行政院國家科學委員會專題研究計畫 成果報告

2007 亞洲奈米論壇－ANF 種子教師研討會
研究成果報告(精簡版)

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計 畫 主 持 人：沈弘俊
共 同 主 持 人：賴梅鳳、傅昭銘、翁宗賢
計畫參與人員：博士班研究生-兼任助理：李青峻
兼任助理(不支薪)：陳佳暐、陳維倫、張芝云

處 理 方 式 ：本計畫可公開查詢

中 華 民 國 97 年 01 月 02 日

行政院國家科學委員會補助專題研究計畫 ■ 成 果 報 告
□期中進度報告

2007 亞洲奈米論壇－ANF 種子教師研討會

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計畫主持人： 沈弘俊教授
共同主持人：翁宗賢副教授、傅昭銘教授、賴梅鳳助理教授
計畫參與人員： 陳佳暐小姐、陳維倫小姐、李青峻先生、張芝云小姐

成果報告類型(依經費核定清單規定繳交)：□精簡報告 ■完整報告

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□赴國外出差或研習心得報告一份
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□出席國際學術會議心得報告及發表之論文各一份
□國際合作研究計畫國外研究報告書一份

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執行單位：國立台灣大學應用力學研究所

中 華 民 國 96 年 12 月 28 日

計畫中、英文摘要與關鍵字。

中文摘要

我國為統籌規劃奈米科技人才培育工作未來之方向，持續與國外分享我國奈米人才培育工作之成果，擬於今年 6 月，配合我國主辦之「台灣國際奈米週」，將邀請亞太地區各會員國之奈米科技教育相關學者、專家、以及 K-12 種子教師，至我國參與 2007 年亞洲奈米論壇－ANF 種子教師研討會（Taiwan Nano 2007－ANF Teachers' Workshop）。

本研討會之國內參與者，擬邀請我國奈米科技 K-12 教育發展中心之各區域中心主任、各區域標竿學校種子教師約 10 至 12 人，發表與分享過去數年我國推動奈米科技 K-12 之成果，包括教材開發、教學推廣、數位學習教材、實驗教具、奈米研習營（夏令營、冬令營、假日營等）、課程融入等等之各項教學經驗，並於會中發表與各國與會代表分享。本研討會亦將邀請亞太地區各會員國之 K-12 教師發表其教學經驗，並與我國種子教師交換心得、討論。最後，本研討會將針對奈米人才培育工作之未來推動方向進行綜合討論，並為亞太地區奈米科技教育人才培育工作之交流推廣奠基。

中文關鍵字 ：奈米科技 K-12、種子教師、亞洲奈米論壇、台灣奈米週

英文摘要

The 2007 ANF Teachers' Workshop, Taiwan Nano 2007, was organized especially for K-12 teachers to share their experiences in teaching nanotechnology. We invited local seed teachers to talk about how they teach nanotechnology in the elementary schools, junior high schools, and senior high schools. We hoped that this Workshop could help those who want to develop K-12 nanotechnology education program. We also welcomed

the teachers from ANF union countries to share their experiences with others. Further, we also invited ANF delegates to share the progress and experiences in their nanotechnology human resource development programs from 13 economies in the Asia Pacific Region including Australia, China, Hong Kong, India, Indonesia, Korea, Japan, Malaysia, New Zealand, Singapore, Taiwan, Thailand and Vietnam. Moreover, this Workshop will continue the effort to give a stimulating and thought-provoking forum for sharing the latest educational development ideas in K-12 education program.

Keyword： Nanotechnology K-12. Seed Teacher, ANF, Taiwan Nano 2007

目　錄

一、會議背景與目的

奈米科技為目前世界各國優先及長期支持的科技研發領域之一，鑒於教育為科技與學術研究之根本，而科技與學術為一國國力之具體表徵，面臨知識經濟及全球化時代來臨之際，科技與學術之優質化儼然成為最佳之國際競爭利器。

有鑑於此，亞洲地區國家於 2004 年 5 月成立了亞洲奈米論壇（Asia Nano Forum）。此論壇為一種網絡組織，是由亞太地區的 13 個經濟體所支持的，包括台灣、澳洲、中國、香港、印度、印尼、韓國、日本、馬來西亞、紐西蘭、新加坡、泰國和越南。亞洲奈米論壇希望透過此網絡彼此合作，以促進亞洲地區在奈米科技之教育、研究、發展及產業推廣。亞洲奈米論壇主要的目標是：

- 在亞洲地區中透過建立設備來分享訊息、人和物理資源及專門技術。
- 協調網絡會員來投資彼此的基礎建設。
- 在網絡會員間開創、發揚及經營科技合作研究計畫。
- 透過處理主要地區問題的合辦項目來支持地區經濟和環境發展，重點在發展和新興經濟的支持。
- 提升奈米科技的大眾認知及教育訓練，並且聯繫社會、環境、健康和經濟的問題。
- 在地區裡扮演一個倡導奈米科技的角色，並在全球論壇中作為地區性的代表。

我國為統籌規劃奈米科技人才培育工作未來之方向，持續與國外分享我國奈米人才培育工作之成果，擬於今年 6 月，配合我國主辦之「台灣國際奈米週」，將邀請亞太地區各會員國之奈米科技教育相關學者、專家、以及 K-12 種子教師，至我國參與 2007 年亞洲奈米論壇－ANF 種子教師研討會（Teachers' Workshop）。

本研討會之國內參與者，擬邀請我國奈米科技 K-12 教育發展中心之各區域中心主任、各區域標竿學校種子教師，發表與分享過去數年我國推動奈米科技 K-12 之成

果，包括教材開發、教學推廣、數位學習教材、實驗教具、奈米研習營（夏令營、冬令營、假日營等）、課程融入等等之各項教學經驗，並於會中發表與各國與會代表分享。本研討會亦將邀請亞太地區各會員國之 K-12 教師發表其教學經驗，並與我國種子教師交換心得、討論，研討會中並安排奈米科技動手做實驗，讓與會者親手體驗到奈米科技。最後，本研討會將針對奈米人才培育工作之未來推動方向進行綜合討論，並為亞太地區奈米科技教育人才培育工作之交流推廣奠基。

二、會議成果

(一)舉辦日期、地點與主題

日期：96 年 6 月 14 日、15 日(週四及週五)兩天

地點：國立台灣大學 應用力學館 一樓國際會議廳

主題：

- 奈米科技 K-12 種子教師培育與教學成果分享（Nanotechnology K-12 Teachers' Training and Cultivation Development)，研討會主題如下：
  - 教材開發
  - 教學推廣
  - 數位學習教材
  - 實驗教具
  - 奈米研習營
  - 課程融入
  - 其他教學相關經驗分享
  - 綜合座談
- 奈米科技實作實驗展示，並進行分組體驗活動。
- 各國 ANF 代表、K-12 種子教師心得交換、討論；最後，本研討會將針對亞太地區奈米人才培育工作之未來推動方向進行綜合討論，為人才培育工

作之交流推廣奠基。

(二)參加對象與人數

1. 參加對象：

(a)國外專家學者與外賓

本次會議對亞太地區 12 個會員國發出會議邀請函，請各國針對此次主題推派代表參加，並分享該國從事奈米教育與人才培育之經驗與成果。參與的會員國包括：紐西蘭、澳洲、韓國、新加坡、泰國、越南、印尼、印度、馬來西亞共 9 個國家代表，22 名專家學者。另外，更邀請了 4 位來自美國亞歷桑納大學之教師，給予本會精采的分享與探討。本會議邀請之國外學者名單，請參考附件一。

另外，由於本次研討會為台灣國際奈米週系列活動之一，因此有部分參與者為奈米週相關活動所邀請來之外賓，對本研討會之內容有興趣而現場報名。

(b)國內專家學者與種子教師

本次研討會中，邀請我國奈米科技 K-12 教育發展中心之各區域主任、各區域標竿學校種子教師約 22 人，發表過去數年我國推動奈米科技 K-12 之成果，分享國內奈米教育的推廣實際面臨之挑戰與心得。另外各區域中心標竿學校約有 50 位教師報名參與。

(c)一般大眾

除了上述對象之外，本研討會更利用網際網路架設宣傳網頁，使任何關心奈米科技發展之一般大眾可以得知本研討會之詳細訊息，並可透過線上報名系統快速報名參加；其中，亦有中小學老師趁此機會帶領學生進行奈米科技戶外教學，增加學生學習奈米科技相關知識之興趣。除此之外，亦有許多前來參觀奈米週展覽之民眾，

經由本研討會工作人員之介紹與協助，於現場直接報名參加。

2.參加人數統計：共計 250 人

	國外學者與外賓	國內專家學者與貴賓	夥伴及標竿老師	一般大眾
人數	37	20	83	110

(三)會議結論

本次會議經過二日的各方經驗交流與議題討論的過程,ANF Teachers' Workshop 圓滿結束。本次的會議重頭戲在於讓 K-12 的種子教師親臨現場以英文的方式介紹自己平日推廣奈米教育的方式與成果、充滿創意的學生作品，這樣的安排頗受好評，會後的延續討論也比往年更加地熱烈。同時各會員國代表及與會成員也都表達積極的態度要將台灣的奈米教育經驗帶回國內，並透過有趣、有效的方式讓中、小學生，甚至是大學生認識奈米科技並進而培育穩固而紮實的奈米研發能量。在未來的奈米科技教育工作上，有以下幾點的會議結論：

1 .互動式的學習架構與知識分享平台

本著推廣奈米科技教育的理念與縮小城鄉教育資源差距的方式,應提供有趣的互動式學習架構，例如：活潑有趣的 Flash 動畫、生活化的動漫影片、遊戲等多媒體教材，來提高基層學子對奈米科技的興趣。而奈米知識交換分享的網路平台更可以縮小時間、空間的差距，讓不管是在都市、鄉下求學的小朋友都有機會一窺奈米科技教育的成果。

2. 持續促進學術研究機構與產業合作

透過定期與不定期的奈米科技研討會讓學術機構發表相關研發成果,促使產業界瞭解國內奈米應用在工業與民生產業中的投資契機。並藉由投資的動能加速奈米科技的學術發展與專利權的取得，如此相輔相成的結果將使得台灣有機會在奈米科技

發展的國際舞台上佔有不可忽視的地位。

3. 出版刊物的翻譯與國際間互助合作

為了在亞洲推廣各會員國奈米科技教育的經驗，必須將歷年來相關的奈米教育精緻化教材、工具與參考書籍等資料翻譯成多國語言，使之能廣泛地被各會員國分享使用。並藉此加強國際合作，在互通有無的成效之下，將使奈米科技教育與發展更有效率。同時台灣奈米科技應用創意競賽的舉辦也將使得亞太地區的各會員國群起仿效，除了喚起各國競相參與奈米科技教育與發展之外，亞太區奈米科技應用創意競賽的促成也是值得努力的方向，此舉將能夠使奈米科技發展更加地多元化，並期待能夠發掘新一代的奈米科技運用。

