Track: ATCM07 Full Papers

Abstract for 12312

The Integrated Lab Program -- Guided Discovery Learning

Authors: Jerome Epstein
Affiliations: Polytechnic University

Keywords: Undergraduate Level, K-12 Level, Guided Discovery Learning, Teacher Education

The need to raise the skill and cognitive level of too many students (and teachers) is now very well documented. This paper will discuss very briefly some evidence of the problem from a new test instrument developed by the author, but primarily will discuss an integrated math and science laboratory program which is specifically designed to meet this problem. The program uses technology extensively, since it is all done in a laboratory, but it is decidedly low-tech. Most of the equipment needed would be found in any college chemistry or physics laboratory, and any that is specific to this program is relatively inexpensive and commonly available. The key is that the use of technology facilitates cognitive growth by allowing modeling of basic concepts and testing of hypotheses. The paper will discuss the basic philosophy and methodology of the program, discuss implementations that have been instituted, and evaluate results. The Integrated Laboratory Program (ILP) is designed to actually deal with the problems, so widely found, of lack of basic skills, lack of problem solving ability, non-transition to formal level thinking, non-transfer of knowledge, and inability to apply basic quantitative reasoning and skill to real world situations. I discuss the history, the philosophy, the methodology, and the nuts and bolts of implementing such a program. Interested persons are urged to contact the author..

Abstract for 12393

Using Videotaped Components of Lesson Study to Build Communities of Practice for Prospective Mathematics Teachers

Authors: Jack Carter, Beverly Ferrucci
Affiliations: California State University, East Bay, Keene State College

Keywords: Undergraduate Level, Equivalence Relations, Lesson Study, Videos

Two tiers of pre-service mathematics teachers participated in an exploratory investigation in which components of lesson study were used to develop, teach, refine, revise, re-teach, and evaluate a unit on mathematical relations. Twelve fourth-year prospective

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mathematics teachers served as the instructional developers, planners, analyzers, and instructors for the unit, and twenty-five, second-year future elementary school mathematics teachers participated as students.

Videotapes of the lesson study and the instruction showed that the fourth-year pre-service teachers were modestly successful in developing their second-year peers' understanding of the properties of a mathematical relation, primarily by using arrow diagrams and relations on sets of people to give meaning to the properties. Analysis of the videotapes and written lessons showed that the participants who taught the lessons were prone to tell their students about relations without providing tasks for the students to conjecture and construct their own relations.

The fourth-year pre-service mathematics teachers prepared a final paper reflecting on their experiences with the lesson study. A review of the final papers showed that these participants valued: (1) the opportunity to experience the lesson study process within the setting of an academic classroom, (2) the opportunity to work in a group to develop and improve a lesson, and (3) the experience of observing, and in some cases teaching, a lesson that incorporated the joint efforts of other participants.

In retrospect, most of the participants also indicated that they would include more examples in the instructional unit, more examples of equivalence relations, more mathematical examples, and more examples generated and constructed by the students. Increasing class participation was also a concern expressed by most participants.

Abstract for 12728

Development of the Web Resources for Interactive Lessons in Geometry

Authors: Maryam Behnoodi, Jun Moriyama
Affiliations: Hyogo University of Teacher Education, Hyogo University of Teachers Education

Keywords: K-12 Level, K-12 Level, K-12 Level, Web resource, Geometry, Multimedia, Internet

The purpose of this paper is to develop interactive web resources for the mathematics curriculum, concentrate on Geometry. Based on the result of our previous survey (M.Behnoodi , J.Moriyama ATCM 2006) we designed the web resources in eight types of contents. A) Lesson planning; B) Dynamic and interactive; C) Printable worksheets; D) explanations in details; E) Engage the students in challenging mathematics learning; F) projects and presentations; G)

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Questions and answers and H) How to use web resources and math software. By these web resources it is expected that the teachers access virtual sections by printing or using simulations and active functions which can be control by students. They also can see the results of students" progress at the end of each lesson by checking the answers of the questions or degree of hardness of each section. Even more, they can make new simulations by themselves after they read our guid manual for software, have used in these resources.

