



# Program of ATCM-Taiwan December 17-19, 2011

NTHU: National Tsing Hua University

NCTU: National Chaio Tung University

All Talks will be held at NTHU unless otherwise specified.

## December 17, 2011 (Saturday)

8:00-9:00 **Registration:** Mathematics Building at NTHU

9:00-12:00 (Computer Room 1) J.C. Chuan's workshop on Dynamic Geometry

### 12:00-13:30 Lunch Break

13:30-15:00 (Computer Room 1) 19592 結構式複製繪圖法的世界 **Ming-Jang Chen's invited talk and workshop at NTHU**

15:00-17:00 (Computer Room 1)

(19706) 中學數學數位教學設計與實作-左台益

(19707) GeoGebra 在高中『插值多項式』與『綜合除法』教學上的應用-官長壽

(19708) 動態幾何教學系統 GeoGebra 在三角測量上的應用-藍邦偉

(19709) 數學數位遊戲學習環境設計：以一元二次多項式配方法為例-張巧倪、左台益、胡政德

(19710) 代數運算動態視覺化學習環境：以一元二次多項式乘法分配律為例-王偉斌、左台益、胡政德

(19711) 多重表徵數位學習環境的設計與實作：以線型函數為例-蕭淑娟;左台益

15:00-17:00 19701 認知與數位教學-注意力的引導- 陳明璋 **at NCTU**

17:00-18:00 **Registration:** Mathematics Building at NTHU

18:00-19:30 **Dinner**

## December 18, 2011 (Sunday)

8:00-8:30 **Registration:** Mathematics Building at National Tsing Hua University (NTHU)

8:30-9:00 **Opening ceremony**

**9:00-9:50 Plenary Speech 1: Room 1, Chair: Jen-Chung Chuan**

*19648 Enhancing Our Knowledge in Math and Sciences in the Technological Era - Wei-Chi Yang, USA*

|               |   |
|---------------|---|
| 10:00-10:50   | <b>Plenary Speech 2: Room 1, Chair: Wei-Chi Yang</b>  |
|               | 19613 <i>Mathematical Modelling and technology in Singapore Schools</i> – Keng Cheng Ang, Singapore   |
| 11:00-12:00   | <b>Parallel Session I: Presentations (Each contributed paper presentation slot is 20 minutes, unless otherwise specified. Please allow 3 minutes for Q&amp;A, and 2 minutes for changeover)</b> |
|               | <b>Room 1: (Chair: Keng Cheng Ang)</b>  |
| 11:00-11:25   | 19630 The effect of the use of technology on the research of scientifically gifted students-Jong Sool Choi, Jae Hoon Jung   |
| 11:30-11:55   | 19626 Investigating the spread of dengue through a mathematical model - a school project- Xi Chen, Yongjie Khoo, Bangyan Wang   |
|               | <b>Room 2: (Chair Jen-Chung. Chuan)</b>   |
| 11:00-11:25   | 19593 激發式動態呈現教學設計之研究－以代數為例 謝東育, 陳明璋   |
| 11:30-11:55   | 19594 激發式動態教學對學習成效與認知負荷影響之研究-以二元一次聯立方程式的應用問題為例- 葉子榕, 陳明璋, 曾建銘   |
| 11:00 - 12:30 | <b>Hands-on Workshop (GC stands for calculator workshop)</b>  |
|               | (GC Room 1) 應用互動和多面向呈現來教數學-廣天國際有限公司 顧問 李睿紘 老師   |

### 12:00-13:30 Lunch Break

|             |   |
|-------------|---|
| 13:30-14:30 | <b>Invited Talks</b>  |
|             | <b>Room 1: (Chair: TBA)</b>   |
| 13:30-14:20 | 19595 Visual Arts, Music Composition via mathematics, : Hualun Li                           |
|             | <b>Room 2: (Chair: TBA)</b>   |
| 13:30-14:20 | 19702 多面體中頂點組態轉換的數學魔術- 孟慶台  |
|             | <b>Room 3: (Chair: TBA)</b>   |
| 13:30-14:20 | Using the Navigator to obtain instant feedback and response from students- 鄭素音 老師 (新加坡華僑中學) |