4. 將 K-12 的指導教材轉化為正規課程

現階段除了舉辦教師間的學術研討會、青年學子的活動研習營外，奈米科技教育並未進入到正規的中小學學習教材當中。而為了將奈米科技教育向下紮根，將研發多年豐富多元的奈米推廣教材融入課程當中有其急迫性。因此未來將奈米教育指導教材轉化為正規課程勢必是一個必須投入更多關注的方向。

5. 亞洲奈米創意競賽

繼去年之後，台灣於今年舉辦了第二屆全國奈米科技應用創意競賽，此競賽目的為激發全國民眾對於奈米尺度新現象應用創意的思考，充分運用奈米科技所帶來之各種可能性，將之應用在民生或工業產品上，進而產生經濟價值。此次競賽反應非常熱烈，可說是十分成功，競賽中優秀且具應用性的創意有機會透過工研院相關單位的配合，讓它真正成為一個商品，上市展售；希望藉由台灣舉辦創意競賽的經驗，也能引起會員國共鳴，各國進而仿照台灣辦理其國內的奈米科技創意競賽。

此外，今年首次試辦國際性奈米科技應用競賽，但由於會員國內奈米科技競賽

風氣不盛，因此參加隊伍不如預期，希望藉著台灣成功的經驗，建議各國仿照台灣辦理其國內的奈米科技創意競賽，未來更可將各區優勝者集合起來舉行亞太區的奈米創意競賽。

三、心得與檢討

「2007 亞洲奈米論壇-種子教師研討會」從 3 月開始進入籌備，雖然只有短短 3 個多月的時間，然因各單位與國內標竿學校種子教師傾力相助，使得本研討會得以順利進行，並於 96 年 6 月 15 日圓滿落幕。總歸而言，本次研討會再一次地提升了台灣奈米科技發展於國際間之肯定並成功地達成初設之目標，各項心得總結如下：

1. 豐富且多元之活動規劃

本次研討會與台灣國際奈米週結合，成為一個規模廣大、主題豐富的多元化活動，主要讓國內外一般社會大眾了解國家及廠商投入奈米技術研發的資源與成果，以正確知識的宣導，教育推廣及提昇國內奈米研發技術，促進工業界和學術界間的交流互動，台灣國際奈米週之活動包括「第二屆全國奈米科技創意應用競賽」、「國際奈米科技研討會暨商機論壇」、「台灣奈米科技展」、「奈米國家型科技計畫成果發表會」五大主題活動，整體內容十分豐富，亦吸引不少國際以及國內專家學者與一般大眾之參與。除此之外，將所有活動地點集結在台灣大學體育館、凝態中心與應用力學研究所內，可整合各方資源，而大會在場地、設備與人員上皆提供充沛協助，對籌備單位與參觀民眾都是十分理想之作法。

2. 促進國際交流與分享

國際間舉辦各式研討會之最重要目的乃透過經驗交流與分享，促進各國間之認識與了解，並奠定未來合作之契機。本次研討會中，國內講者多為 K-12 標竿學校之種子教師，透過站在教育第一線的教師講述國內奈米科技教學經驗，無形中也增添不少生動性，與會之國外學者專家，十分精彩地分享其國內在奈米科技教育與人才

培訓之經驗，並針對亞太地區未來奈米科技之發展提供許多意見與建議，此乃舉辦本次會議之最重要目的。

3. 奈米科技動手作實驗

本次會議中，將奈米科技的實驗融入議程中，活動中，設計「奈米金」、「奈米磁顆粒」等實驗單元，藉由活潑且趣味性十足的實驗過程，增進大眾對奈米科技的學習興趣，對奈米科技有更進一步的認識。首次將會議中加入實驗活動，使本次會議不只是靜態的教學經驗分享，更融入動態的實作活動，使本次會議增色不少。

本次研討會雖然圓滿落幕，然在會議籌備管理方面尚有不足之處，因此提出下列幾點建議，盼對未來相關會事籌備者有所助益：

1. 在經費充足情況下，可多方邀請各會員國國內產官學各界之代表，針對奈米科技進行全面性探討，以利迅速達成各方共識。
2. 建立一個有效的聯絡網，以便 13 個會員國之奈米科技相關單位密切聯繫，未來在舉辦各奈米相關主題活動時，可減少聯繫困難，增加各國代表出席率；另外，透過網際網路(網站、E-mail 等)的運用，將立即資訊及時傳遞，亦方便各國教學資源資與相關資訊之分享，真正達成整合亞太地區資源與共同促進亞洲奈米科技發展之目標。

最後，感謝奈米科技國家型計畫辦公室、國家科學委員會、教育部顧問室大力支持，促使本次會議圓滿進行，更對 17 位國內 K-12 標竿學校之種子教師表達謝意，由於擔任講者之種子教師平日並非擅長英文教學，為更生動用英文表達奈米科技的教學經驗，從投影片製作、試講到正式上台，每位講者均花不少心思，會議能如此成功，這 17 位 K-12 標竿學校之種子教師功不可沒；希冀日後的會議中，各會員國能邀請國內種子教師一同來分享。

四、會議剪影

Opening Remarks

<table>
<tr><td> 
</td><td>  </td></tr>
<tr><td>沈弘俊教授開場介紹</td><td>劉佩玲教授開幕致詞</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>吳茂昆教授開幕致詞</td><td>陳南鳴主任蒞臨指導</td></tr>
</table>

Keynote Session

Nanotechnology Human Resource Development (NHRD) Program in Taiwan

Prof. Jing-Tang Yang (楊鏡堂教授)

與會來賓

Session 1：Nanotechnology Promotion Activities in K-12 Schools

Chairman: Prof. Chia-Chi Sung (宋家驥教授)

Li-Hsien Chien (簡麗賢), Taipei First Girls High School, Taipei (北一女中)

Sheau-Dao Su (蘇小島), Bei-Men Elementary School, Taoyuan (北門國小)

Andrea Hildebrandt and Barbara Babb, USA

Francesca Calati, St. Helena Secondary College, Eltham, Victoria, Australia

***Session 2*：Teaching Material Development, Science Camp and Hands-on**

Yen-Hung Pan (潘彥宏), Taipei First Girls High School, Taipei (北一女中)

John Paderi, Arizona State University, Arizona, USA

Shu-Chiung Liu (劉淑瓊), National Taichung Girls High School, Taichung (台中女中)

Chin-Shueh Chen (陳錦雪), Affiliated Elementary School of Taipei Municipal Education University, Taipei (台北市立教育大學附設實驗國民小學)

Prof. Weon Bae Ko, Department of Chemistry, Sahmyook University, Korea
Chih-Hui Chung（鍾志輝）, Lu-Chu Senior High School, Kaohsing（路竹高中）

Session 3：Activities for K-12 Nano Technology Education Hands-on

Prof. Chao-Ming Fu (傅昭銘教授)

奈米科技實驗動手作

Session 4：Animation, E-learning Teaching Material and Summer Camp

Chairman: Prof. Meng-Kao Yeh

Sian-Yuan Jhan and Kuang-Chi Ma (詹賢媛、馬廣琪), Ji-An Junior High School, Hualien (吉安國中)

Han-Chien Yang **(**楊漢倩), Hsin Tein Senior High School, Taipei (新店高中)

Meng-Hung Chen **(**陳孟宏), National Taichung First Senior High School, Taichung (台中一中)

Li-Hsueh Hsu (徐麗雪), Dongmen Primary School, Taipei (東門國小)

Xian-Lin Li (黎湘玲), Wanfang High School, Taipei (萬芳高中)

Session 5：Curriculum Integration, Lesson Design and Promotion Activities

Chairman: Prof. Dong-Hwang Chen (陳東煌教授)

Li-Chen Chou (周利貞), National Taipei University of Education Experimental Elementary School, Taipei

Chi-Lan Cheng (鄭及蘭), Taipei Fuhsing Private School, Taipei (私立復興實驗高級中學)

Fan-Pai Wei(魏汎百),Ta-Tung Elementary School, Kahsiung(大同國小)

Chen-Chen Liu (劉蓁蓁), Tainan Municipal Jinsyue Elementary School, Tainan (進學國小)

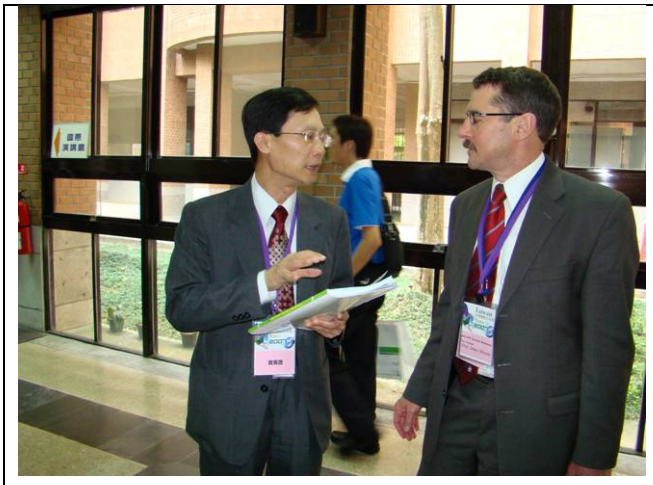
Session 5：Curriculum Integration, Lesson Design and Promotion Activities

	
Wun-Bang Liao (廖文邦), Guang-Wu Junior High School, Hsinchu (光武國中)	Mr. Loo Kok Hoo, Sunway Mas Commercial Center, Malaysia

Panel Discussion

國際交流



2007 與會人員大合照

2007 亞洲奈米論壇－種子教師研討會 網頁 **http://www.nano-taiwan.ntu.edu.tw/anf/**

附件一 活動議程

2007 Asia Nano Forum - Teachers' Workshop
2007 亞洲奈米論壇 – 種子教師研討會

June 14~15, 2007, International Conference Hall, Institute of Applied Mechanics, NTU, Taipei, Taiwan