Abstract for 12731

Visualization of Gauss-Bonnet Theorem

Authors: yoichi maeda
Affiliations: Tokai University

Keywords: Intermediate, Advanced

The sum of external angles of a polygon is always constant, 2PI . There are several elemental proofs of this fact. In the similar way, there is an invariant in polyhedron that is 4PI. To see this, let us consider a regular tetrahedron as an example. Tetrahedron has four vertices. Three regular triangles gather at each vertex. Developing the tetrahedron around each vertex, there is an open angle, PI. The sum of these open angles is 4PI. As another example, let us consider a cube. There are eight vertices and an open angle is PI/2 at each vertex. The sum of open angles is also 4PI. This fact is regarded as a discrete case of the famous Gauss-Bonnet theorem. Using dynamic geometry software Cabri 3D, we can easily understand a simple proof of this theorem. The key word is polar polygon in spherical geometry.

Abstract for 12745

Enhancing Conceptual Understanding in Calculus Using Casio Class Pad 300

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

Keywords: K-12 Level, Computer Algebra Systems, Handheld Calculators, Paper-pencil skills, Constructivist Approach

World over, Computer Algebra Systems (CAS) have greatly influenced mathematics teaching and learning. The last two decades have witnessed extensive research in this area and Mathematics educators have been investigating various ways of integrating CAS with classroom teaching to develop a balanced curriculum, which lays less

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emphasis on paper-pencil techniques and focuses more on understanding concepts. Computer Algebra Systems such as Mathematica, Maple, Derive etc. provide powerful dynamic working environments. However the availability of CAS in the form of handheld calculators such as the Casio Class Pad 300 has brought the power of visualization and exploration right into the hands of the student.
This paper describes a research study conducted with 40 students of year 11 in a traditional teaching environment where the prescribed curriculum emphasizes on mastery of paper-pencil skills and using technology is not a general practice. Two exploratory lab modules in calculus, one based on understanding of limits and the other on application of derivatives to optimization problems, have been discussed. These modules utilize the graphic, numeric and symbolic manipulation capabilities of the Class Pad 300 to facilitate conceptual understanding.
The study revealed that CAS provided opportunities for re-sequencing concepts and skills thus making it possible to teach concepts and applications before manipulative skills. The easy graphing capability of the Class Pad lead to a 'geometric' approach, which allowed the students to visualize and explore concepts. The study also showed that CAS led to the constructivist approach where the learning environment was transformed from the traditional teacher-centered classroom to a student-centered laboratory where the students discovered mathematical ideas for themselves.

Abstract for 12755

Exploring the Possibility of Generalizing 2-Dimensional Geometric Properties to 3-Dimensional Geometric Properties Using Computer Tools

Authors: Dohyeon Kim, Seunguk Jang, Hyobin Lee, Yeongdae Kim
Affiliations: Korea Science Academy
Keywords: K-12 Level

In this paper we would show how we could use computer programs in geometry researches. This paper contains the processes of exploring the possibility of generalizing the properties of 2D-geometry to that of 3D-geometry. Also, we would show how we could generalize backward; we could generalize further on 2D-geometry using the properties we found in 3D-geometry. In our research, we tried to generalize triangular properties into polygons and tetrahedrons. The computer tools we used are GSP and Cabri 3D. We used GSP for 2-dimensional researches and Cabri 3D for 3-dimensional researches.

