehension about the value of mathematics can be much enhanced.

Abstract for 20110

PROMOTING THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN THE TEACHING AND LEARNING OF MATHEMATICS: SEAMEO QITEP IN MATHEMATICS' EXPERIENCES

Authors: Wahyudi, Pujiati

Affiliations: SEAMEO QITEP in Mathematics, Yogyakarta, Indonesia

This paper describes SEAMEO QITEP in Mathematics' experiences in promoting the use of ICT in Mathematics classroom in Southeast Asian region. SEAMEO QITEP in Mathematics is one of Centers under SEAMEO which was launched on July 13, 2009. The Center concerns to improve mathematics education in Southeast Asia. One of its core business is to conduct training courses for mathematics teachers and educational personnel, namely (1) Course on Utilization and Development IT-based Mathematics Learning. The other courses are: (2) Teacher-made Teaching Aids; (3) Joyful Mathematics Learning; (4) Differentiated Instructions; (3) Clinical Supervision; (5) Lesson Study in Mathematics Education; and (6) Southeast Asia Mathematics Realistic Education (SEA RME). In line with UNESCO (2007) concern, SEAMEO QITEP in Mathematics also stresses the importance of the use of ICT in mathematics education by putting it in its core business. The 1st Course on 'Utilization and Development of IT-Based Mathematics Learning' was conducted from 20 September to 15 October 2010 in Yogyakarta. Through the course the participants were guided to explore and use the power of ICT in teaching and learning mathematics. The core activities ranges from the simplest use of ICT such as slide presentation to more complex use of ICT for example utilising Learning Management Systems and developing e-Textbook from Student's textbook. Participants' journey during the implementation of ICT use in mathematics classroom is presented. The factors that support and hinder the participants in employing the ICT are discussed.

Abstracts for Hands-on Workshops

Abstract for 19710

A Hands-On Experience with Virtual Calculus Tutor

Authors: Jonathan Lewin

Affiliations: Kennesaw State University

Virtual Calculus Tutor is the combination of a complete 4 semester calculus textbook in a friendly on-screen form and 101 hours of sound video that the reader can use at any time to enter a virtual classroom where the exact material he/she is reading on the screen is provided as a classroom lecture.

Students appreciate contact with a teacher when they need more help and guidance than any book can provide. Instructors may appreciate the option of being able to direct a student to the Virtual Calculus Tutor virtual classroom instead of having to sit with the student for long periods of time during office hours.

Participants will also be given the opportunity to install Virtual Calculus Tutor on their own computers. The auithor will also be available at ATCM to help those who may interested in creating their own on-screen content and videos.

For more information, please click on the Virtual Calculus Tutor link in the ATCM website.

Abstract for 19731

RESISTED MOTION: A CRTICAL ANALYSIS USING CLASSPAD MANAGER

Authors: Wei Ching Quek

Affiliations: Singapore Polytechnic

In engineering mathematics, resisted motion is usually introduced as an application of ordinary differential equation to make mathematics relevant to students' discipline of studies. The ClassPad Manager is a popular learning tool. We will explore how the tool will assist the learning of resisted motions. This workshop will present some common strategies to critically analyse the resisted motion with ClassPad's symbolic, graphic and numerical capabilities..

This workshop is consists of three activities:
1. Getting Started
ClassPad Manager is a popular handheld CAS calculator. The workshop intends to share with participants essential features of the ClassPad Manager and explore the potentials to solve differential equations. No previous experience with the ClassPad Manager is assumed.
2. Problems Solving
Examine some interesting resisted motion models. Participants will explore the problem from different perspectives, numerically, graphically symbolically and provide further insights to the problem.
3. Lesson Plan
Approaches and views from mathematics and physics will be discussed.

Abstract for 19752

Using Grapher to Help Students Visualize Concepts

Authors: Drew Ishii

Affiliations: Sage Hill School, California Mathematics Council

Grapher is a powerful program found on all Mac computers and laptops that can help students with 2D and 3D visualization of concepts ranging from basic functions in Algebra through multivariable Calculus. Students should not be stifled in their learning of mathematical topics especially advanced topics because of their lack of visualization skills or lack of programming knowledge. In this session, we will work with many different concepts including three-dimensional coordinate systems, quadratic surfaces, vector functions, and the TNB frame. Participants will see how intuitively students can investigate various mathematical topics by experimenting with the program.