### 14:30-15:00 Tea Break

|             |   |
|-------------|---|
| 15:00-16:00 | <b>Invited Talks</b>                                  |
|             | <b>Room 1: (Chair: TBA)</b>                           |
| 15:00-15:50 | 搭配高中數學課程的數位教具 ( I , II , III , VI ) - Wei-Chang Shann |
|             | <b>Room 2: (Chair: TBA)</b>                           |
| 15:00-15:50 | 使用 TI-Nspire 來強化數學教學與學習- 魏兆姝 科主任 (新加坡華僑中學)            |

|               |   |
|---------------|---|
| 16:00 - 17:30 | <b>Hands-on Workshop (GC stands for calculator workshop)</b>  |
|               | (GC Room 1) 19584 Using Graphing Technology to engage students in Mathematical Investigations for understanding- Su Yin Tee |
|               | (GC Room 2) 在教學微積分時一些使用 TI-Nspire 的有趣例子-新加坡華僑中學 魏兆姝 科主任   |

|             |                    |
|-------------|--------------------|
| 09:00-17:00 | <b>Exhibitions</b> |
| 18:00-19:30 | <b>Dinner</b>      |

# December 19, 2011 (Monday)

## 8:00-8:30 Registration: Math Building of NTHU

|            |   |
|------------|---|
| 8:30-9:20  | <b>Plenary Speech 3: Room 1: Chair: Yuan Yuan</b>   |
|            | <i>Instructing Quadratic Equations Through Proportion and Construction in a Dynamic Geometric Environment-Hee-chan Lew, South Korea</i> |
| 9:30-10:20 | <b>Plenary Speech 3: Room 1: Chair: Wei-Chi Yang</b>  |
|            | 19641 动态几何在中国：我所经历的这 12 年 -Chuan-Bo ZUO, China  |

## 10:30-11:00 Tea Break

|               |  |
|---------------|--|
| 11:00-12:00   | <b>Parallel Session II: Presentations (Each contributed paper presentation slot is 20 minutes, unless otherwise specified. Please allow 3 minutes for Q&amp;A, and 2 minutes for changeover)</b> |
|               | <b>Room 1: (Chair: M. J. Chen)</b>   |
| 11:00-11:25   | 19605 Roses Theorems and its Proof with Projective Geometry Methods--Hiroataka Ebisui  |
| 11:30-11:55   | 18791 "Using Spreadsheet to create different rug designs"- Maryanne Bagore   |
|               | <b>Room 2: (Chair: Amy Leh)</b>  |
| 11:00-11:25   | 19620 Technology Training to Middle School Mathematics Teachers- Amy Leh, Lee Grafon   |
| 11:30-11:55   | 19647 Implementing a 3D Logo Environment for Learning Mathematics: Potentials and Challenges-Andy Yeh  |
|               | <b>Room 3: (Chair: TBA)</b>  |
| 11:00-12:15   | 19704 利用萬用揭示板開發新移民親子數學數位素材之成果分享<br>袁 媛; 魏敏媛  |
| 11:30-11:55   | 19705 國小數學數位圖畫故事書的開發研究-袁 媛; 陳敏慧  |
| 12:00 - 12:30 | <b>Closing</b>   |

## 12:30-13:30 Lunch Break

|        |                      |
|--------|----------------------|
| 13:30- | <b>School Visits</b> |
|--------|----------------------|