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Abstract for 12758

Cognitive Requirement and Management of Cognitive Object-Oriented Teaching Model

Authors: Hsiu Ju Chang
Affiliations: Taipei County Zih-Ciang Junior High School

Keywords: Intermediate, Advanced, K-12 Level, COOTM, Information management, metacognition

Cognitive Object-Oriented Teaching Model (COOTM) adopted the capabilities of technology to provide instructors, learners, material developers, and system administrators with suitable strategies and interfaces to co-construct the adaptive teaching and learning environments. By design, such adaptive environments require sophisticated levels of cognitive supporting functions in explicit scaffolding of cognitive requirements, metacognition and teaching/learning strategies. The challenges of an adaptive educational system are also to construct or reconstruct cognitive requirements and guide or redirect metacognition for learners during learning processes. It means that the well-designed of cognitive programs will benefit for learners to build their metal images for recalling and cognizing knowledge/concept which will support the meaningful constructions and interpretations on learners¡¦ knowledge construction. Furthermore, the information management of web-based educational system is the essential factor to acquire and assist teaching/learning processes and is the communicate mechanisms to perform objectives among learners, instructors, material developers, and system administrators. In this paper we based on a model, named Cognitive, Object-Oriented Teaching Model (COOTM) to implement adaptive teaching and learning environment. The precision and bridging behaviors of COOTM are identified by well defined teaching programs, real teaching/learning actions, adaptive cognitive levels, cognitive representations and the detectable/reachable interactive information processes between instructors, learners, material developers and system administrators. While learning is happen, the COOTM tries to maintain and transform the individual learning processes into the visible and manipulated features transparently and sensibly in web-based educational system. The purpose of this paper is to critically analyze criteria underlying learner-centered, tutor-centered, and web-based environments in light of how well learners appear to meet the cognitive requirements for engaging learning processes and how well instructors detect to reach the cognitive management for improving teaching processes.

Abstract for 12846

Variational iteration method and Homotopy-perturbation for solving

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wave equations
Authors: amin barari, D.D Ganji, abdoul reza Ghotbi, Hamid Mohammadi
Affiliations: ms student of mazandaran university in civil engineering, associate prof in mechanical engineering, Ms student in civil engineering
Keywords: Advanced, wave equations, the one-dimensional wave equation, kinematic wave

In this paper, the solutions of the three types of wave equations consist of one-dimensional wave equation, kinematics wave equation and non-linear homogeneous wave equation are obtained by means of homotopy perturbation method (HPM) and variational iteration method (VIM). These equations describe the propagation of a wave (disturbance), and it arises in a wide variety of physical problems. The results reveal that the homotopy perturbation method (HPM) and variational iteration method (VIM) are very effective, convenient and quite accurate to systems of partial differential equations. It is predicted that the HPM and VIM can be found widely applicable in engineering.

Abstract for 12847
EFFECTS OF INTEGRATING THE USE OF GRAPHIC CALCULATORS ON PERFORMANCE IN TEACHING AND LEARNING OF MATHEMATICS FROM THE COGNITIVE LOAD PERSPECTIVE
Authors: Nor'ain Mohd. Tajudin, Rohani Ahmad Tarmizi, Wan Zah Wan Ali, Mohd. Majid Konting
Affiliations: Universiti Pendidikan Sultan Idris, Institute for Mathematical Research, Institute for Mathematical Research, Universiti Putra Malaysia, Sedang, MALAYSIA
Keywords: K-12 Level, Graphic calculator, cognitive load theory

Cognitive load theory assumes that some learning environment impose greater demands than others, consequently impose a higher information processing load on limited cognitive resources in working memory. The theory holds that if an instructional strategy reduces extraneous cognitive load and/or increases germane cognitive load during learning as compared to another instructional strategy, then it will be more efficient in promoting learning, provided that the total cognitive load does not exceed the total mental resources. Based on this premise, three phases of quasi-experimental studies were conducted to investigate the effects of integrating the graphic calculator in mathematics teaching and learning on form 4 Malaysian secondary school students' performance. The findings from this study indicated that integrating the use of graphic calculator can reduce cognitive load and lead to better performance in learning of Straight Lines topic and increase 3-dimensional instructional

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efficiency index. Thus the graphic calculator strategy is instructionally more efficient than the conventional instructional strategy. In addition, a non-significant interaction was found between mathematics ability and instructional strategy. Overall, this study has shown promising implications for the potential of the tool in teaching mathematics at Malaysian secondary school level.