Abstract for 19780

TI 84 Plus Workshop

Authors: Craig Refugio, Patrick Galleto

Affiliations: Negros Oriental State University, Jose Rizal Memorial State University

This workshop intends to present the capability of the TI 84 plus in: solving equations in one variable; solving quadratic equations; drawing families of graphs; finding maxima, minima and zeros of functions; verifying trigonometric identity; solving exponential and logarithmic equations; and finding determinants and inverses as well performing operations on matrices.
Thirty (30) sets of TI 84 plus will be brought to this workshop so as to have 30 participants.

Abstract for 19791

Learning with an advanced scientific calculator

Authors: Barry Kissane, Marian Kemp

Affiliations: Murdoch University

While scientific calculators have been available since the 1970s, advanced versions have been developed recently to suit the needs of mathematics education and extend the mathematical capabilities to equations, vectors, matrices, series, complex numbers, probability and statistics, as well as elementary calculus operations of integration and differentiation. So, these calculators provide powerful learning opportunities for many aspects of mathematics treated these days in senior secondary school and university curricula, as well as giving students access to efficient calculation. In this workshop examples will be used to consider some of the ways in which sophisticated mathematical and statistical concepts can be developed.

Abstract for 19793

Learning with a graphics calculator

Authors: Marian Kemp, Barry Kissane

Affiliations: Murdoch University

Graphics calculators provide opportunities for both students and their teachers to engage with mathematics in new ways. This workshop is intended to offer an introduction, for those new to this technology, of some of the possibilities open to classrooms in which such technology is present. A key aspect is that graphics calculators can be used to support student learning of mathematics, even in situations for which external examination rules do not permit their use in formal assessment. We will illustrate the possibilities through drawing upon a range of mathematics areas, including the study of functions, equations, elementary statistics, probability, trigonometry and differential calculus. The focus will be on teachers of senior secondary or early undergraduate mathematics. We will use the Casio fx-9860GII calculator, but do not expect that participants will have prior experience with this calculator.

Abstract for 19794

Using a scientific calculator for learning mathematics

Authors: Marian Kemp, Barry Kissane

Affiliations: Murdoch University

Scientific calculators have been used by both students and teachers for almost forty years, mostly for simple and more complex arithmetic calculations and for tasks involving logarithmic, exponential and trigonometric functions. More recently, modern scientific calculators have been developed to become more user-friendly and to extend their mathematical capabilities to suit modern curricula. While calculators are sometimes regarded as merely devices to produce numerical answers, in this workshop we will also consider instead some ways in which the development of mathematical ideas in the secondary school can be supported with such a calculator. We will use the Casio fx-82 ES PLUS calculators, but do not expect that participants will have prior experience with this calculator.

Abstract for 19899

Problem Solving with the TI-84 Plus Graphing Calculator

Authors: Wee Leng Ng

Affiliations: National Institute of Education, Nanyang Technological University

Equipping students with a set of concepts and skills that enable them to solve a wide variety of mathematical problems is one of the primary aims of mathematics education. To facilitate students' acquisition of problem solving skills, many educators have advocated the use of handheld technology to empower students to learn across different visual representations of a mathematical problem.

The TI-84 Plus Graphing Calculator is a useful tool for students in developing a deeper understanding of mathematics through exploring, investigating, conjecturing and discovering. In this workshop, participants will explore the usefulness of the TI-84 at different stages of mathematical problem solving.

Abstract for 19900

Developing Deeper Understanding of Mathematical Concepts Through TI-Nspire Learning Handheld

Authors: Wee Leng Ng

Affiliations: National Institute of Education, Nanyang Technological University

Handheld graphing technology, if used appropriately in the mathematics classroom, has the potential to enhance teaching and learning of mathematics by empowering students to learn across different visual representations of a mathematical problem. With the aid of such technology, teachers have the means to help students develop a deeper understanding of mathematical concepts and broaden their critical thinking skills.