# Abstracts for Invited Speeches

## Abstract for 19592

開啟數學與藝術的一扇窗-結構式複製繪圖法的世界

A New Window for Mathematics and Art – The World of Structural Cloning Method

Author: Mingjan Chen 陳明璋

Affiliation: National Chiao Tung University 國立交通大學通識教育中心

當數學與藝術連結時，結構式複製繪圖法(Structural Cloning Method, SCM)以「結構」與「複製」的概念詮釋造形，開啟結合數學與藝術創作的另一扇窗。結構式複製繪圖法(Structural Cloning Method, SCM)是一系列 2D 幾何變換組合之人機介面，原來的目的是用來解決數位教材設計時定位不易的問題，由於功能簡單有彈性，延伸出許多不同的造形方法，可以繪製繁複的圖案，成為一種新的繪圖法。本演講將介紹結構式複製繪圖法的基本概念；如何設計具靜態結構的圖像，如稱對稱造形、對稱中造亂、對稱中的錯覺律動、繁複的密貼圖等；如何設計具有動態結構的圖像，如傳統碎形、紋路及大自然景觀等；以及如何設計兼具動態及靜態結構的圖像。當運用結構式複製繪圖法於大自然景觀設計時，我們發明跳躍式疊代法(Leaping Iterated Function System, LIFS)來轉化計算資源指數成長為恆常，同時提供一個繪圖的美感介面，因此可以繪製如真的山林雲霧圖以及類似國畫般的山水圖。演講過程將理論、成果並陳，同時運用 AMA 當場示範結構式複製繪圖法簡單而強大功能。

## Abstract for 19595

Visual Arts, Music Composition via mathematics

Author: Hualun Li

Affiliation: Chung Hua University

Through computer technology, we can apply mathematics idea to music composition and visual art design. Now students can produce their own art and realized the power of mathematics.

## Abstract for 19613

Mathematical Modelling and technology in Singapore Schools

Author: Keng Cheng Ang

Affiliation: Nanyang Technological University, 1 Nanyang Walk, Singapore 637616

In recent years, there is a greater emphasis on mathematical modelling and applications in the Singapore mathematics curriculum. There are many ways in which the teaching and learning of mathematical modelling may be motivated and facilitated. In this paper, we describe how technology can provide the much needed support for mathematical modelling activities. Examples on modelling tasks designed for Singapore students at different levels are presented and described. These examples not only illustrate the use of real data and technology in mathematical modelling activities, they also underline the importance of keeping such tasks in relevant contexts to provide added motivation for students. In addition, through this series of examples drawn from different fields and topics, we discuss how a range of technological tools may be successfully and efficiently utilized in modelling tasks. Finally, we examine the need for an optimal use of technology to balance between achieving the objectives of the tasks and attaining the goals of learning mathematics.

### **Abstract for 19641**

动态几何在中国：我所经历的这 12 年

Author: Chuan-Bo ZUO

Affiliation: Guangzhou University

1999 年第四届亚洲数学技术大会 (Asian Technology Conference on Mathematics, ATCM) 在中国成功召开。

在此之前，对于一般的学校来说信息技术在数学教育中的应用几乎是一片空白。大部分学校的教室没有计算机和投影仪等多媒体设备，更加没有专为数学教学而装备的计算机实验室；绝大多数数学教师对于计算机应用于教学的理解还只是停留在 PowerPoint 的使用层面，而对于动态几何的概念则是闻所未闻。正值当年，中国的科学家推出了自己的第一款动态几何软件—Z+Z 智能教育平台；关于几何画板的第一本专著《如何用几何画板教数学》由人民教育出版社出版发行；以几何画板、Z+Z 智能教育平台为代表的动态几何软件的培训在全国范围内也开始有组织地进行。

在此之后，中央政府推动的“校校通工程”、“农远工程”、“班班通工程”等一系列措施使得学校在教育信息化的硬件方面逐步完善，各省市相继开展动态几何运用于数学教学的实验研究，许多师范院校的数学系相继开展动态几何课程，动态几何在数学教学中的应用与实践方面的论文成为许多核心刊物的重要部分，等等。

可以说，1999 年是一道分水岭。然而，12 年过去了，动态几何软件在中国地区的应用，取得了什么成就？发生了哪些变化？遇到了什么瓶颈？还存在哪些问题？本文将作者过去 12 年的亲身经历，利用所了解到的事实，从某些角度介绍了以动态几何为代表的信息技术在中国地区数学教育领域中的应用现状。

### **Abstract for 19648**

Enhancing Our Knowledge in Math and Sciences in the Technological Era

Author: Wei-Chi Yang

Affiliation: Radford University, Virginia, USA

Many students may have lost confidence or interests in mathematics long before entering universities because of their fear in algebra and geometry. It is therefore important to build a curriculum where teachers know when and how to introduce a subject with lots of intuition and motivations before intensive algebraic manipulations are demonstrated. In doing so, mathematics can be made more accessible, interesting and challenging to more students at younger ages. In this presentation, we will see how mathematics can be linked to many interesting real-life applications through evolving technological tools. We give several examples by starting from accessible 2D cases and lead to more challenging 3D cases. Examples are to demonstrate that Dynamic Geometry is crucial for conjecturing the existence of a solution and a CAS will enable us to find or approximate the desired solutions when it is possible.