Program

Thursday, JUNE 14	*Room 100*
09:00 - 10:00	**Taiwan Nano 2007** - Opening Ceremony 台灣國際奈米週開幕典禮 (NTU Sports Center 臺灣大學體育館)
10: 00 - 10:20	**ANF Teachers' Workshop** - Registration 種子教師研討會報到 (International Conference Hall, Institute of Applied Mechanics 應用力學館國際會議廳)
10:20 - 10:40	Opening Remarks 開幕式
10:40 - 11:10	**Keynote Speech 邀請演講** Nanotechnology Human Resource Development (NHRD) Program in Taiwan Prof. Jing-Tang Yang (楊鏡堂教授)
Session 1	**Nanotechnology Promotion Activities in K-12 Schools (K-12 中小學奈米科技教學推廣)** **Chairman: Prof. Chia-Chi Sung (宋家驥教授)**
11:10 - 11:30	Nanotechnology Education at Taipei First Girls High School (北一女的奈米科技教育) Li-Hsien Chien (簡麗賢), Taipei First Girls High School, Taipei (北一女中)
11:30 - 11:50	Integration of Research, Education and Outreach: Student-Teacher-Scientist Partnerships through Cooperation between K-12 and University, Andrea Hildebrandt, Kenilworth School, and Barbara Babb, Chandler High School, Phoenix, Arizona, USA
11:50 - 12:10	The Development of Nano Education in Elementary School of Taoyuan County (桃園縣推動奈米科技融入小學教學計畫之實踐) Sheau-Dao Su (蘇小島), Bei-Men Elementary School, Taoyuan (北門國小)
12:10 - 12:30	A Science of Limitless Possibilities Francesca Calati, St. Helena Secondary College, Eltham, Victoria, Australia
12:30 - 13:30	Lunch午餐
Session 2	**Teaching Material Development, Science Camp and Hands-on (教材開發、科學營、動手做實驗活動) Chairman: Prof. Fuh-Sheng Shieu (薛富盛教授)**
13:30 - 13:50	Lesson Design: Self-Assembly in Biology (教案設計：生物自組裝) Yen-Hung Pan (潘彥宏), Taipei First Girls High School, Taipei (北一女中)
13:50 - 14:10	Introduction to the Nano World through Size and Scale Phenomena John Paderi and Ben Campbell, Arizona State University, Arizona, USA
14:10 - 14:30	Nano Lesson by Science Fiction (奈米科技小說－科幻赤壁/決戰未來) Shu-Chiung Liu (劉淑瓊), National Taichung Girls High School, Taichung (台中女中)
14:30-14:50	A Science Camp of Nanotechnology for Elementary School Children & Their Parents (小學奈米親子營), Chin-Shueh Chen (陳錦雪), Affiliated Elementary School of Taipei Municipal Education University, Taipei (台北市立教育大學附設實驗國民小學)
14:50 - 15:10	Synthesis of Fullerene Derivatives under Ultrasonic Condition and Self-Assembled Fullerene-Gold Nanoparticle Films Prof. Weon Bae Ko, Department of Chemistry, Sahmyook University, Korea
15:10 - 15:30	Nano Science and Technology Hands-on (奈米科技動手做 – 光觸媒除污、光觸媒防霧、蓮葉效應、撥水奈米布料) Chih-Hui Chung (鍾志輝), Lu-Chu Senior High School, Kaohsing (路竹高中)

15:30 - 15:50	Coffee Break 茶敘	
Session 3 15:50 - 17:10	**Activities for K-12 Nano Technology Education Hands-on (奈米科技動手做)** **Prof. Chao-Ming Fu (傅昭銘教授)** **(Room 111)**	**International Nano Innovation Contest (國際奈米創意競賽)** **Prof. Gou-Jen Wang (王國禎教授)** **(Room 100)**
18:30 -	Banquet 晚宴 (Howard International House 14F 福華國際文教會館14樓)	

Friday, JUNE 15	*Room 100*
Session 4	**Animation, E-learning Teaching Material and Summer Camp (動畫設計、數位學習教材、夏令營) Chairman: Prof. Meng-Kao Yeh (葉孟考教授)**
08:30 - 08:50	Nanotechnology Integrated Teaching Materials of Senior High Schools (奈米科技融入高中教材), Han-Chien Yang (楊漢倩), Hsin Tein Senior High School, Taipei (新店高中)
08:50 - 09:10	Animation for Nanotechnology Education－The Wonderland of Nanotechnology (奈米動畫－迷走星球), Meng-Hung Chen (陳孟宏), National Taichung First Senior High School, Taichung (台中一中)
09:10 - 09:30	Experience of Nano Summer Camp (奈米夏令營經驗分享) Li-Hsueh Hsu (徐麗雪), Dongmen Primary School, Taipei (東門國小)
09:30 - 09:50	"Experiment and Experience" – Nanotechnology Lesson Design and Teaching in 7th Grade (萬芳高中國中部奈米教案研發及實施概況) Xian-Lin Li (黎湘玲), Wanfang High School, Taipei (萬芳高中)
09:50 - 10:10	Nanotechnology Promotion Experience of Ji-An Junior High School (吉安國中推廣奈米科技教育經驗分享), Sian-Yuan Jhan and Kuang-Chi Ma (詹賢媛、馬廣琪), Ji-An Junior High School, Hualien (吉安國中)
10:10 - 10:30	Coffee Break 茶敘
Session 5	**Curriculum Integration, Lesson Design and Promotion Activities (課程設計、教案開發、學校推廣活動) Chairman: Prof. Dong-Hwang Chen (陳東煌教授)**
10:30 - 10:50	Teacher-designed Curriculum and Instructional Material of Nanotechnology (奈米科技融入小學課程教學), Li-Chen Chou (周利貞), National Taipei University of Education Experimental Elementary School, Taipei (國立台北教育大學附設實驗國民小學)
10:50 - 11:10	Instructional Design for Kindergarten to 2nd-Grade Students (幼稚園至小二教案開發經驗分享) Chi-Lan Cheng (鄭及蘭), Taipei Fuhsing Private School, Taipei (私立復興實驗高級中學)
11:10 - 11:30	Spring of Nanotechnology Instruction – The Nano The Future (奈米的春天與發芽) Fan-Pai Wei (魏汎百), Ta-Tung Elementary School, Kaohsiung (大同國小)
11:30 - 11:50	K-12 Nanotechnology Education Program – Living in a Nanotechnology Era (國小奈米科技教學活動－奈米科技生活家) Chen-Chen Liu (劉蓁蓁), Tainan Municipal Jinsyue Elementary School, Tainan (進學國小)
11:50 - 12:10	Nanotechnology and Science Teaching in Junior High School (奈米科技融入國中教學) Wun-Bang Liao (廖文邦), Guang-Wu Junior High School, Hsinchu (光武國中)
12:10 - 12:30	Nanotechnology Education Awareness Program Mr. Loo Kok Hoo, Sunway Mas Commercial Center, Malaysia
12:30 - 12:50	Panel Discussion and Closing (綜合座談與閉幕)

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台灣國際奈米週 Taiwan Nano

ANF 種子教師研討會

6/14、15 ANF Teachers' Workshop

奈米週活動內容
國際奈米科技研討會暨商機論壇
台灣奈米科技展
ANF種子教師研討會
第二屆全國奈米科技創意應用競賽
奈米國家科技計畫成果發表會
線上報名
會場地圖
住宿資訊
活動回顧
主辦單位

※活動照片

「2007亞洲奈米論壇---種子教師研討會」已圓滿落幕，部分活動照片，展示如下


大合照


大合照


吳茂昆所長


吳茂昆所長


顧問室-陳南鳴主任


楊鏡堂教授


楊鏡堂教授


楊鏡堂教授


會場


會場


會場

- Panel Discussion »
  沈弘俊1 沈弘俊2 沈弘俊、各區域中心主持人
- Session 1 »
  Andrea Hildebrandt Barbara Babb 簡麗賢 蘇小島 宋家驥 Francesca Calati
- Session 2 »
  John Paderi Weon Bae Ko 薛富盛 潘彥宏 劉淑瓊 陳錦雪 路竹高中團隊
- Session 3 »
  傅昭銘 動手做1 動手做2
- Session 4 »

※活動概述

奈米科技爲目前世界各國優先及長期支持的科技研發領域之一，鑒於教育爲科技與學術研究之根本，而科技與學術爲一國國力之具體表徵，面臨知識經濟及全球化時代來臨之際，科技與學術之優質化儼然成爲最佳之國際競爭利器。

有鑑於此，亞洲地區國家於 2004 年 5 月成立了亞洲奈米論壇（Asia Nano Forum）。此論壇爲一種網絡組織，是由亞太地區的 13 個經濟體所支持的，包括台灣、澳洲、中國、香港、印度、印尼、韓國、日本、馬來西亞、紐西蘭、新加坡、泰國和越南。亞洲奈米論壇希望透過此網絡彼此合作，以促進亞洲地區在奈米科技之教育、研究、發展及產業推廣。亞洲奈米論壇主要的目標是：

- 在亞洲地區中透過建立設備來分享訊息、人和物理資源及專門技術。
- 協調網絡會員來投資彼此的基礎建設。
- 在網絡會員間開創、發揚及經營科技合作研究計畫。
- 透過處理主要地區問題的合辦項目來支持地區經濟和環境發展，重點在發展和新興經濟的支持。
- 提升奈米科技的大眾認知及教育訓練，並且聯繫社會、環境、健康和經濟的問題。
- 在地區裡扮演一個倡導奈米科技的角色，並在全球論壇中作爲地區性的代表。

我國爲統籌規劃奈米科技人才培育工作未來之方向，持續與國外分享我國奈米人才培育工作之成果，擬於今年 6 月，配合我國主辦之「台灣國際奈米週」，將邀請亞太地區各會員國之奈米科技教育相關學者、專家、以及 K-12 種子教師，至我國參與 2007 年亞洲奈米論壇－ANF 種子教師研討會（Teachers’ Workshop）。

本研討會之國內參與者，擬邀請我國奈米科技 K-12 教育發展中心之各區域中心主任、各區域標竿學校種子教師約 10 至 12 人，發表與分享過去數年我國推動奈米科技 K-12 之成果，包括教材開發、教學推廣、數位學習教材、實驗教具、奈米研習營（夏令營、冬令營、假日營等）、課程融入等等之各項教學經驗，並於會中發表與各國與會代表分享。本研討會亦將邀請亞太地區各會員國之 K-12 教師發表其教學經驗，並與我國種子教師交換心得、討論。最後，本研討會將針對奈米人才培育工作之未來推動方向進行綜合討論，並爲亞太地區奈米科技教育人才培育工作之交流推廣奠基。

※活動目的

- 本研討會將邀請我國以及亞太地區各會員國之 K-12 種子教師發表其奈米科技人才培育與教學經驗
- 本研討會亦將展示奈米科技實作實驗，並進行分組體驗活動
- 進行各國 K-12 種子教師心得交換、討論，最後，本研討會將針對奈米人才培育工作之未來推動方向進行綜合討論，並爲亞太地區奈米科技教育人才培育工作之交流推廣奠基