In this workshop, participants will explore several mathematical concepts through the TI-Nspire Technology.

Abstract for 19906

New features of GeoGebra for teaching mathematics (3D, HTML5 version, tablet optimized version, etc.)

Authors: Balazs Koren, Zsolt Lavicza, Markus Hohenwarter

Affiliations: Eotvos Lorand University Budapest, University of Cambridge, Johannes Kepler University Linz

GeoGebra 4.2 (currently in Beta version, but expected to be released in autumn 2012) includes a full Computer Algebra System (CAS) window by which symbolic calculations can be fully integrated into teaching mathematics. When the development of GeoGebra started it was Java based. Java has the advantage to run on every desktop platform. With the introduction of tablet computers and smartphones, the development of GeoGebra changed. In the beginning of summer 2012 we introduces the html5 based version of the software. The next release of GeoGebra is version 5.0 with real 3D. The proposed workshop will consist of two 60-minute sessions introducing different features of the software: Session 1: CAS and the use of dynamic symbolic calculators Participants will be introduced to the CAS window of GeoGebra 4.2 and can discover how dynamic symbolic operations can be integrated into lessons of different levels. Demonstration of version 5.0 with real 3D. Session 2: GeoGebra in the browser, the html5 version, GeoGebra for tablet devices. Showcase and demonstration of the new versions of GeoGebra. During both sessions, participants will learn how to use GeoGebra as a visualization tool for teaching and to create student-engaging interactive online materials. Free software and ready-to-use materials will be provided. No special computer experience is required.

Abstract for 19922

Technology, mathematics and hands on experiments

Authors: Christopher Longhurst

Affiliations: Hewlett Packard

Have often have our students complained about why are we doing this? Or math is irrelevant to life!

Putting together real life experiments can make mathematics come to life.
How is this done when time and syllabus constraints don't allow it? This workshop will focus on three experiments that can be set up simply and make math more relevant. I will demonstrate the set up

procedure and develop the hands on activity for the teacher and student, followed by a worksheet.
Materials: emulator, MCL, probes and calculators.

Abstract for 19923

Teaching calculus using a visual and discovery approach.

Authors: Christopher Longhurst

Affiliations: Hewlett Packard

In this workshop I will provide an overview of how I teach calculus with a visual approach. Firstly, I will summarise my program and take parts of it and demonstrate how investigation, discovery and visualisation can be used to make calculus more interesting and understandable for the students.

This will be a hands on workshop using graphing calculators and emulators

Abstract for 19926

Using Scientific Calculator in Mathematics Classroom and Supplementary text Book grade 12

Authors: Koy keolong

Affiliations: Using Scientific Calculator

- The Education System in Cambodia has changed in the last 20 years
- According to the recommendation of royale government , they plan to include the usage of Scientific Calculator in the curriculum of hight schools of Ministry of Education, Youth and Sport in 2015 .
- In 2009 ,we tried the Project included Scientific Calculator of Mathematics learning and teaching at 4 places :
PreahSisovath High school.
National Institute of Education
Royal University of Phnom Penh
Khemarak University

Then we also wrote the textbook for grade 12 sdtudents included the use of caculater for solving difficult Exercises .

Abstract for 19931

Colourful Activities using TI-Nspire CAS

Authors: Raymond Rozen

Affiliations: RMIT University, Jacaranda-Wiley, MAV, Accredited T3 Trainer

In this hands-on session participants will have the opportunity to engage with a number of mathematical activities which use the TI-Nspire CAS calculator with Operating System v3.2. Investigations include some of the new features of Version 3.2, including creating a locus of points for parabolas, graphing parametric equations and visualizing the solution to simultaneous equations using three dimensional graphing. These activities are suitable for the TI-Nspire CAS ClickPad and TouchPad and Teacher Software. Previous experience with using the TI-Nspire is desirable but not essential.