### **Abstract for 19700**

Instructing Quadratic Equations Through Proportion and Construction in a Dynamic Geometric Environment

Author: Hee-chan Lew(Korea National University of Education)

Affiliation: Korean National University of Education

Quadratic equations are traditionally carried out through algebraic methods by symbolic manipulation like factorization or quadratic formulae. While such symbolic approach is very efficient in solving an equation itself it might be difficult for students to find some meanings in their solutions of the quadratic equations because the solution process is based on the symbol manipulation at the abstract level. Unlike the algebraic approach, geometric approach might be more meaningful to students because it is based on the visual and operation of geometric figure at the concrete

level. Greek mathematics shows how to solve quadratic equations using construction. Quadratic equation problems can be easily solved when they are approached geometrically and such activities can also be carried out even in a pencil and paper learning environment. However geometric approach is not often considered as a standard method in solving quadratic equations. There are a few textbooks to introduce geometric methods to solve quadratic equations, including the method proposed by Al-Khwarizmi, but such methods are only regarded as supplementary. It might be because geometric approach is not easy as well as not interesting for students to handle geometric figure in the static paper and pencil environment. This research aims to investigate the possibility of juxtaposing algebraic and geometric methods in instructing quadratic equations to Korean 9th graders by using proportion and construction in a dynamic geometric environment. Through this activity in the dynamic environment the ninth graders are expected to grow a richer and more integrated perspective towards quadratic equations with an eye to accommodate different approaches and angles to one problem.

## Abstracts for Pre-session on December 17, 2011

### Abstract for 19701

認知與數位教學- 注意力的引導

Author: 陳明璋

Affiliation: 國立交通大學通識教育中心\

人類的知覺系統是經過千萬年的演化而來，它面對的環境是大自然；而資訊科技則是近幾十年的科技成就，它讓我們輕易的運用大量的訊息；我們要問，人類的知覺系統有能力因應這個變革嗎？以使用最廣泛的 PowerPoint 為例，認知負荷理論大師 John Sweller 曾說過：“The use of the PowerPoint presentation has been a disaster, It should be ditched.”。主要是因為我們(在教學上)過度的使用 PowerPoint，忽略了認知的歷程的負荷。讓我們回想一下，我們都有聽人用簡報系統演講的經驗，你是否經常的在畫面上找資料，資料量少還好，稍微多一些的時候，眼睛就很容易疲累，很辛苦，以致於演講者的口語和畫面上的訊息經常無法協調；本演講運用 AMA 設計演講內容，現場實際的操弄訊息，讓聽眾了解視覺搜尋的特性，感受注意力引導的作用。

### Abstract for 19706

中學數學數位教學設計與實作

Author: 左台益

Affiliation: 國立臺灣師範大學數學系

資訊科技融入數學教學為目前數學教學實務與研究的趨勢之一。本論壇分別從動態表徵的不同面向展示中學數學數位教學的設計方法與實作成品。五位中學在職與職前教師依據他們的教學經驗與理論背景應用動態幾何軟體設計具多重表徵可操作視覺化學習環境。

### Abstract for 19707

GeoGebra 在高中『插值多項式』與『綜合除法』教學上的應用

Author: 官長壽

Affiliation: 國立羅東高中

在本篇報告中，透過 GeoGebra 設計動態的控制及互動式的輸入操作觀察變化，建立『插值多項式』與『綜合除法』的動態教學環境模式。三個操作實例：(1)【拉格朗日插值法】：求過已知  $n$  點的多項式，利用因式定理，以化繁為簡的方式，找出  $n$  個容易求出的多項式，再利用線性組合，求出所要的多項式，(2)【牛頓插值法】：求過已知  $n$  點的多項式，利用逐一條件滿足的方式，求出所要的多項式，(3)【綜合除法】：利用 GeoGebra 的動態效果，呈現綜合除法的規律操作過程，增進學生學習的效率。希望藉由此動態視覺化環境的觀察與操作來理解並學習抽象的數學解法過程。