※ 時間地點

日期：96 年 6 月 14 日、15 日(週四及週五)兩天
地點：國立台灣大學 應用力學館 一樓國際會議廳

※研討主題

- 各國奈米科技 K-12 種子教師培育概況與教學經驗、成果分享：
    - 教材開發
    - 教學推廣
    - 數位學習教材
    - 實驗教具
    - 奈米研習營
    - 課程融入
    - 其他教學相關經驗分享
    - 綜合座談
- 奈米科技實作實驗展示，並進行分組體驗活動。
- 各國 ANF 代表、K-12 種子教師心得交換、討論；最後，本研討會將針對亞太地區奈米人才培育工作之未來推動方向進行綜合討論，爲人才培育工作之交流推廣奠基。

※參加對象

- 奈米科技 K-12 人才培育與前瞻人才培育各區域中心教授代表
- 各區域中心標竿學校種子教師
- 國科會、教育部及工研院代表
- 12 個 ANF 會員國家代表（澳洲、中國、香港、印度、印尼、韓國、日本、馬來西亞、紐西蘭、新加坡、泰國、越南）
- 各大專院校相關領域教師與學生
- 對奈米科技人才培育有興趣之社會大眾

※ 活動費用

活動全程免費，請先上網報名。

※ 辦理單位

主辦單位：

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- 國家科學委員會
- 國立台灣大學
- 教育部顧問室北區奈米科技 K-12 教育發展中心

※ 辦理單位

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- 國家科學委員會
- 國立台灣大學
- 教育部顧問室北區奈米科技 K-12 教育發展中心
- 教育部顧問室北區奈米科技前瞻人才培育教育發展中心

協辦單位：

- 教育部顧問室
- 教育部顧問室全國奈米科技人才培育推動計畫辦公室
- 教育部顧問室中北區奈米科技 K-12 教育發展中心
- 教育部顧問室中南區奈米科技 K-12 教育發展中心
- 教育部顧問室南區奈米科技 K-12 教育發展中心
- 教育部顧問室東區奈米科技 K-12 教育發展中心
- 教育部顧問室中北區奈米科技前瞻人才培育中心
- 教育部顧問室中南區奈米科技前瞻人才培育中心
- 教育部顧問室南區奈米科技前瞻人才培育中心
- 教育部顧問室東區奈米科技前瞻人才培育中心

※ 聯絡人

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附件五 英文網頁

台灣國際奈米週 Taiwan Nano

ANF Teachers' Worksho

6/14、15 ANF 種子教師研討

* Chinese About/ Program/ Content/ Sign u

Program

- International Nenotechnology Workshop & Business Opportunity Forum
- Taiwan Nano Exhibition
- ANF Teachers' Workshop
- National Nenotech Innovative Competition
- Annual Meeting of National Nanoscience and Nanotechnology Program

Registration

Venue

Accommodation

Previous Events

Organizers

交通部觀光局 Tourism Bureau TAIWAN Touch Your Heart

※**Pictures** 2007ANF Teachers' Workshop was finished. Some pictures taken during the workshop can be viewed as follows.



Group Group Director Photo Photo Wu



Director Director Wu Chen

Prof. Yang



Prof. Yang Prof. Yang Chamber

TOP

※Scope of the Workshop

The 2007 ANF Teachers' Workshop is organized especially for K-12 teachers to share their experiences in teaching nanotechnology. We will invite local seed teachers to talk about how they teach nanotechnology in the elementary schools, junior high schools, and senior high schools. We hope that this Workshop will help those who want to develop K-12 nanotechnology education program. We also welcome the teachers from ANF union countries to share their experiences with others. Further, we would like to invite ANF delega to share the progress and experiences in their nanotechnology huma resource development programs from 13 economies in the Asia Paci Region including Australia, China, Hong Kong, India, Indonesia, Kore Japan, Malaysia, New Zealand, Singapore, Taiwan, Thailand and Vietnam. Moreover, this Workshop will continue the effort to give a stimulating and thought-provoking forum for sharing the latest educational development ideas in K-12 education program.

※Topics

- Teacher's Training and Development
- Publications and Teaching Material Development
- Development of Nanotechnology Experiments
- E-learning Materials and Games
- Nanotechnology Summer Camp and Classes
- Curriculum Integration and Lesson Design
- Other Promotion Activities
- Activity of Hands-on Experiments

※General Information

- **Workshop Title**

  ANF Teachers' Workshop

- **Dates and Time**

  2007/June/14 (Thursday) 10:00am-17:20pm

  2007/June/15 (Friday) 09:00am -15:30pm

- **Venue**

  International Conference Hall (Rm. 100), Institute of Applied Mechanics, NTU

- **Language**

  Official language of the Workshop is English

- **Guiding Organization**

  National Science Council of Executive Yuan

  Advisory Office, Ministry of Education Program

  Office, National Science and Technology Program

- **Executive Organization**

  Institute of Applied Mechanics, National Taiwan University

  North Regional Center for K-12 Nanotechnology Educati

  North Regional Center for Advanced Nanotechnology Education

  Nanotechnology Human Resource Development (NHRD) Program Office, Advisory Office, Ministry of Education

※Charge

Free. Please register via the Internet.

※Secretariat

Professor Horn-Jiunn Sheen

Institute of Applied Mechanics, National Taiwan University

E-mail: sheenh@ntu.edu.tw Tel: +886-2-3366-5851 Fax: +886-2-3366-5633

※Organizers

Sponsers：

- Program Office, National Science and Technology Program for Nanoscience and Nanotechnology
- National Science Council (NSC)
- National Taiwan University
- North Regional Center for K-12 Nanotechnology Education
- North Regional Center for Advanced Nanotechnology Educatio

Co-organizers：

- Advisory Office, Ministry of Education (MOE)
- Nanotechnology Human Resource Development (NHRD) Progr Office, Advisory Office, Ministry of Education (MOE)
- Mid-North Regional Center for K-12 Nanotechnology Education
- Mid-South Regional Center for K-12 Nanotechnology Educatio
- South Regional Center for K-12 Nanotechnology Education
- East Regional Center for K-12 Nanotechnology Education
- Mid-North Regional Center for Advanced Nanotechnology Education
- Mid-South Regional Center for Advanced Nanotechnology Education
- South Regional Center for Advanced Nanotechnology Educatio
- East Regional Center for Advanced Nanotechnology Education

※Taiwan Nanotechnology K-12 Education Program

Technological development requires trained personnel. Skilled and dedicated workers are important the technological advancement. Nanotechnology, an emerging field that is expected to bring up significant impact in many fields of science and technology, was recognized as a catalyst and enabling power for their transformation a higher level of achievement. To accelerate the research and development of nanotechnology, the National Science Council (NSC) Taiwan launched the National Science and Technology Program for

Nanoscience and Nanotechnology in 2002. In addition, a human resource development plan was included as integral component, wh is in charged by the Ministry of Education (MOE).

The Nanotechnology Human Resource Development Program (HHRD was established to coordinate the design and execution of nanoeducation and the cultivation of required professional teaching manpower as well as educational materials including E-learning. Und the supervision of MOE, the NHRD Program was coordinated by the NHRD Office to lead the Regional Center for K-12 Nanotechnology Education, the Regional Center for Advanced Nanotechnology, and t E-Knowledge Exchange Platform. The aim of this project was to prepare a future generation of researchers, engineers, designers, business leaders, and general public with knowledge in nanoscience and technology that will support the development of next generation high-tech industry and research. The main objectives of the NHRD Program are as follows:

- Promote life-long learning in Nanotechnology education.
- Promote Nanotechnology knowledge in general public.
- Promote the integration of a hierarchical educational system t cover the whole spectrum from K-12 to higher education, and the general public.
- Narrow down the gap between city and rustic area in nanoscience and technology education and reduce the disparit of resource development.

TOP

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

附件六 投影片資料

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Opening Ceremony

ANF Teachers' Workshop

http://www.nano-taiwan.ntu.edu.tw/anf/

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Welcome to ANF Teachers' Workshop

Professor Horn-Jiunn Sheen (沈弘俊教授)

Professor Tzong-Shyan Wung (翁宗賢教授)

Professor Chao-Ming Fu (傅昭銘教授)

Professor Mei-Feng Lai (賴梅鳳教授)

Scope of the Workshop

- To share the teaching experience, the latest educational developments and ideas in K-12 education program for 13 economies in the Asia Pacific Region.

2007ANF Teachers' Workshop

About this Workshop

- Sponsored and supported by:
  - National Science Council (NSC)
  - Advisory Office, Ministry of Education (MOE)
  - Program Office, National Nanoscience and Nanotechnology Program
  - National Taiwan University
  - Program Office, Nanotechnology Human Resource Development (NHRD) Program, Advisory Office, Ministry of Education (MOE)
    - 5 Regional Centers for K-12 Nanotechnology Education
    - 5 Regional Centers for Advanced Nanotechnology Education

ANF (Asia Nano Forum)

- 13 Economies in Asia Pacific Region.
  - Australia, (4)
  - China,
  - Hong Kong, (1)
  - India, (2)
  - Indonesia, (5)
  - Korea, (1)
  - Japan,
  - Malaysia, (9)
  - New Zealand, (1)
  - Singapore, (2)
  - Taiwan, (>100)
  - Thailand, (6)
  - Vietnam. (1)
- USA, Arizona State, (4)

Program

Thursday, JUNE 14		*Room 100*
10: 00 - 10:20	**ANF Teachers' Workshop** - Registration 種子教師研討會報到	
10:20 - 10:40	Opening Remarks 開幕式	
10:40 - 11:10	**Keynote Speech 邀請演講 (Prof. Jing-Tang Yang 楊鏡堂教授)**	
Session 1 11:10 – 12:30	**Nanotechnology Promotion Activities in K-12 Schools (K-12中小學奈米科技教學推廣) Chairman／Prof. Chia-Chi Sung (宋家驥教授)**	
Session 2 13:30 – 15:30	**Teaching Material Development, Science Camp and Hands-on (教材開發、科學營、動手做實驗活動) Chairman／Prof. Fuh-Sheng Shieu (薛富盛教授)**	
Session 3 15:50 - 17:10	**Activity of Hands-on Experiments Prof. Chao-Ming Fu (傅昭銘教授) (Room 111)**	**International Nano Innovation Contest 國際奈米創意競賽 (王國禎教授) (Room 100)**
Friday, JUNE 15		*Room 100*
Session 4 08:30 - 10:10	**Animation, E-learning Teaching Material and Summer Camp (動畫設計、數位學習教材、夏令營) Chairman／Prof. Meng-Kao Yeh (葉孟考教授)**	
Session 5 10:30 – 12:30	**Curriculum Integration, Lesson Design and Promotion Activities (課程設計、教案開發、學校推廣活動) Chairman／Prof. Dong-Hwang Chen (陳東煌教授)**	
12:30 - 12:50	Panel Discussion and Closing Remarks (綜合座談及閉幕)	

Presentations

- 1 Keynote Speech, by Prof. J.T. Yang
- 21 Presentations, by Scholars, Teachers:
  - Taiwan (16, all K-12 School Teachers) –
    Great challenge for them to present in English!!
  - Australia, (1)
  - Korea, (1)
  - Malaysia, (1)
  - USA (2)
- Hands-on Experiments, (Prof. Chao-Ming Fu)
  - About 50 K-12 schools 6-11th graders to joint
  - International Nano Innovation Contest
- Please finish presentation in 15-17 minutes.