Abstract for 19932

The Application of Graphing Calculator in High School Function Teaching

Authors: Jie Shen

Affiliations: Tianjin Teaching and Research Institute, Tianjin, China

As the basic knowledge in high school mathematics, function takes the cultivation of students' thought of number-shape combination, rational thinking, applying awareness and innovation awareness as efficient carriers throughout high school mathematics. The biggest characteristic of function learning is the combination of formula-and-shape. Graphing calculator is of various functions, such as calculation, construction and statistics. At the same time, with its portability, appropriability, interactivity and networking, it provides a studying environment of audio-visual, automatic and polybasic for mathematics learning, contributing to the demonstration of knowledge forming, breakthrough of mathematics difficulties, permeation of thinking method and promotion of rational thinking. Several specific cases are illustrated to

explain the application of CASIO graphing calculator in function teaching and problems needing attention.

Abstract for 19937

Visualization with GInMA in algebra teaching

Authors: Vladimir Shelomovskii, Svetlana Nosulya

Affiliations: Murmansk State University, Deoma

This Workshop is focused on the aspect of visualization during teaching of algebra. We consider visualization with GInMA software, its features and benefits. We show the samples of visualization of such topics as: the function and the parameter, addition of fractions, rounding, multiplication of polynomials, the scale, the numerical ray, the number line, the coordinate plane. We show how visualization in algebra allows us to perform necessary intermediate transformations. Prior experience with GInMA is not necessary. The knowledge on how to use GInMA and its tools will be introduced. At the end of the Workshop you will create your own interactive picture.

Abstract for 19938

Visualization with GInMA in geometry teaching

Authors: Vladimir Shelomovskii, Svetlana Nosulya

Affiliations: Murmansk State University, Deoma

This Workshop is focused on the aspect of visualization during teaching of geometry. We consider visualization with GInMA software, its features and benefits. We use visualization as a basic tool in the study of all major geometric topics. We start with interactive pictures that allow younger students to understand the basics of geometry, that is, the concepts of the area and the volume, the similarity of the shapes, the symmetry about the point, a line and a plane, the concepts of parallelism and perpendicularity. We show how the concept of distance between two points is transformed into the concept of distance between shapes and solids, then into the concept of the shortest path inside the shape or the solid, as well as on its surface, that is, we tell about optimization and bifurcation. We show how to construct the cross-section of a pyramid, and the cross-section of a parallelepiped in a convenient way. Prior experience with GInMA is not necessary. The knowledge on how to use GInMA and its tools will be introduced. At the end of the Workshop you will create your own interactive geometric draft.

Abstract for 19942

Guidobaldo's theorem: central perspective understood with Cabri 3D

Authors: Jean-Jacques Dahan, Jean-Marie Laborde

Affiliations: IREM of Toulouse, Cabrilog

We will use Cabri 3D to rediscover where are the vanishing points of the direction of parallel lines in the pictures we take with our cameras. These points will appear in pictures of buildings pasted in Cabri 2 plus files. Their position with respect to the eye of the observer and the head angle of the camera will help us to rediscover Guidobaldo del Monte's theorem. This workshop is an illustration of Jean-Jacques Dahan's presentation about this theorem.

Abstract for 19943

Construction of Maximal Twistable Tetrahedral Torus

Authors: Jen-chung Chuan

Affiliations: National Tsing Hua University

In the fascinating book "More Mathematical Activities" Brian Bolt supplies a net for a rotating ring of six tetrahedrons. Based on this net, the model forming a twistable tetrahedral torus can be constructed with patience. In this talk we are to show how such a model can be built with Cabriâ€• 3D. With the magic supplied by the dynamic geometry software we are to show how ALL such models can be constructed.

Abstract for 19944

Drawing Conchoid of de Sluze with the Peaucellier Cell, a workshop with Cabri II Plus

Authors: Jen-chung Chuan

Affiliations: National Tsing Hua University

The Peaucellier Cell was the first (1864) planar linkage capable of
transforming the rotary motion into a perfect straight line motion. Interchanging the role of the rotor and the fixed rod, the output is observed
to trace out an interesting curve satisfying the equation
r = cos(t) + a sec(t)
the equation of the conchoid of de Sluze.
In this workshop we are to explore the dual role of the Peaucellier Cell
offering a novel perspective to study the duality between the circle-conchoid
pair in the same way as the telescope-microscope pair.