### Abstract for 19708

動態幾何教學系統 GeoGebra 在三角測量上的應用

Author: 藍邦偉

Affiliation: 臺北市泰北高級中學

空間概念對高中學生而言是抽象的，所以三角測量是一個不易學習的單元。現在，我們藉著 GeoGebra 這套軟體，嘗試使用虛擬實境的想法，做動態的模擬，使學生更了解測量的觀念。我們藉由不同的視角、參考線等等傳遞出數學的概念；並藉由動態的模擬，使得學生在上課時，覺得枯燥的數學課變有趣，題目更生動活潑。在動態模擬中，可以找出適當三角形的邊角關係，使同學能夠更容易畫出正確的圖形，以方便解題；最後透過空間座標系的建立，以更完整的觀念來表達三角測量的精神。

### Abstract for 19709

數學數位遊戲學習環境設計：以一元二次多項式配方法為例

Author: 張巧倪、左台益、胡政德

Affiliation: 國立臺灣師範大學數學系

本研究目的是設計與實作一種可行的一元二次多項式配方法(以下簡稱為配方法)的數位遊戲學習環境。學習環境考量數學學科內容本質、認知負荷與呈現方式三個部分，即(1)配方法數學單元結構；(2)認知負荷理論；(3)多重表徵理論與遊戲方式。此數位遊戲學習環境的特徵提供學生對操作表徵、圖形表徵與符號表徵間的轉換，讓學習環境不僅可以達到學習配方法的需求，更可提高學生學習興趣以及降低學生不必要的負荷。本文將陳述數學數位設計理由及其重要的特徵，最後呈現此數位遊戲學習環境的評估及其設計結果。

### Abstract for 19710

代數運算動態視覺化學習環境：以一元二次多項式乘法分配律為例

Authors: 王偉斌、左台益、胡政德

Affiliation: 國立臺灣師範大學數學系

在本篇文章中，我們呈現設計和實作一種可行的一元二次多項式乘法分配律概念(本文以乘法分配律稱之)的動態視覺化學學習環境。本研究考量數學學科內容本質、認知負荷與呈現方式三方面，即(1)乘法分配律的數學單元主題、(2)認知負荷理論建構與(3)動態視覺化方式。此動態視覺化學學習環境的特徵提供學生數學概念不同表徵的轉換，讓他們建立數學概念的視覺化，並可以藉由此環境觀察與操作視覺物件來理解抽象的數學運算過程。學習環境設計理由及其重要的特徵分析將於本文中陳述，最後本文呈現此學習環境的評估、及其設計結果。

### **Abstract for 19711**

多重表徵數位學習環境的設計與實作：以線型函數為例

Authors: 蕭淑娟、左台益

Affiliations: 臺北市立萬華國民中學; 國立臺灣師範大學數學系

本研究旨在設計一個互動式動態連結多重表徵的學習環境，以幫助學生強化線型函數  $y=mx+b$  的數學結構與表徵轉換轉移之概念。學習環境設計乃選用動態幾何軟體 GeoGebra 搭配 JavaScript 語法，依據多重表徵理論設計線型函數單元的教學活動。根據 30 位七年級學生在診斷性問卷中處理線型函數多重表徵的作法區分成單一表徵型、單向轉移型、表徵轉移型及表徵靈活型，以了解學生在教學前後處理表徵轉換與轉移之影響。研究結果顯示在此學習環境下，學生不僅能掌握變數  $x$  與  $y$  的共變關係，且能理解參數  $m$  與  $b$  多重表徵的意義。其中有 75.86% 的學生在教學後處理表徵的作法有所提升。顯示此學習環境能有效強化學生處理表徵轉換與轉移的能力，如此深度理解線型函數的表現是傳統教學環境不容易達成的。本研究根據研究結果，對線型函數單元的後續研究及教學提出相關建議，以做為學術研究及教師參考使用。