Abstract for 12854

The Effectiveness of The Contextual Approach To The Teaching And Learning Statistics In The Universiti Tun Hussein Onn Malaysia (UTHM)

Authors: nafisah kamariah md kamaruddin, Assoc Prof Dr Wan Mohd Rashid Wan Ahmad
Affiliations: Universiti Tun Hussein Onn Malaysia, Universiti Tun Hussein Onn Malaysia (UTHM)
Keywords: Undergraduate Level, Contextual, statistics, mathematics lab, video, pbl

In 1997, the Technical Education Department under the Ministry of Education, Malaysia, introduced the contextual approach in teaching and learning mathematics, additional mathematics, physics, chemistry and biology in all Malaysian technical secondary schools. From 1998 to 2000 more than 80% of the UTHM intake was from Malaysian Technical Secondary Schools. Thus it was UTHM's obligation to introduce this program as a continual process in higher learning institutions, and thus in 2001, contextual approach in teaching and learning mathematics was introduced in Centre of Science Studies in UTHM. The implementation of contextual approach in UTHM is already more than four years; however there is no proper module of teaching and learning mathematics contextually and there is no experimental research that has been done to study whether this method is effective. Thus, this research is to study the effectiveness of the contextual approach.

Contextual learning means learning that incorporate examples that are drawn from everyday experiences in personal, societal and occupational life and that provide concrete hands-on applications of material to be learned (First Tech Prep National Convention, 1997). The contextual learning key elements are to develop subject matter content, to involve students in doing, to make the connection between content and practice, to practice cooperative learning and to carry out learning in workplace setting (First Tech Prep National Convention, 1997). This research will focus on the contextual approach in teaching and learning mathematics for the second year degree technical students from the Faculty of Technical Education, UTHM. The objectives of this research are as follow:

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1. To determine whether using statistics video clips embedded in power point presentations in learning statistics helps students to understand the statistics concepts
2. To determine whether using mathematical lab using SPSS in learning statistics helps students to understand the statistics concepts
3. To determine whether there is a significant difference between the test result of the contextual group with the non-contextual group.

In this research, a quasi-experimental research design is used. The research instruments will be the questionnaires. 3 quizzes and test. Researchers will designed questionnaires which will consist of 5 main sections : Background, Teaching and learning approach, Video, Class activities, Statistics lab. Likert scale was used as a form of measurement. Solomon's Four-Group Design will be used where the students will be divided into four groups: 2 control groups and 2 treated groups as shown in the attachment. This design allows the researcher to assess whether there is an interaction between the treatment and the pretest. This design combines two basic experimental designs.

This research will produce a proper implementation of contextual approach in teaching and learning mathematics in higher learning institutions. Hence it will help students to learn mathematics and most importantly to apply it in their engineering subjects.

Abstract for 12870

How learning and teaching of Mathematics can be made interesting: a case study

Authors: Sarwar J. Abbasi, Kehkashan Iqbal
Affiliations: Karachi Institute of Economics & Technology, University of Karachi

Keywords: Undergraduate Level, Graduate Level

Abstract: In this paper, we estimate the true proportion of mathematics educators and teachers at undergraduate / post graduate level in Karachi, Pakistan making Math courses interesting. We use random sampling of 75 students of engineering and commerce studying in three different institutes/universities namely University of Karachi, Usman Institute of Technology (UIT) and Karachi institute of Economics & Technology (PAF-KIET). For developing a 95% confidence interval to estimate this true population proportion, we use normal distribution. Furthermore, we investigate with the help of students' responses obtained from the sample data how mathematics teachers at undergraduate/post graduate level make their courses interesting – by their dedication, by giving logical reasoning and concrete examples or by making complex mathematical methods

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accessible to students giving them know-how of mathematical software.

Abstract for 12898
Mathematics Problems and Real Life Scenarios
Authors: Andrew Toon
Affiliations: SIM University
Keywords: Undergraduate Level

Problems that demonstrate the power and relevance of mathematics have always been a time consuming challenge. Here we demonstrate that the development of such problems can be efficiently aided with the use of video sharing websites, which require students to extract their own data to understand and solve problems based on real-life scenarios.