Once more, Welcome to Workshop!

and

Wish all of you a very productive and pleasant time!

Chien-Ming Wang, 6th Win

Hong-Chih Kuo, 1st Win and Hit 1st Homer

2007ANF Teachers' Workshop

Welcome to Taiwan

- If you have some spare time, please visit:
  - Taiwan Nano 2007
    - Taiwan Nano Exhibition 2007
    - International Nanotechnology Workshop
    - Taiwan-USA Nano Business Forum
  - Taipei 101 (still the tallest building now!)
  - National Palace Museum (very beautiful collections)

Taiwan Nano 2007

2007 ANF 種子教師研討會

6/14、15 ANF Teachers' Workshop

Opening Remarks

ANF Teachers' Workshop

2007ANF Teachers' Workshop

Keynote Speech 邀請演講

- Prof. Jing-Tang Yang (楊鏡堂教授)
  - Professor, Department of Power Mechanical Engineering, National Tsing Hua University, Taiwan, R.O.C.
  - Joint Professor, Institute of Microelectromechanical System, National Tsing Hua University, Taiwan, R.O.C.
  - Research Interests: Microfluidics (微尺度流體力學), Bio-MEMS (生醫微機電), Energy and combustion (能源與燃燒), Jet propulsion (噴射推進), Biomimetic Engineering (仿生動力機械)
  - Director, Mid-North Regional Center of K-12 Nanotechnology Human Resource Development (NHRD) Program, Taiwan, R.O.C. (2004/1 ~ 2006/12)
  - ◆ Director, Nanotechnology Human Resource Development (NHRD) Program, Taiwan, R.O.C. (2007/1 ~)
  - ◆ Principal Commissioner, Energy Planning & Management Program of National Science Council, Taiwan, R.O.C.

2007ANF Teachers' Workshop

Session 1 (11:10 – 12:30)

- Nanotechnology Promotion Activities in K-12 Schools (K-12中小學奈米科技教學推廣)
  - Chairman／Prof. Chia-Chi Sung (宋家驥教授)

11:10-11:30	Nanotechnology Education at Taipei First Girls High School (北一女的奈米科技教育) Li-Hsien Chien (簡麗賢)
11:30-11:50	Integration of Research, Education and Outreach: Student-Teacher-Scientist Partnerships through Cooperation between K-12 and University, Andrea Hildebrandt, Kenilworth School, and Barbara Babb, Chandler High School, Phoenix, Arizona, USA
11:50-12:10	The Development of Nano Education in Elementary School of Taoyuan County (桃園縣推動奈米科技融入小學教學計畫之實踐) Sheau-Dao Su (蘇小島)
12:10-12:30	A Science of Limitless Possibilities Francesca Calati, St. Helena Secondary College, Eltham, Victoria, Australia

2007ANF Teachers' Workshop

Session 2 (13:30 – 15:30)

- **Teaching Material Development, Science Camp and Hands-on (教材開發、科學營、動手做實驗活動)**
  - **Chairman／Prof. Fuh-Sheng Shieu (薛富盛教授)**

13:30 - 13:50	Lesson Design: Self-Assembly in Biology (教案設計：生物自組裝) Yen-Hung Pan (潘彥宏)
13:50 - 14:10	Introduction to the Nano World through Size and Scale Phenomena John Paderi and Ben Campbell, Arizona State University, Arizona, USA
14:10 - 14:30	Nano Lesson by Science Fiction (奈米科技小說－科幻赤壁/決戰未來) Shu-Chiung Liu (劉淑瓊)
14:30-14:50	A Science Camp of Nanotechnology for Elementary School Children & Their Parents (小學奈米親子營), Chin-Shueh Chen (陳錦雪)
14:50 - 15:10	Synthesis of Fullerene Derivatives under Ultrasonic Condition and Self-Assembled Fullerene-Gold Nanoparticle Films Prof. Weon Bae Ko, Department of Chemistry, Sahmyook University, Korea
15:10 - 15:30	Nano Science and Technology Hands-on (奈米科技動手做 – 光觸媒除污、光觸媒防霧、蓮葉效應、撥水奈米布料) Chih-Hui Chung (鍾志輝)

2007ANF Teachers' Workshop

Session 3 (15:50 - 17:10)

- **Activity of Hands-on Experiments**
  - **Prof. Chao-Ming Fu (傅昭銘教授)**

15:50 - 17:10	**Activities for K-12 Nano Technology Education Hands-on (奈米科技動手做) Prof. Chao-Ming Fu (傅昭銘教授) (Room 111)**

2007ANF Teachers' Workshop

Session 4 (08:30 – 10:10)

- **Animation, E-learning Teaching Material and Summer Camp (動畫設計、數位學習教材、夏令營)**
  - **Chairman／Prof. Meng-Kao Yeh (葉孟考教授)**

08:30-08:50	Nanotechnology Integrated Teaching Materials of Senior High Schools (奈米科技融入高中教材), Han-Chien Yang (楊漢倩)
08:50-09:10	Animation for Nanotechnology Education－The Wonderland of Nanotechnology (奈米動畫－迷走星球), Meng-Hung Chen (陳孟宏)
09:10-09:30	Experience of Nano Summer Camp (奈米夏令營經驗分享) Li-Hsueh Hsu (徐麗雪)
09:30-09:50	"Experiment and Experience" – Nanotechnology Lesson Design and Teaching in 7th Grade (萬芳高中國中部奈米教案研發及實施概況) Xian-Lin Li (黎湘玲)
09:50-10:10	Nanotechnology Promotion Experience of Ji-An Junior High School (吉安國中推廣奈米科技教育經驗分享), Sian-Yuan Jhan and Kuang-Chi Ma (詹賢媛、馬廣琪)

2007ANF Teachers' Workshop

Session 5 (10:30 – 12:30)

- **Curriculum Integration, Lesson Design and Promotion Activities (課程設計、教案開發、學校推廣活動)**
  - **Chairman／Prof. Dong-Hwang Chen (陳東煌教授)**

10:30-10:50	Teacher-designed Curriculum and Instructional Material of Nanotechnology (奈米科技融入小學課程教學), Li-Chen Chou (周利貞)
10:50-11:10	Instructional Design for Kindergarten to 2nd-Grade Students (幼稚園至小二教案開發經驗分享) Chi-Lan Cheng (鄭及蘭)
11:10-11:30	Spring of Nanotechnology Instruction – The Nano The Future (奈米的春天與發芽) Fan-Pai Wei (魏汎百)
11:30-11:50	K-12 Nanotechnology Education Program – Living in a Nanotechnology Era (國小奈米科技教學活動－奈米科技生活家) Chen-Chen Liu (劉蓁蓁)
11:50-12:10	Nanotechnology and Science Teaching in Junior High School (奈米科技融入國中教學) Wun-Bang Liao (廖文邦)
12:10-12:30	Nanotechnology Education Awareness Program Mr. Loo Kok Hoo, Sunway Mas Commercial Center, Malaysia

Taiwan Nano 2007

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6/14、15 ANF Teachers' Workshop

Panel Discussion

ANF Teachers' Workshop

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Closing Remarks

ANF Teachers' Workshop

Nanotechnology Human Resource Development (NHRD) Program in Taiwan

Ministry of Education

Professor Jing-Tang Yang
Department of Power Mechanical Engineering
Institute of Microelectromechanical Systems
National Tsing Hua University, Hsinchu, Taiwan

and

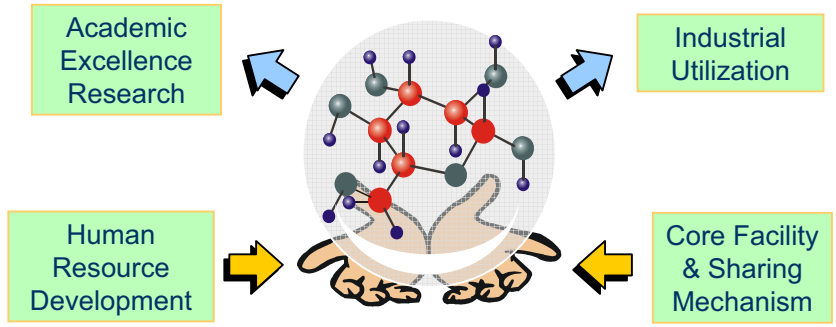
Professor Pei-Ling Liu
Institute of Applied Mechanics
National Taiwan University, Taipei, Taiwan

June 14th, 2007 @ Taipei

Outline

- Project goals
- Project organization
- Project contents
- Executive results
- Economical outcomes
- Future work

Taiwan's Nanotechnology Program



1. Accelerating collaboration between education, academia and industry
2. Developing multidisciplinary, creative, and lifelong Learners

Project Goals of Human Resource Development

Project goals

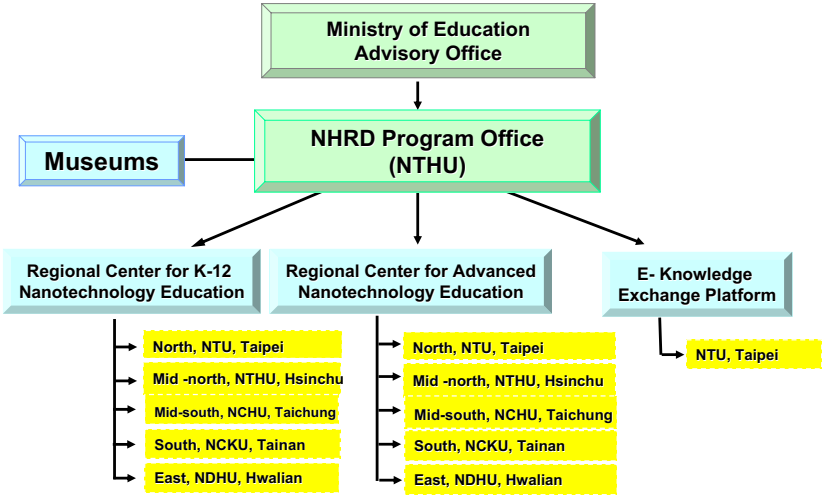
- Promote life-long learning in Nanotechnology Education
- Promote the popularization of Nanotechnology Education
- Upgrade the higher professional education, K-12 education and accomplishment education of science of the general public
- Narrow down the gap between city and rustic area and reduce the disparity of resources deployment