## **Abstracts for Regular Speeches**

### **Abstract for 18791**

“Using Spreadsheet to create different rug designs”

Author: Maryanne Bagore

Affiliation: Divine Word University, Papua New Guinea

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 inventive way on how Excel can be 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 or rugs which are made mostly from the pandanus plant and also 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 be 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 19588**

Three Mutually Tangential Spheres in Cyclide and Related Constructions



Author: Shih-hung Huang

Affiliation: Nthu-math-Taiwan

By means of inversion with respect to a sphere in space, torus will be transformed to surface, called cyclide. The parabolic cyclide will be shown in this paper. Also, the deformation of Dupin cyclide illustrated by a symmetric Dupin horn cyclide will be demonstrated too. Based on Steiner porism, Steiner annulus 3-chain(sphere case) is studied in this paper. To obtain the geometric properties similar to Steiner porism on surface of cyclide, we intend to focus three mutually tangential spheres in Dupin ring cyclide.

### **Abstract for 19589**

The Intersection of Two Cones Sharing the Same Cross-section

Author: Shih-wei Lin

Affiliation: NTHU-math-Taiwan

A cross-section of a cone means the intersection of a plane with the cone. Two cones may or may not share the same cross-section. If two cones share a cross-section, then they share another one. In Chapter 1 and 2, we state in detail how to use Cabri 3D to draw the figure of the intersection of two cones. In Chapter 3, we introduce the property of tangent lines on the two conic section.

Finally, we consider a special case in the figure. To evaluate the volume of the intersection of two cylinders will be an interesting question in Calculus.

### **Abstract for 19593**

激發式動態呈現教學設計之研究—以代數為例

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在林煜庭(2007)的研究顯示,使用具有適性指標教材的課堂授課中,學生的學習成效會優於沒有適性指標的教材的課堂授課。依據其研究可知在激發式動態呈現教學環境下,融合適性指標,有助於數學學習;但在毫無視覺情境、生活體驗、自然語意可言的代數教材學習上,算式展演的繁雜冗長,會讓學習者無法掌握解題過程的主要概念,即使適性指標加入設計亦無法完全解決。本文研究主題以國中一年級數學科二元一次聯立方程式單元為教材設計主題,隨機挑選對此單元學習成就低落的學生分成兩班進行補救教學實驗,採準實驗研究法。研究發現教材設計者可遵循教學內容結構化、教材呈現區塊化、建立訊息關聯及口語簡化解說四大原則並搭配適性指標教材設計原則來將繁冗的代數教材予以改良,從研究證實確實產生顯著效果,證實了代數教材設計原則確實能有效幫助學習。

### **Abstract for 19594**

激發式動態教學對學習成效與認知負荷影響之研究

- 以二元一次聯立方程式的應用問題為例

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在謝東育(2009)的研究顯示,代數教材遵循教學內容結構化、教材呈現區塊化、建立訊息關聯及口語簡化解說四大原則並搭配適性指標,確實能夠有效幫助學生學習。但對於數學應用問題中,代數教材設計原則無法成功建立文字表徵與符號表徵之間的轉換。本研究以七年級數學教材中二元一次聯立方程式的

應用問題為例，去檢視代數教材設計原則結合圖像化，是否有較好的學習成效和較低的認知負荷。採實驗研究設計，隨機挑選對此單元學習成就低落的學生分成三組進行補救教學實驗。研究結果發現代數教材設計原則結合圖像化的教學設計可以協助低學業成就的學生，不論在學習成效或降低認知負荷都有較佳的表現。

### **Abstract for 19620**

Technology Training to Middle School Mathematics Teachers

Authors: Amy Leh and Lee Grafon

Affiliation: California State University San Bernardino, USA, PSUSD

This paper reports on the implementation and evaluation of an Enhancing Education Through Technology Competitive Grant (EETT-C) project. During 2005-2008, the project served 60 sixth to eighth grade mathematics teachers and approximately 6,500 students in Palm Springs Unified School District, a medium-sized, high-poverty school district in Southern California in the United States. The research-based program was designed to facilitate the delivery of a student program that effectively integrated technology into the curriculum to improve student achievement. Classroom observation and interview results indicated that the program was effective.