Abstract for 12901
Using MS Word and Field Codes for Teaching Calculus for the Blind
Authors: Felino Pascual
Affiliations: Mathematics/Statistics, Winona State University
Keywords: Undergraduate Level, Calculus, Blind, Braille

At Winona State University, we have had a few blind students major in or take courses in the mathematical sciences. This talk relates some of my experiences in teaching calculus to a blind student in a classroom situation, including some of the problems we faced, and the strategies, technological and non-technological, that we used to get around these problems. During lectures, I used MS Word, which made typed transcripts of the lectures immediately available for Braille translation. I also used a standard feature of MS Word called Field Codes with which I could create mathematical expressions that could be rendered in Braille. The talk will feature some examples of Field Code-generated expressions and the creation of shortcut keys for these expressions.

Abstract for 12907
Integrating Calculators into the Singapore's Primary Mathematics Curriculum
Authors: Yeo Kai Kow Joseph
Affiliations: National Institute of Education
Keywords: Novice, Calculators, Primary Mathematics Curriculum, Mathematical Tasks

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The use of scientific calculators will be first allowed in Singapore Primary School Leaving Examination (PSLE) for all primary level mathematics subjects from the year 2009 onwards. Following the revised mathematics syllabus and curriculum in 2007, not only is the use of calculators is included in the national examination, all Primary 5 and 6 mathematics teachers will be expected to integrate the use calculator into their mathematics lessons from 2008 onwards. As a result, primary school mathematics teachers are required to be proficient in using the calculator and adept at facilitating pupils' usage of the calculator so as to meet the new assessment requirements. Evidence from literature review and research has showed that calculator is an effective tool for enhancement of mathematical concept, development of mental arithmetic skills, pattern recognition, mathematical investigation, solving real life problem and improving problem solving ability. Yet, many teachers and parents continue to believe that they can bring more impairment than good in the learning of mathematics, therefore their use for instruction should never be encouraged in the primary schools. The purpose of this paper is to review what research says about outcome of calculator use in the learning of primary mathematics. This paper also describes six appropriate calculator activities that can be integrated in the teaching and learning of mathematics at the primary level.

Abstract for 12910

Graphic Tool for Communication with Visually impaired Persons

Authors: Ryoji Fukuda, Tetsuya Ohashi
Affiliations: Graduate School of Computer Science and Systems Engineering Kyushu Institute of Technology, Faculty of Engineering Oita University Japan

Keywords: Novice, K-12 Level, Graphic Tool, Visually Impaired

Graphical contents are very useful and convenient in communication including mathematical concepts. However, these are barriers for visually impaired people. Our software is a communication tool for graphical contents between a sighted person and a visually impaired person. This will remove some of these barriers.
The targets of our system are two-dimensional graphic documents, and the objects are in Japanese high school mathematics. When the sighted person explains something using some mathematical concept, sometimes he (or she) has to explain the graphical content, since the concept often has close connection to the graphical content sub consciously. On the other hand, when the visually impaired person explains some mathematical contents, sometimes he (or she) has to

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create corresponding graphical contents. These are not easy, however, to find an adequate way to express or to create these graphical contents. Our system can be a platform for these communications.

Abstract for 12911
Visual Linear Algebra: Meaning and Realization
Authors: Vladimir Nodelman
Affiliations: Holon Institute of Technology
Keywords: visualization, linear algebra, dynamic, interactive

Topics: Applications using Dynamic/Interactive Geometry or/and CAS, Mathematics Teaching, Learning and Assessment using Technology
Linear Algebra, being one of the fundamental mathematics courses, remains one of the least supported by instructional aids. Educators are making multiple efforts trying to ease its understanding, to visualize its notions and their interrelations. Subjects of Analytic Geometry are often studied within Linear Algebra course or before it and play a role of a natural tool for modeling algebraic ideas. However visualization cannot be reduced just to illustration of the course contents. It means also emphasizing and actualization of the correspondent intellectual activities that are also an important part of the studies. This paper demonstrates some new ideas and possibilities in Linear Algebra visualization by means of ""VisuMatica""- a tool developed for teaching mathematics in integrated visual and "interactive" manner.