Project organization -1/3

- **Project Title：Nanotechnology Human Resource Development (NHRD) Program, Ministry of Education**
- **PI and Co- PIs**
  - 2003-2005: **PI**: **T. T. Wu**, Co-PIs: M. K. Kuo
  - 2006: **PI**: **C. P. Hwu**, Co-PIs: W. B. Young, C. L. Chen
  - 2007-present: **PI**: **J. T. Yang**, Co-PIs: D. J. Yao, J. A. Yeh
- **Organization ：**
  - 2003-2005: Institute of Applied Mechanics, National Taiwan University
  - 2006: Department of Aeronautics and Astronautics, National Cheng Kung University
  - 2007-present: Department of Power Mechanical Engineering, National Tsing Hua University
- **Project Period ：6 years (2003.1.1~2008.12.31)**
- **Budget for each year ：**

2003	2004	2005	2006	2007
NT$21,895,000 (US$663,484)	NT$50,000,000 (US$1,515,151)	NT$68,951,000 (US$2,089,424)	NT$78,865,000 (US$2,389,848)	NT$80,000,000 (US$2,424,276)

Project organization -2/3



Project organization -3/3

- **Regional Center for Advanced Nanotechnology Education**
  - North, NTU, Taipei
    - 14 partner universities
  - Mid-North, NTHU, Hsinchu
    - 10 partner universities
  - Mid-South, NCHU, Taichung
    - 16 partner universities
  - South, NCKU, Tainan
    - 18 partner universities
  - East, NDHU, Hwalien
    - 4 partner universities
- **Regional Center for K-12 Nanotechnology Education**
  - North, NTU, Taipei
    - 15 leading schools, 202 seed teachers
  - Mid-North, NTHU, Hsinchu
    - 9 leading schools, 1049 seed teachers
  - Mid-South, NCHU, Taichung
    - 10 leading schools, 642 seed teachers
  - South, NCKU, Kaohsiung
    - 19 leading schools, 878 seed teachers
  - East, NDHU, Hwalien
    - 14 leading schools, 173 seed teachers

Locations of Regional Centers

The program office is located at PME, NTHU

Project contents – 1/4

- **NHRD Program Office**
  - **Integrate all work of advanced education centers, K-12 education centers and E-knowledge exchange platform**
  - **Edit teaching materials of nanotechnology**
    - Books for university students
    - Books for K-12 teachers and students
    - Multi-Media interactive CDs for K-12 students
    - Translation of published books or CDs
      - Chinese to English or Japanese, English to Chinese
  - **Hold national workshops for K-12 education, university student competition, etc.**
  - **Establish international collaboration**
    - Exchange of K-12 experience; exchange of university students
    - Attend International Nano Tech Exhibition
  - **Manage administrative works between Ministry of Education and all regional centers**

Project contents – 2/4

- **Regional Center for K-12 Nanotechnology Education**
  - **Training of K-12 seed teachers by offering lectures, workshops, lab training courses such as AFM, etc.**
  - **Edit teaching materials of nanotechnology**
    - Books for K-12 students (of elementary, junior high and senior high schools) including comic books and text books
    - Multi-Media interactive CDs for K-12 students, such as animated cartoon, flash and powerpoint files, webpage design, videos for hands-on experiments, etc.
    - Teaching plans for K-12 teachers
  - **Extension education by K-12 leading schools**
    - Hold K-12 summer camp, circulating exhibition of mobile museum
    - Extend to students in suburban areas.
  - **Establish online nanodictionary – Chinese/English/Japanese**
  - **Collaboration with museums such as National Taiwan Science Education Center, National Museum of Natural Science, and National Science and Technology Museum to popularize the nanotechnology to the general public**

Project contents – 3/4

- **Regional Center for Advanced Nanotechnology Education**
  - **Offer nanotechnology curriculum (credit hours for a series of course work)**
  - **Offer non-credit certification nanotechnology courses, science-camps, lab and hands-on training, equipment operation courses, summer school, etc.**
  - **Establish distant learning system for nanotechnology**
    - Extend to the universities that have not enough professors and facilities for nanotechnology education – cross-university program
    - Motivate E-learning courses to free the time and space constraints
  - **Hold academic workshops, university-industry workshops, lectures, competitions, summer camps, etc.**
  - **Support K-12 education centers with human and equipment resources**

Project contents – 4/4

- **E-Knowledge Exchange Platform**
  - Integrate and display the achievements of all education centers
  - Exchange information among centers
  - Establish E-learning platform
  - Publish Nano News Letters
  - Connect all related networks of nano education and research
  - Hold on-line creative idea competition for students

Executive Results

- **Table of executive contents – K-12 Nanotechnology Education**

K-12 Nanotechnology Education Team	
universities	**13**
leading schools	**69**
K-12 active seed teachers	**258**
K-12 potential seed teachers	**768**
Publications	
books, cartoon, lesson plans, lecture notes subsidiary materials	**111**
Activities	
Conferences	**6** (~674 participants)
seminars, competitions, exhibitions, workshops, speeches	**150** (~20865 participants)

Executive Results

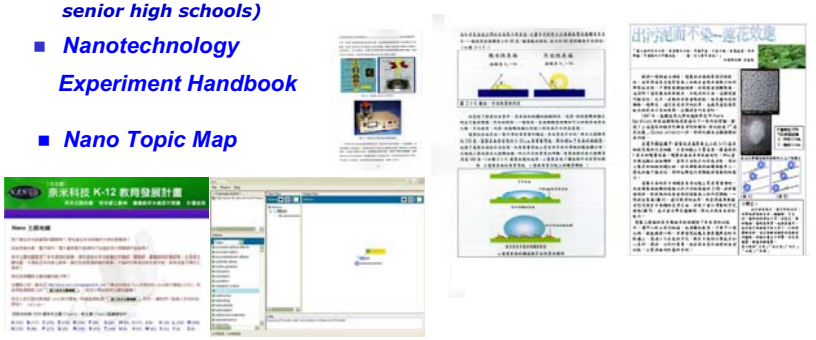
- **Table of executive contents – Advanced Nanotechnology Education**

Advanced Nanotechnology Education Team	
universities	**57**
Nano-science and technology Program	
students enrolling in nanotechnology programs	**7270**
students completing nanotechnology programs	**475**
Publications:	
handouts/lecture notes	**111**
Activities	
training courses for equipment user	**~ 6323** participants
national competitions, exhibitions, conferences	**~ 18859** participants

Executive Results - K-12 Nanotechnology Education

- **Books under preparation**
  - ***Generation N Treasure Book*** *(written by teachers and professors)*

    (Text books for students in elementary schools, junior high schools and senior high schools)
  - ***Nanotechnology Experiment Handbook***
  - ***Nano Topic Map***



http://pesto.lib.nthu.edu.tw/k12/topicmap.asp

Executive Results - K-12 Nanotechnology Education

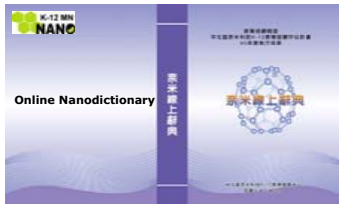
- **Online Nanodictionary**

  Chinese/English/Japanese

  Collection: 450 new words with clear definition

  Search system:

  1. Look up meaning in Chinese by English.
  2. Look up all lexicons which contains the input fragment of a word.
  3. A per word in dictionary homepage.



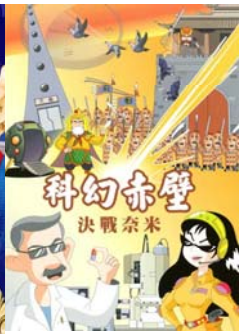
http://pesto.lib.nthu.edu.tw/k12/dictionary.asp

2007 ANF Teachers' Workshop

Executive Results - K-12 Nanotechnology Education

- **PC game software for high school students**
  - ***The Wonderland of Nanotechnology***

- **Animated Cartoon for high school students**
  - ***A Science Fiction at the Red Cliff***

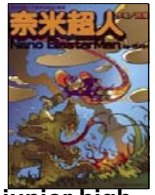


Taiwan Nano 2007 NANO

2007 ANF Teachers' Workshop

Executive Results - K-12 Nanotechnology Education

- **Cosmic books for students in elementary schools**
  - ***Nano Blaster Man***



- **Animated Cartoon for students in elementary and junior high schools**
  - ***A Fantasy Journey for Nana and Nono***
  - ***Nano Magic***

Taiwan Nano 2007 NANO

2007 ANF Teachers' Workshop

Executive Results - K-12 Nanotechnology Education

- **Text books for students in senior high schools**
  - ***Nano-Symphony***

- **Text books for K-12 teachers and university students**
  - ***Nanotechnology – Fundamental, Application and Experiment***

Taiwan Nano 2007 NANO

Executive Results - K-12 Nanotechnology Education

- **Experiment Kits**
  - Synthesis of II-VI Quantum dots
  - Synthesis of nano-gold
  - Synthesis of nano-magnetic particles
  - Biomedical application of nano-magnetic beads
  - Fabrication of solar cell using TiO_2
  - Carbon nano-tube model
  - Self-assemble of Poly-Styrene spheres
  - Fabrication of liquid crystal display
- **Experiment Illustration DVD**

Executive Results - K-12 Nanotechnology Education

- **AFM Laboratories**


- **Nanotech Classes and Summer Camps**


Executive Results - K-12 Nanotechnology Education

- **Lab Tour**


- **Nanotech Game**
- **Nano Little Pioneers**


Executive Results - K-12 Nanotechnology Education

- **Mobile Museum**
  - *National Taiwan Science Education Center*

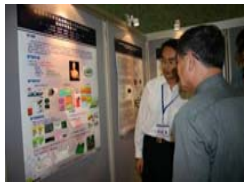

Executive Results - K-12 Nanotechnology Education

- Lectures for the general public

- Annual Conference for Seed Teachers

Executive Results - K-12 Nanotechnology Education

- Collaboration with Museums
  - *National Nature Science Museum*
  - *National Science and Technology Museum*



- Exhibitions
- Lectures
- Science competition

Executive Results – Advanced Nanotechnology Education

- Nano Science and Technology Program - undergraduate and graduate courses
- Nanoscience Lab Program
- Nano-Electronics Program
- Cross-University Program
- Summer School Program
- Distant Learning Program
- Nano Material Program
- Interaction with Industry
- Conferences and Workshops
- National Competitions on Nanotechnology and Nanoscience for college students

Executive Results – international collaboration

- International Exchange Programs
  - 2 graduates from USA → Taiwan
  - 6 graduates from Taiwan → USA, France, Singapore
- International Relations
  - Northwestern University
    Prof. R. P. H. Chang, National Center for Learning and Teaching in Nanoscale Sci. and Eng. (NCLT)
  - Arizona State University
    Prof. B. L. Ramakrishna, Interactive NanoVisualization for Sci. and Eng. Edu. (INVSEE)
  - University of Wisconsin, Madison
    Prof. W. C. Crone, Mat'ls Research Sci. and Eng. Center (MRSEC)
  - Ohio State University
    Prof. L. J. Lee, Ohio Center for Multifunctional Polymer Nano-mat'ls and Devices (CMPND)
  - The NanoTechnology Group Inc.
    J. L. Feather