The presentation starts with an overview of the instructional strategies used to deliver the student program and the corresponding faculty development strategies. Descriptions of technologies used in the program are embedded. The overview is followed by the program evaluation, with a focus on classroom observations and interviews.

### **Abstract for 19625**

Mathematics, Origami and GeoGebra 2

Author: Shi-Pui Kwan

Affiliation: The Hong Kong Institute of Education

I am a lecturer from the Institute of Education doing primary and secondary mathematics teacher education in Hong Kong.

This is my second presentation on the above title. I had presented the first one in GeoGebra conference 2011 this summer.

I will share more examples on how origami and GeoGebra are integrated into my teaching. It is hope that through exchanges and discussions I would have more ideas and insights on putting them into better practice in mathematics education.

### **Abstract for 19626**

Investigating the spread of dengue through a mathematical model - a school project

Authors: Xi Chen, Yongjie Khoo, Bangyan Wang

Affiliation: River Valley High School, Singapore

This paper reports a modelling study on the spread of dengue undertaken by students in a high school project. A  $S_i$  Susceptible, Exposed, Infectious, Resistant (or Removed)  $EIR$  model based on the assumption of mass action interaction is used to study the interactions between hosts and vectors in the transmission of dengue. Populations of host and vector are divided into compartments representing the disease status (susceptible, exposed, infectious, and, for hosts, resistant), and the relationships between compartments are described by a set of differential equations. The improved Euler method is successfully applied and implemented on Microsoft Excel to solve the system of equations. Model parameters such as the biting rate, number and lifespan of mosquitoes are varied to examine their effects on certain characteristics of dengue transmissions. These include the peak of outbreaks, onset of the epidemic and the duration of epidemic. Based on the findings, the impacts of these variables on dengue epidemics are then discussed. Our results, which are justifiable in

real terms, may explain the various vector control methods adopted by the Singapore government since the 1960s.

### **Abstract for 19630**

The effect of the use of technology on the research of scientifically gifted students

Author: Jong Sool Choi, Jae Hoon Jung

Affiliation: Korea Science Academy of KAIST, Changwon Science High School  
Korea Science Academy of Kaist, one of high schools for scientifically gifted students in Korea, has a student research program, call Research and Education (R&E). We participated in this program in 2006, 2007, 2009, 2010 with the title "Exploring the possibility of generalizing 2-dimensional geometric properties to 3-dimensional geometric properties with using 3-D geometric tools". This report evaluates these projects. As a result, the use of technology contributed greatly in the research of students so that they derived several interesting facts every year.

### **Abstract for 19605**

Roses Theorems and its Proof with Projective Geometry Methods

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For thousands of years some people had felt Shinto and created images that others gladly considered and applied in everyday life, for example, such as the Pythagorean Theorem. These images are placed in the Shinto churches in Japan. For three decades computer ousted images and replaced them by the numbers. The place of the image and the logical transition is taken by the Chevia value verification. However, when it is necessary to consider a slightly more complex system with many inputs, then even a system such as Maple is unable to process the information. In this paper we consider a given set of eight points which lie on a conic curves (ellipse, parabola, hyperbola or a pair of lines). The solution reveals regularity in the arrangement of the two groups of children from these points, which independently of the location of parents line up in fours along two straight lines. The development of geometric visual systems gives a clear geometric proof. CAD, instead of ruler and compass, also allows us to draw clear figure in geometry construction with ease. GInMA or Geogebra capabilities make a wonderful visual proof. I have found a new theorem, please enjoy.

### **Abstract for 19647**

Implementing a 3D Logo Environment for Learning Mathematics: Potentials and Challenges

Author: Andy Yeh

Affiliation: Queensland University of Technology

This paper presents an initial implementation of a 3D Logo environment named 'VRMath 2.0' for learning mathematics. As indicated by its name, VRMath 2.0 employs a desktop virtual reality (VR) and the web 2.0 technologies. Educationally, VRMath 2.0 will inherit the power and benefits from the microworld paradigm. Moreover, its educational value will be further extended by its 3D VR interface and web 2.0 style of content creation. The potentials of this learning environment include, but not limited to, the enabling of a wide range of opportunities to investigate and develop human spatial abilities, via an online platform with knowledge building community. The challenges, however, are firstly revolving around the technical issues

of implementing a sustainable application, and secondly, our imaginations on how to evolve and utilize this learning environment for learning and research.