Abstract for 19945

Turning between Rhombic Triacontahedron and Dodecahedron Back and Forth, a workshop with Cabri 3D

Authors: Jen-chung Chuan

Affiliations: National Tsing Hua University

In this workshop, we are to guide the participants to construct an animation showing how a 30-faced regular rhombic polyhedron can be decomposed into several pieces and then reassembled to form a dodecahedron. The two do NOT enclose the same volume!

Abstract for 19948

Workshop for Introducing MathDisk

Authors: Ajit Kumar, Mohamed Jaffarali

Affiliations: Mathdisk Technologies, ICT, Mumbai

The workshop aims to help users understand the basic techniques involved in creating worksheets using MathDisk (www.mathdisk.com).
• Introduce the Equation Editor, Geometric Computations, Auto Variables, 2D and 3D Function Graphing, and Animation
• Provide specific examples to highlight different tips and tricks involved in creating simple to complex mathematical expressions using MathDisk''s equation editor.
• How to seamlessly interconnect expressions and models drawn using direct user interface.
• Providing specific of natural math notation in vector and geometric operations.
• A step by step tutorial of building a worksheet will be discussed which will help users understand the various menu options involved and how to effectively combine them.
• Users will also learn function graphing both in 2D and 3D which will be followed by using animation, image manipulation and annotation to enhance their worksheet''s visual appeal.
• Users will also be briefed about tips and tricks of using multiple expression groups and graph sheets using an applied example.
• The workshop will end by introducing the users to rigid body dynamics and scripting.

Abstract for 19959

The Geometer''s Sketchpad Introductory Workshop: Tessellations and Tilings

Authors: Nicholas Jackiw

Affiliations: KCP Technologies, Inc., Simon Fraser University

Participants will meet and learn the basic operations of *The Geometer's Sketchpad*, the most widely-used school mathematics software, in the context of exploring regular tessellations of the plane via regular polygons. This hands-on workshop is for mathematics teachers at all grade levels, and is recommended for users new—or relatively new—to Dynamic Geometry technology. Bring your laptop!

Abstract for 19960

The Geometer's Sketchpad: Beyond Geometry

Authors: Nicholas Jackiw

Affiliations: KCP Technologies, Inc., Simon Fraser University

This hands-on technology workshop will focus on applications of *Sketchpad* outside the typical geometry curriculum---especially to algebra, trigonometry, and calculus. While representative topics and activities will be visited, our attention will be split between topics and the tool itself---particularly those aspects of the technology appropriate to mathematical modeling involving equations and their graphs. Some prior *Sketchpad* experience useful but not essential. Bring your laptops!

Abstract for 19995

ATCM 2012 Pre-Conference Workshop: Introduction to e-Teaching and e-Assessment of Secondary School / Undergraduate Mathematics using Maple

Authors: Bill Blyth, Asim Ghous

Affiliations: Australian Scientific & Engineering Solutions (ASES); School of Mathematical and Geospatial Sciences, RMIT University, Australia

Maple is a leading Computer Algebra System, CAS, used and developed continually for 25 years. At RMIT University, Maple has supported student learning for 20 years. This hands-on workshop offers different activities according to each participant's Maple expertise. Participants are invited to bring their own laptop: a 30- day free evaluation copy of Maple will be provided. Participants will be encouraged to work collaboratively (in small groups) on activities without lectures (but with tutor help), just as the students do.

Beginners will be invited to work through

B1. (some of) an Introduction to Maple file (first year students complete in two hours, higher years students take one hour),

B2. a basic "Polya: How to Solve It" file on maximizing the area of a fenced region,

B2 a basic assignment, the Norman window problem, with parameterization and simple automatic marking of the answer.

B3 Time permitting, look at

(a) the advanced Norman window problem introducing multiple representations and solutions using graphical methods (zooming-in), animations and proof without calculus, or

(b) a simple trapezoidal rule (for data) application, the Fish Pond problem, with immediate automatic marking (of several steps) within the Maple file. (Students like immediate marking!)

Experienced users will be invited to

E1. OPTIONAL: bring their own work to seek advice.