Abstract for 12912
Beyond the Web-Based Cognitive and Interactive Metacognition Interface within Teaching Similar Triangles
Authors: Hsiu Ju Chang
Affiliations: Taipei County Zih-Ciang Junior High School
Keywords: K-12 Level, cognitive,interactive,metacognition interface

Most of good performances of teaching and learning outcomes are based on the suitable information management and communication during the teaching and learning processes. Every educational communication is not a simple thing which usually involves encoding and decoding information from teaching and learning interface. The interface maintains information which includes different views in teaching, learning, developing, and administering to transmit and receive criteria information and knowledge during teaching and learning processes. However the transmitters and receivers are not always skillful in expression and comprehension or not always energetic enough to send or receive the information exactly. Consequently, the losing information or misconception happened commonly during each information communication. Similarly, while

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instructor and learner communicate the concepts via the web pages in the web-based educational system, the event of losing information occurs in the same time. In other words, the communication interface may not always maintain a good or suitable expression in each concept or knowledge and the learners may not always skillful enough to comprehend and receive the expressions via the interface. Then the web-based teaching and learning communicated interface are not always suitable for supporting, diagnosing and monitoring in teaching and learning misconceptions. This paper presents a Web-Based Cognitive and Interactive Metacognition Interface (WBCIMI) to support learners and instructors to percept, monitor and communicate the critical information and metacognition within teaching similar triangles in web-based educational system. Teaching scenario and empirical evaluation (N= 105, Grade 8, 14~15 years old, from three classrooms) have been done to express multi-stage supporting and multi-level detections of learner¡¦s misconception to detect and guide the metacognition of learners to show the WBCIMI is available

Abstract for 12913

Calculators in the Mathematics Classroom: A Longitudinal Study

Authors: Michael O. J. Thomas, Ye Yoon Hong, Jennifer Bosley, Alan Gil delos Santos
Affiliations: The University of Auckland, St Cuthberts College

Keywords: K-12 Level, Calculator, Secondary School, longitudinal, survey

A key variable in the use of calculators in the learning of mathematics is the teacher. In turn there are many factors that influence whether an individual teacher uses the calculator, and if they do then how they use it. This study reports on a ten-year longitudinal survey data into the use of calculators in the upper secondary school. It presents the pattern of calculator use, some possible reasons for this pattern, and obstacles to increased use. In addition the relationship between calculators and national assessment and equity are examined. Results show that many teachers see benefits in using calculators in mathematics teaching although a sizeable minority are opposed to their use. Further, there is a continuing need for professional development that specifically addresses how to integrate calculators into mathematics teaching in a manner that focuses on the mathematics.

Abstract for 12916

The arbelos, mathematics and computer graphics

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Authors: Hiroshi Okumura, Masayuki Watanabe
Affiliations: Maebashi Institute of Technology
Keywords: arbelos, Java, geometric animation, computer graphics

The arbelos is a plane figure formed by three mutually touching circles with collinear centers. The figure is a historical one, but there are still many discoveries and ongoing researches for this today, which give comprehensible examples of development of mathematics and also give good geometric computer animation materials.

Abstract for 12917

A LaTeX plotting software KETpic and its development
Authors: Masayoshi SEKIGUCHI, Yuuki Tadokoro, Takayuki Abe, Kenji Fukazawa, Masataka Kaneko, Satoshi Yamashita, Setsuo Takato
Affiliations: Kisarazu National College of Technology, The Toho University
Keywords: Undergraduate Level, Graduate Level, LaTeX, CAS, Tpic, KETpic

Topics: Mathematics Education using Information & Communication Technology, Applications using Maple, Applications using Mathematica

We have developed a LaTeX plotting software and call it KETpic.
It is a macro package for Maple and Mathematica, which are famous computer algebra systems (CASs). KETpic enables us to draw fine pictures in LaTeX documents. It is useful particularly for typesetting mathematical documents. In this paper, we explain properties, advantages and perspectives of KETpic with its examples.