#### **Abstract for 19702**

多面體中頂點組態轉換的數學魔術

Author: 孟慶台

Affiliation: 新竹市虎林國中

討論阿基米德多面體的切入點可以很多，本報告將正多面體納入，以相同的頂點組態出發，架構出每個頂點接三個、四個、五個正多邊形的多面體。以五個的為例，它們分別為：扭稜十二面體

(Snub Dodecahedron)、扭稜立方體 (Snub Cube / Cubus Simus / Snub Cuboctahedron)與正二十面體；三者我們合稱 $(3, 3, 3, 3, n)$

，其中依序為 $(3, 3, 3, 3, 5)$ 、 $(3, 3, 3, 3, 4)$ 與 $(3, 3, 3, 3, 3)$ 。當找出它們一致性的關鍵後，將之轉換成通式，便可只更動變數，例如 $(3, 3, 3, 3, n)$ 中的 $n(=5、4$

或 $3)$ ，就讓它們在Cabri 3D軟體上彼此互換，它們的對偶多面體亦然。隨著以上的變身，它們內在重要的數值，例如：體積、外接球半徑、兩面角……等，也將以通式的方式，完整且精確(非近似)的被計算出來。

#### **Abstract for 19704**

利用萬用揭示板開發新移民親子數學數位素材之成果分享

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本研究是以萬用揭示板數學教學網(<http://163.21.193.5>)為設計新移民親子數學活動的輔助平台，參與親子數學課程設計的團隊，包含萬用揭示板研發團隊及研究場域小學的10位低年級教師，在兩週一次的研討中，萬用揭示板研發團隊先行初步設計在萬用揭示板教學網的教學活動，再於研討會議中請現場小學老師提出修正意見，每一個活動實際進行新移民家庭教學後，再經由研究團隊分享教學歷程及部分實際參與教學的教師分享教學情形。經由再一次的檢討，始完成每一教學活動的設計。最後，再於萬用揭示板教學網上的精選教材區揭示教材及活動教案。目前，研究團隊以開發國小一及二年級的教學採材為主，在這個報告中，我們分享些研發成果，並對這些教材內容加以介紹，以鼓勵更多教師及家長使用這些數位教材進行師生或親子的學習互動。

#### **Abstract for 19705**

國小數學數位圖畫故事書的開發研究

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國外近二十餘年來已興起將兒童圖畫故事書融入數學的教學研究，數學教室中使用兒童圖畫故事書教學已十分普及。國內自數學魔術小子套書引入台灣之後，開啟了使用兒童圖畫故事書教學數學的風氣，甚至有教科書出版業者將圖畫故事書的想法融入教科書的設計中。但多年下來，國內與數學有關的兒童圖畫書資源仍以譯作為主，本土化與數學有關的圖畫故事書資源欠缺，而針對將兒童圖畫故事書融入數學的教學策略研究還不多見。建立在先前研究的基礎上，本研究利用萬用揭示板(Magic Board)開發本土化的數位數學圖畫故事資源，並利用數學文獻的批判與編修策略融入國小數學教學設計，以發展為圖畫故事書融入國小數學教學的教學案例，作為推廣研習教材，以提升國小教師應用圖畫故事書教學數學的專業素養。在本報告中，我們將分享一個初步完成的數位繪

本內容，並說明如何利用這個教學資源進行數學文獻的批判與編修策略的教學活動。

## Abstracts for Workshops

### **Abstract for 19584**

Using Graphing Technology to engage students in Mathematical Investigations for understanding

Author: Su Yin Tee

Affiliation: Hwa Chong Institution (College)

Packaged in the right way, graphing technology has the potential to provide the opportunities for learning through mathematical investigations. In this workshop, practical examples of lesson activities in graphing, calculus and statistics will be shared and participants will experience how a graphing handheld can be used to engage students and promote understanding in a Mathematics classroom.