E2. Work through B2 and B3 (see above), or

E3. Spot the Curve: identify the randomly generated translation of a curve, with immediate automatic marking. Great fun: understanding of animation is required, so an Introduction to Animation file will be provided..

Abstract for 19996

ATCM 2012 Conference Workshop: Introduction to e-Teaching and e-Assessment of Secondary School / Undergraduate Mathematics using Maple

Authors: Bill Blyth, Asim Ghous

Affiliations: Australian Scientific & Engineering Solutions (ASES); School of Mathematical and Geospatial Sciences, RMIT University, Australia

Maple is a leading Computer Algebra System, CAS, used and developed continually for 25 years. At RMIT University, Maple has supported student learning for 20 years. This hands-on workshop offers different activities according to each participant's Maple expertise. Participants are invited to bring their own laptop: a 30-day free evaluation copy of Maple (and several Maple files) will be provided. Participants will be encouraged to work collaboratively (in small groups) on the activities without lectures (but with tutor help), just as the students do. This workshop will be either:

I. a shortened version of the Pre-Conference workshop for those who did not attend the Pre-Conference workshop. See the abstract for the topics for beginners or for experienced users of Maple.

II. a continuation for those who attended the Pre-Conference workshop. According to interest, another topic

could be chosen: such as the Animation Assignment (with a choice of a secondary school level animation project – this is an extended project that is designed to be interesting) or a more advanced topic such as Taylor Series (designed to support standard lectures and could be completed in the workshop time available)..

Abstract for 19997

ATCM 2012 Conference Workshop: Introduction to Computer Aided Assessment of Secondary School / Undergraduate Mathematics using MapleTA

Authors: Bill Blyth, Asim Ghous

Affiliations: Australian Scientific & Engineering Solutions (ASES); School of Mathematical and Geospatial Sciences, RMIT University, Australia

MapleTA is the major Computer Aided Assessment, CAA, system for courses using mathematics. It is now in version 8 and very many features, see http://www.maplesoft.com for a detailed summary, including a recorded webinar "Introduction to MapleTA". MapleTA has much mathematical appeal because it uses Maple as its Computer Algebra System, CAS: the full power of Maple is available, but invisible to the student who does not need to know anything about Maple. MapleTA keeps full records of student results and can communicate directly with most Learning Management Systems, LMS, such as Black Board and Moodle.

This workshop offers different activities according to each participant's Maple expertise. Participants are invited to bring their own laptop: connection with the internet will allow participants to direct trial some MapleTA materials. Participants will be encouraged to work collaboratively (in small groups) on the activities.

In this workshop participants will:

1. (internet connection permitting) use a guest login as a student to complete a couple of standard questions on first year calculus. MapleTA has a large data bank of questions, so assignments could be constructed from just choosing questions that are already provided.

2. Work through the design of a MapleTA question for the Norman Window problem (see the Pre-Conference or Conference workshop on Maple). The question formulation is simple, but does use a parameter (to individualize the question) and we also include a diagram (generated by Maple, within MapleTA). To mark the answer, we only need a simple match of the symbolic answer (and Maple is used invisibly by MapleTA to accept any mathematically equivalent answer).

3. Work through the design of a MapleTA question for Chris Sangwin's problem: "Give an example of an even function". We'd like to ask this the type of question. However, in this case, we cannot specify all possible correct answers. Since the full power of Maple is available, we can test whether the student's response satisfies the properties that are required.

4. Work through the design of a multistep MapleTA question, if time permits. Universities in many countries have decreasing staff/student ratios. First year courses, in particular, have large enrolments so MapleTA (the only commercially available CAS-enabled CAA) has much to offer staff in managing their marking load.

Abstract for 20111

TI-Nspire CX: a new experience in teaching and learning of Mathematics

Authors: Ms Kwee Tiow Choo

Affiliations: Senior Consultant of Hwa Chong Institution (College) in Singapore

The launch of the new calculator TI-Nspire in 2007 was an exciting development in GC Technology. Multiple representations and dynamic links enable multiple approaches to solving problems. Working documents can also be saved, recalled, edited and transferred between handheld and computer. This is an optimal tool for concept and skill development in the classroom. It offers a new experience in teaching and learning of Mathematics, it has the potential to provide the opportunities for learning through mathematical investigations. We will demonstrate and share how the TI-Nspire can be used to enhance the teaching and learning of Mathematics. Participants will experience how it can be used to engage students and promote understanding in a Mathematics classroom. Topics shared will include graphing, calculus and statistics.