Abstract for 12925

Exploring Ellipses by Shuttling Between the Two and Three Dimensional Worlds -Integrated Learning Function and Geometry to Foster Function Sense
Authors: Chieko Fukuda, Kyoko Kakihana
Affiliations: Teikyo University, JAPAN, TSUKUBA GAKUIN University, JAPAN
Keywords: K-12 Level, K-12 Level, Cabri3D, Cabri 2 plus, ellipses, DGS, function sense, conic sections

The ellipse often appears in astronomy and we can see a lot of ellipses in our daily lives. It has been studied for a long time by researchers, and has deep roots in the history of science. Although an ellipse is familiar to us, there are very few mathematics teaching materials about them nor are ellipses usually included in Japanese school curricula. It may be one of the reasons why Japanese teachers and students have not been able to draw and explore figures

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of ellipses and other conic sections easily, especially spatial ones. The development of dynamic geometry software (DGS), for example Cabri Geometry II Plus and Cabri3D , has helped the spatial study of ellipses. In our research, we developed many teaching materials for ellipses and we show them in an e-book (Kakihana, 2007). By using these materials, students are able to explore an ellipse spatially and foster a gfunction sense" (Kyoko Kakihana, Chieko Fukuda, & Katushiko Shimizu (2002); Fukuda, and Kakihana (2005), etc.) in an integrated learning environment for functions and geometry.

Abstract for 12929

The Dynamic Geometry Software as an Effective Learning and Teaching Tool

Authors: Zhognhong Jiang
Affiliations: New York University, NCTM, SSMA
Keywords: Undergraduate Level

This article describes how the use of dynamic geometry software has helped pre-service teachers develop their abilities in three aspects: 1) challenging problem solving; 2) mathematical modeling; and 3) constructing student-centered teaching projects. The examples given indicate that for some of the challenging problems that are presented to students, it is almost impossible or very hard to manually make correct drawings. To overcome this difficulty, the use of dynamic geometry software seems to be critical, or at least very desirable. In addition, the use of the software can stimulate students' insight of problem solving and provide an easy and convincing way of verifying the solution. Moreover, students can construct accurate visual representations to model real world situations very efficiently by using transformations in dynamic geometry software. This can save time significantly so that students can concentrate on more conceptual oriented tasks. Good teaching projects that take advantage of dynamic geometry software can also effectively enhance school children's' mathematics learning.

Abstract for 12938

On Proof Techniques and Technology

Authors: Ma. Louise Antonette De Las Penas, Debbie Bautista
Affiliations: Ateneo de Manila University
Keywords: Undergraduate Level, K-12 Level, Graduate Level

In this paper, we discuss ways on how technology enables students to investigate mathematical ideas, discover facts and formulate good

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proofs.

Abstract for 12952

Converting 'More to Less' and 'Less to More': Designing Self-Determined Learning Environments within Minimalist Instruction

Authors: Lenni Haapasalo
Affiliations: University of Joensuu

Keywords: K-12 Level, ClassPad, computer-based, conceptual, constructivism, minimalist instruction, procedural, self-determined, simultaneous activation, technology-based

Emphasizing the genesis of heuristic processes and students' ability of to develop intuition and mathematical ideas within constructivist approach can hardly be reached without a systematic planning of the learning environments from the teacher's side. In learning situations, however, students very often want to have freedom to choose the problems that they want to solve within continuous self evaluation instead of relying on guidance by the teacher. Based on results of the ClassPad project the article suggests that a viable pedagogical framework to fulfill strong demands of constructivist view of teaching and learning might be to convert systematic planning to minimalist instruction within self-determined learning environments. Concepts and procedures can be mainly constructed by students themselves – and other way around - well-known concepts can be applied in one form or the other one. Minimalist approach seems not only to enrich student's mathematical profile and self-confidence but also lead to higher cognitive performance.