Executive Results – international collaboration

- **Nano Tech Exhibitions**
  - *Nano Tech 2004, Taiwan*
  - *Nano Tech 2005, Japan*
  - *Nano Tech 2006, Japan*
  - *Nano Tech 2007, Japan*

Executive Results –

E-knowledge Exchange Platform

http://www.nano.edu.tw

Economics Outcomes

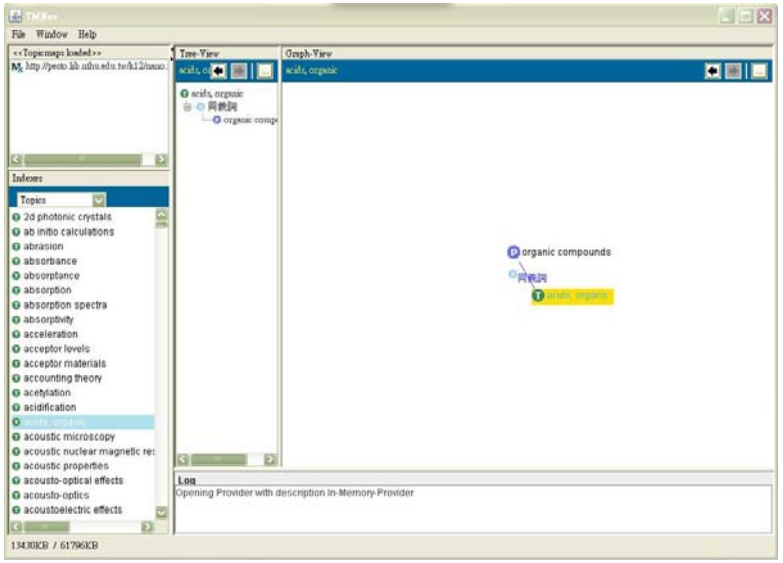
- **Academic or Technological Efficiency**
  - Nurture professional human resource with capability to research and innovate
- **Social Efficiency**
  - Strengthen popular science education in nanotechnology
- **Economic Efficiency**
  - Decrease the cost of human resource development effectively

Future Work

- **E-learning courses**
- **Distant interactive learning**
- **Promoting collaboration between academic institutes and industry**
- **Publications internationalization**
- **International collaboration**
- **Transferring K-12 teaching materials to school curricula**

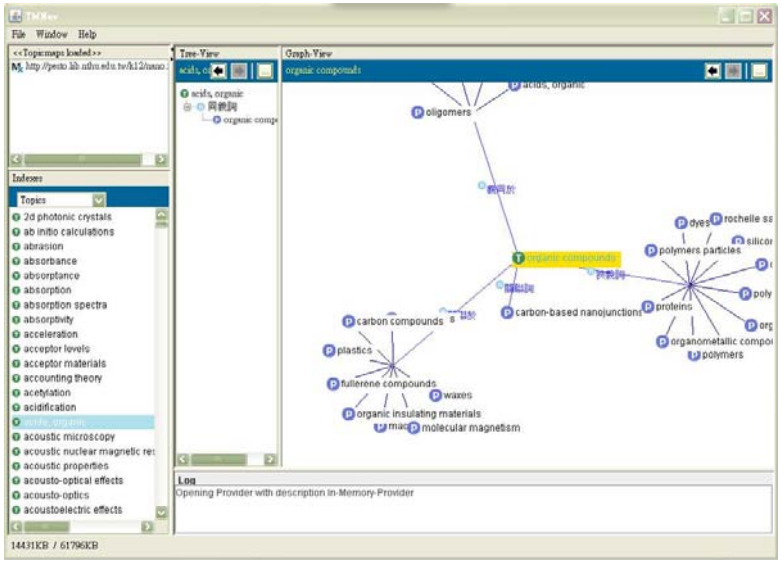
Thank You for Your Attention!

2007 ANF Teachers' Workshop



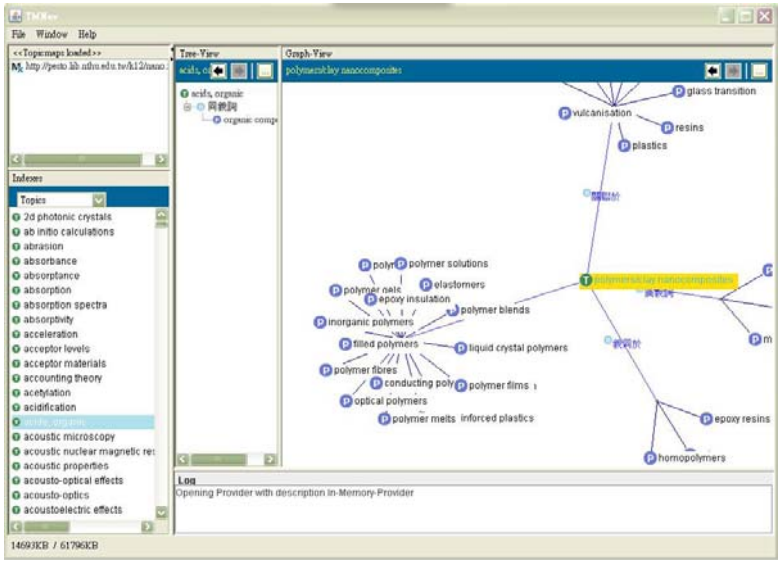
Taiwan Nano 2007 NANO

2007 ANF Teachers' Workshop

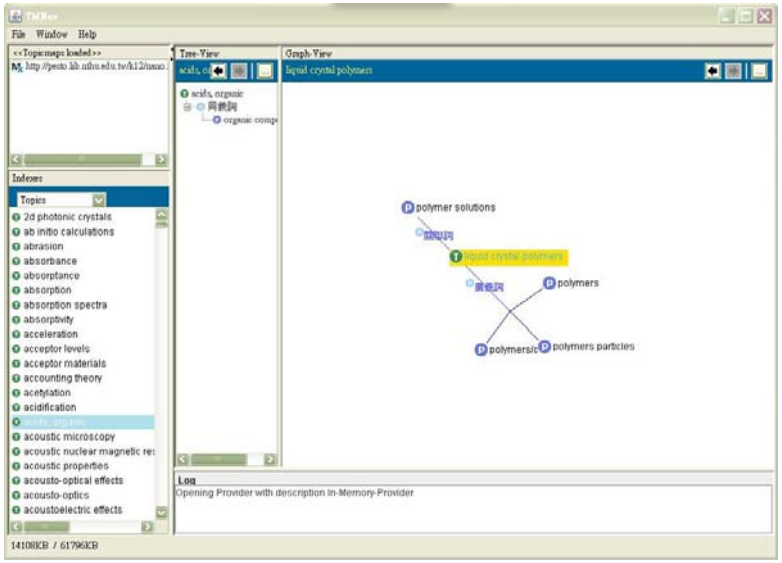


Taiwan Nano 2007 NANO

2007 ANF Teachers' Workshop



Taiwan Nano 2007 NANO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Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Nanotechnology Education At Taipei First Girls High School

(北一女中的奈米科技教育)

Chien, Li-Hsien (簡麗賢)

Physics Teacher, Taipei First Girls High School, Taipei, Taiwan, R.O.C. (北一女中)

Seed Teacher, Northern K-12 Regional Center of Nanotechnology Human Resource Development Program, Taiwan, R.O.C.

Outline

- Objective
- Nanotechnology Seed Teacher Team
- Teaching Strategy
- Seed Teachers Training
- Nanotechnology Promotion Activities
- Conclusions

Objectives

- To enable the students to understand nanotechnology and nanoscience.
- To enable the students to classify nano phenomenon.
- To introduce nanotechnology to teachers and students.
- To encourage teachers to create and share lesson plans and teaching materials with others.

Nanotechnology Seed Teacher Team

- Lesson plans and teaching materials developed by nine nanotechnology seed teachers.
- Physics Teacher：3
  Lee（李美英） Huang（黃光照） Chien（簡麗賢）
- Chemistry Teacher：3
  Ho（何鎮揚） Jiang（江慧玉） Chang（張永佶）
- Biology Teacher：2 Pan（潘彥宏） Hu（胡苓芝）
- Special Education Teacher：1 Yu（于曉平）

Teaching Strategy

- To integrate nanotechnology into Physics, Chemistry, and Biology class teaching.
- To integrate nanotechnology into seminars, student activities, and competitions.
- Develop teaching materials.
- Teaching promotion at other schools.

Seed Teachers training

10 Lectures and 3 Workshops 2004

12 Lectures and 3 Workshops 2005

10 Lectures and 3 Workshops 2006

Seed Teachers training

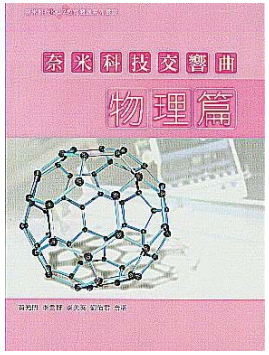
Hands-on activities May 08, 2007, N.T.U.