Abstract for 20112

How to develop mathematical thinking in the classroom with DbookPro in Thai

Authors: Masami Isoda, Maitree Inprasitha

University of Tsukuba, Japan, Khon Kaen University, Thailand

In this workshop, participants learn how to use simple mathematics for Earth science in relation to

Earthquake and Tsunami and how to use interactive board in the classroom with dbookPro. International Edition of the DbookPro for editing and using tool of e-textbook is developed by Dr. Masami Isoda and Dr Devadason Robert Peter. On this workshop, participates use the e-textbook (Isoda, 2012) which developed by dbookPro. The e-textbook is produced by the grant from ATCM 2011: Masami Isoda sincerely acknowledges for the support from the ATCM, special thanks to Dr. Wei-Chi Yang for his whole-hearted supports toward the Tsunami disaster in March, 2011.

Reference: Isoda, M. (2012). The Tsunami in March 11th, 2011 : what can we learn from the disaster beyond the expectation in the case of Japan? Tsukuba: CRICED, University of Tsukuba.

Abstract for 20113

TMathematical Modeling for High School Mathematics on Earthquake and Tsunami with the freeware 'dbookPro'

Authors: Masami Isoda,

Affiliations: University of Tsukuba, Japan

In this workshop, participants will learn how to use simple mathematics for Earth science in relation to Earthquake and Tsunami and how to use interactive board in the classroom with dbookPro. International Edition of the DbookPro for editing and using tool of e-textbook is developed by Dr. Masami Isoda and Dr Devadason Robert Peter. In this workshop, participates shall use the e-textbook (Isoda, 2012) which developed by dbookPro. The e-textbook is produced by the grant from ATCM 2011: Masami Isoda sincerely acknowledges for the support from the ATCM, special thanks to Dr. Wei-Chi Yang for his whole-hearted supports toward the Tsunami disaster in March, 2011.

Reference: Isoda, M. (2012). The Tsunami in March 11th, 2011 : what can we learn from the disaster beyond the expectation in the case of Japan? Tsukuba: CRICED, University of Tsukuba.

Abstracts for Poster Sessions

Abstract for 19760

Virtual Game in Classroom for Introducing 3D Vector Operations

Authors: Hitoshi Nishizawa, Kohtaro Shimada, Takayoshi Yoshioka

Affiliations: Toyota National College of Technology

The virtual game presented in this poster is designed to motivate students to learn 3D linear algebra in pre-college mathematics. Students are expected to be familiar to graphical image of 3D vector operations though this game and feel the reality in them because the rules of the game and how the winner are decided are shown graphically using 3D vector operations. The game is a good introduction to the lessons of 3D vectors and their operations.
The game is a tournament, where an avatar of a student or a team of avatars compete each other in various kind of battles at every stage of the tournament. Every student owns an avatar for the game, and the avatar has a characteristic vector of three elements: physical strength, thinking ability, and musical skills. And the battlefields also have 3D characteristic vectors, and the winner of a battle is decided by vector operations. For example, a dot product calculates the effective strength of each player in a battle, with its performance in the battlefield. The operations are first shown graphically in the game, and later explained using their symbolic operations in the rulebook, which becomes the introduction to formal lessons of vector operations.
The game is conducted by a client/server system, which consists of a terminal computer for each team and the host computer connected to a data projector, which display the game to the spectators. Each computer has a terminal program coded with MATHEMATICA using its graphical interface and built-in functions, and connected to the database management program running on the server.
The authors demonstrate how the game-system actually works using a set of notebook computers.