Abstract for 12957

Two explorations with Cabri 3D leading to two theorems

Authors: Jean-Jacques Dahan
Affiliations: IREM of Toulouse

Keywords: Intermediate, Advanced, Undergraduate Level, Graduate Level, experiment, conjecture, discovery, quasi-tessellation, convex hull

Exploring the volume of the convex envelope of a net of a cube with Cabri 3D, as the net opens and closes will lead to a conjecture about the maximum of this volume. We will prove this conjecture. We will also solve experimentally the problem of the tessellation of a cylinder with equilateral triangles after the observation of a picture taken in the convention Center of Hong Kong. The proof will be exposed. Eventually we will present quasi-tessellations to

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illustrate the Schwarz paradox in relation with the lateral area of a cylinder.

Abstract for 12961

Application of network simplex method to currency arbitrage detection

Authors: Wan Mei, Amanda Soon
Affiliations: Mathematics and Mathematics Education Academic Group, National Institute of Education, Nanyang Technological University
Keywords: Undergraduate Level, binary integer programming, network simplex method, currency arbitrage detection.

In this paper, we use a binary integer programming model to detect currency arbitrages. This problem has a special structure, which allows us to apply the network simplex algorithm. Using matlab, a program modelled on this algorithm was constructed to detect currency arbitrages involving numerous pairs of exchange rates.

Abstract for 12977

Making Mathematics Simple, Attractive, and Personal

Authors: Brenda Lee
Affiliations: Wu Feng Institute of Technology
Keywords: K-12 Level, Excel Spreadsheets, Individualized Mathematics Activity, Learning Mathematics

An instructional activity has been created to help students make connection of different topics in mathematics. This activity is based on students' personal names or other words to arouse students' interest in learning mathematics. However, since this mathematics learning is an individualized activity, the assessment of students' performances seems very difficult. In this paper, we will discuss how we use the Excel Spreadsheet Models (ESM) for students to pose questions, discover new mathematics ideas and checking answers. The teachers can use this ESM to check and/or evaluate students' individualized mathematics homework or tests. With all the possible answers collected from the whole class, the students can identify patterns and define mathematics concepts. Thus the purposes of learning mathematics are not just graded students, but to offer opportunities for students to work cooperatively, individually, creatively, and successively.

Abstract for 12982

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Locii Associated with Tangents and Normals of Conic Sections
Authors: Tilak dealwis
Affiliations: Southeastern Louisiana University
Keywords: Intermediate, Undergraduate Level

In this paper, we will investigate several locus problems associated with tangent lines and normal lines of conic sections. The conic sections we consider include parabolas and ellipses, but hyperbolas will be left to the reader. For example, given an arbitrary point P on one of these conic sections, consider the tangent line and/or the normal line to the conic at that point. One can form several regions bounded by these tangent lines, normal lines, other auxiliary lines, and the conic section itself. We are primarily interested in investigating the locus of the center of gravity of these regions as the point P moves along the conic section. The computer algebra system Mathematica was used to help with our computations.

Abstract for 12994
Exploring Ethnomathematics with the Geometer's Sketchpad (GSP): Thai Students' Weaving Projects
Authors: Krongthong Khairiree
Affiliations: International College SuanSunandha Rajabhat University Bangkok Thailand
Keywords: Novice

The purpose of this research study is to explore the connection of mathematics, arts and technology in the context of school mathematics in Thailand. The research study emphasizes on students' projects on the ethnomathematics particularly the weaving using the Geometer's Sketchpad (GSP). GSP empower students to use their ability to visualize and create graphical representation, which will enable them to develop their mathematical thinking skills, concepts and understanding.
The research findings showed that through the use of GSP the students were able to illustrate the connection of geometry patterns and functions based on indigenous Thai designs such as Tean-Jok, Nam-Lhai, and Mud-Mee, and also to create new designs. In addition, students' projects on the ethnomathematics revealed that their designs were woven into textiles and cloths. These findings displayed the implications of drawing on students' mathematics project through mathematics learning and commercial product.

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