Abstract for 19877

Exponential stability of switched linear systems with interval time-varying delays

Authors: Grienggrai Rajchakit

Affiliations: Major of Mathematics, Maejo University, Chiangmai 50290, Thailand

This paper is concerned with exponential stability of switched linear systems with interval time-varying delays. The time delay is any continuous function belonging to a given interval. By constructing a suitable augmented
Lyapunov-Krasovskii functional combined with Leibniz-Newton''s formula, a switching rule for the exponential stability of switched linear systems with interval time-varying delays and new delay-dependent sufficient conditions for the exponential stability of the systems are first established in terms of LMIs. Numerical example is included to illustrate the effectiveness of the results.

Abstract for 19878

Exponential mean square stability of stochastic systems with interval time-varying delays

Authors: Manlika Rajchakit

Affiliations: Major of Statistics, Maejo University, Chiangmai 50290, Thailand

This paper is concerned with mean square exponential stability of stochastic systems with interval time-varying delays. The time delay is any continuous function belonging to a given interval. By constructing a suitable augmented
Lyapunov-Krasovskii functional combined with Leibniz-Newton''s formula, new delay-dependent sufficient conditions for the mean square exponential stability of the stochastic systems are first established in terms of LMIs. Numerical example is given to show the effectiveness of the obtained results.

Abstract for 19907

Ten years of GeoGebra

Authors: Balazs Koren, Markus Hohenwarter, Zsolt Lavicza

Affiliations: Eotvos Lorand University Budapest, Johannes Keppler University Linz, University of Cambridge

GeoGebra is free and multi-platform dynamic mathematics software for all levels of education that joins geometry, algebra, tables, graphing, statistics and calculus in one easy-to-use package. It has received several educational software awards in Europe and the USA.

The poster is going to show the development of GeoGebra. How it started, developers joined the OpenSource project. New versions of the software, new features included. The current state of development and the future of the software, including beta state development and plans.

Beside the development of the software, the poster shows the development of the community. The community of users, developers, translators from all around the world.

Abstract for 19924

A classification and extension of the linkage -from the view to constitute-

Authors: Chieko Fukuda, Kyoko Kakihana

Affiliations: Teikyo University, JAPAN, Tsukuba Gakuin University

A planar linkage is a collection of fixed-length, one-dimensional segments lying in a plane, joined at their endpoints to form a connected graph. Linkages have been applied with various machines or tools in our lives for a long time. Then some classification of the linkage is considered by the aspect of a practical function. For example, there are linkages to pull a straight line (i.e. Peaucellier''s exact straight-line linkage) or to stretch or shrink figures (i.e. a pantograph). Here, I emphasize geometrical elements of linkages, and classify them from a constitutive viewpoint which is different from a functional aspect. The constitutive viewpoints refer to changing the position of the pinned point or bar, increasing the numbers of the bar or rearranging some linkages in the three dimensions from the two dimensions. I try to look for a new function of linkages by this way of expansion.

Abstract for 19956

Learning to Solve Least Squares Curve/Line Method by Using Spreadsheets

Authors: Sammy Khayat, Craig Refugio

Affiliations: Negros Oriental State University

Least Squares Curve/Line is a mathematical procedure for finding the best fitting curve to a given set of points by minimizing the sum of the squares of the offsets or "the residuals") of the points from the curve/line. The sum of the squares of the offsets is used instead of the offset absolute values because this allows the residuals to be treated as a continuous differentiable quantity. . However, because squares of the offsets are used, outlying points can have a disproportionate effect on the fit, a property that may or may not be desirable depending on the problem at hand.
In this paper, all of the aforementioned terms are calculated using spreadsheets and the procedures are emphasized on a step by step manner.

Abstract for 19971

Matrix Operations Through Spreadsheets

Authors: Craig Refugio, Sami Khayat

Affiliations: Negros Oriental State University

Matrix operation is tedious if it is done through manual computations. This paper presents how spreadsheet can do matrix operations such as addition, subtraction, multiplication, determinants, inverse, adjoint and transpose. Applications are also emphasized in this paper like solving systems of equations as well as areas of triangles drawn in a rectangular coordinate plane through spreadsheet.
A group of 19 Bachelor of Secondary Education major in Mathematics students were pre-tested and post-tested about the aforementioned matrix operations through spreadsheet. Results showed that students gained significant skills in performing matrix operations.