Lotus effect

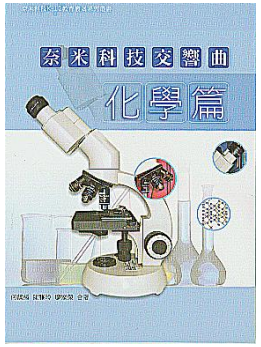
Nanometer magnetic particles

Books on Nanotechnology published (2004)

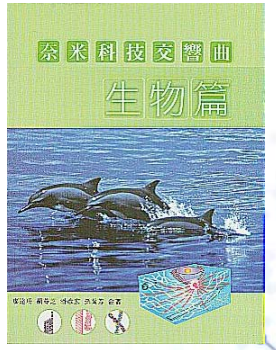
Popular Science Books: *Nano-Symphony*



physics



chemistry



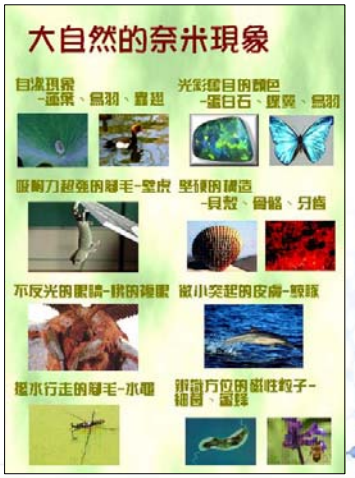
biology

Nanotechnology promotion education

- Class teaching
- Nanoscience Camp
- Nanotechnology week
- Composition competition
- Experiment in AFM labs
- E-learning Web Site
- Lectures to other schools
- Support other projects
- General public science lectures

Class teaching

Posters on campus



Labs

Science Experiments in NTU AFM lab

Visit NTU NEMS center

Composition Competition (2005)

- Ask each student to write a story or a report concerning nanotechnology.
- Essays received: 37
- Awarded selections: 10

2007ANF Teachers' Workshop

Nanoscience Camp (2006)

Nov. 4-5, 2006 in TFG

Nov. 4-5, 2006 in NTU

2007ANF Teachers' Workshop

Feedbacks from science Camp

- Participants: 60 students from about 40 high schools
- 80% students find the lecture topics interesting

76% students find the lectures easy

56% students find the experiments easy to understand, while

12% find them hard

2007ANF Teachers' Workshop

Lecture (Apr. 03, 2007 TFG)

Professor Lowe, University of Cambridge

Topic: Nano-biotechnology

2007ANF Teachers' Workshop

Nanotechnology Week (TFG)

Lectures for School Anniversary

Dec. 12, 2006

Conclusions

- Seed teachers play an very important role in education promotion.
- Various topics and activities are needed for high school students .
- **Nano Science Camp** and **Nanotechnology Week** were very popular for students.
- Nano topics are stimulating. Seed teachers and students learned a lot from lectures and other activities.

2007ANF Teachers' Workshop

Thanks for Your Attention.

Integration of Research, Education and Outreach:

Student-Teacher-Scientist Partnerships Through Cooperation Between K-12 and University

Andrea Hildebrandt
Kenilworth School-Phoenix, Arizona USA
Barbara Babb
Chandler High School-Chandler High School

U.S. Science Standards

The National Academy of Sciences developed National Science Education Standards to help achieve the goal of student science literacy

Each state develops it own science standards based on the National Standards

The five unifying concepts identified in the National Science Education Standards include (1995) the following:

- Systems, Order, and Organization
- Evidence, Models, and Explanation
- Constancy, Change, and Measurement
- Evolution and Equilibrium
- Form and Function

Arizona Science Standards

The state Board of Education adopted the Arizona Academic Standards in 1998 based on the National Science Standards to define what Arizona's students need to know and be able to do by the end of twelfth grade.

Developed by committees of educators, parents, students, and business and community leaders, these standards were written in grade-level clusters with benchmarks at 3, 5, 8, and high school (Arizona Department of Education).

Arizona Science Standards

The goal in the development of the standard was to assure that the six strands:

1. Inquiry process
2. History and nature of science
3. Science in personal and social perspective
4. Life science
5. Physical science
6. Earth science

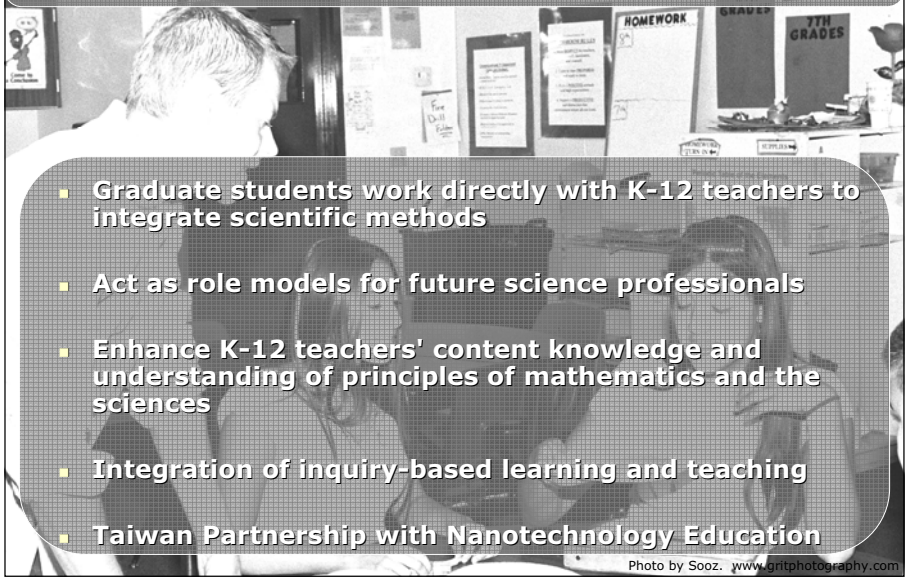
Each of the six strands is broken down into a number of grade level appropriate concepts. All concepts are then broken down further into specific performance objectives for the students.

Difficulties in Transitioning Standards into Effective Science Instruction

- The standards are not regularly updated, so new scientific research and topics such as nanotechnology may be neglected
- Teachers may receive minimal further training in recent scientific research

The GK-12 program helps eliminate these problems through a collaboration graduate-level research scientists and K-12 teachers

GK-12 Program: Graduate Teaching Fellows in K-12 Education



- **Graduate students work directly with K-12 teachers to integrate scientific methods**
- **Act as role models for future science professionals**
- **Enhance K-12 teachers' content knowledge and understanding of principles of mathematics and the sciences**
- **Integration of inquiry-based learning and teaching**
- **Taiwan Partnership with Nanotechnology Education**

Photo by Sooz. www.gritphotography.com

GK-12 Down to Earth Science at Arizona State University

Program Objectives:

- Improved communication and teaching-related skills for Fellows
- Integration of research with education
- Enriched learning experience for K-12 students
- Professional development opportunities for K-12 teachers
- Strengthened partnerships between higher education institutions and local school districts

Benefits to Graduate Student Fellows

- Learn to communicate science research to a broader audience
- Develop inquiry-based science lessons
- Interact with faculty experienced with innovative teaching at the college-level
- Learn teaching strategies for different learning styles from K-12 teachers
- Mentor children

Benefits to K-12 Community

- Teachers have "science expert" readily available
- Teachers have access to ASU outreach programs
- Teachers and graduate students will develop activities that will be shared with other teachers in their districts
- Students have opportunity to interact with scientists and have role models
- Students experience the excitement of the research at the cutting edge of science and engineering

Classroom Applications of GK-12

GK-12 allows for the curricular and instructional collaboration of graduate student fellows and K-12 science teachers to design inquiry-based lessons.

In this lesson, students designed and tested their own experiments to explain what causes the reaction when Mentos and Diet Coke are combined.

Nano-Scale Appreciation and GK-12

In this lesson, GK-12 graduate student fellows and teachers created an inquiry-based lesson using dialysis tubing which allowed student to gasp the idea of molecular size.

Nano-Scale Appreciation and GK-12

- Teachers and fellows develop lessons which help students develop an appreciation for the nano scale .

- Students tested the how the size and surface area of objects can effect their physical properties.

References

Arizona Department of Education. (2005, March 10). Science Standard Articulated by Grade Level http://www.ade.state.az.us/standards/science/articulated.asp (Accessed May 10, 2007)

National Research Council. (1996). *National Science Education Standards*. National Research Council. National Academy Press. Washington D.C.

National Research Council. (2001). *Inquiry and the National Science Education Standards*. National Research Council. National Academy Press. Washington D.C.

National Science Foundation. NSF Graduate Teaching Fellows in K-12 Education (GK-12). (2008, Nov. 7). Program NSF 07-555. http://www.nsf.gov/pubs/2007/nsf07555/nsf07555.htm (Accessed May 10, 2007).

Thank you!

Acknowledgements

- **This work was funded by the Track II GK12 NSF grant #DGE0086465 to Dr. B.L. Ramakrishna**
- **Thank you to our hosts in Taiwan for your wonderful hospitality!**

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

The Development of Nano Education in Elementary School of Taoyuan County (桃園縣推動奈米科技融入小學教學計畫之實踐)

Presenter : Sheau-Dao Su (蘇小島)

Cheng-Hsien Tung, Jung-Hui Wan, Sheau-Dao Su

Bei-men Elementary School (北門國小), Taoyuan, Taiwan

The Development of Nano Education in Taoyuan County

Movement One

The Nano Education seminars ---Continue to make citizens and teachers of Taoyuan Country understand the impacts of Nano technology on future life of human beings and the other creatures. (Through the touring seminars and workshops with rewards)

（1）First Seminar ：（95.09.11～95.09.15）。
（2）Second Seminar ：（95.09.18～94.09.22）。
（3）Third Seminar ：（95.09.25～95.09.29）。
（4）Fourth Seminar ：（95.10.02～95.10.06）。
（5）Fifth Seminar ：（95.10.09～95.10.13）。
（6）Sixth Seminar ：（95.10.16～95.10.20）。
（7）Seventh Seminar ：（95.10.23～95.10.27）。
（8）Eighth Seminar ：（95.10.30～95.11.03）。
（9）Nineth Seminar ：Nano exhibition（95.11.25 ）。
（10）Others ：Other related activities

Seminar in Bei-men elementary school

A workshop with rewards in Bei-men elementary school

A seminar in Jong-Jen elementary school

A principal is introducing Nano Technology

Nano seminar

A Nano seminar in Jwu-Wei junior high school

All students are attending the Nano seminar

Movement Two

Create an Internet platform for Nano technology education

Target

- Create an Internet platform for Nano technology education to share the teaching experience and knowledge.
- Unite the Internet resources to manage knowledge of Nano education.
- Provide information of Nano Technology for effective learning of students and teachers.
- Make Nano education more effective by humanizing an interactive communicating interface of computer.

Movement Three

- Combine the strength of communities, enterprise, parents, and teachers to develop Nano education.
- For instance, conduct learning activities in University and private company.

Visit the laboratory of Tsing-Hua University

Visit the private Her-Chen company for Nano technology

Movement Four

Train teachers of Nano education by seed schools which are conducted and united by Beimen elementary school. Reinforce teachers' abilities to design lesson plans of Nano technology education.

Cultivate the seed teachers

Unite the teaching strategy of six schools

Teachers sharing experience with each other

1. Building a BLOG for sharing the teaching experience
2. Conducting the seminars for seed schools to enhance the teaching ability

Design at least 20 lesson plans for elementary and junior high schools

Movement Five：Develop a working studio to create mini-books for Nano education

95.08.09-10

About 40 teachers

Design, produce, discuss, teach, share, and study mini-books

Build a delicate teaching process

10 Nano mini-books in 2006

The future aspects of Nano technology education:

Train more teachers and spread out the knowledge and experience of Nano technology education. The target is to hold over 10 touring seminars and at least 10,000 students will attend. At least over 20 teachers and over 10 schools can join the design of teaching lesson.

year / number / Object	2005	2006	2007 (Target)
Elementary	8	16	22
Junior high	1	2	3
High school	0	0	1
Total	9 (2,000 students)	18 (6,000 students)	26 (10,000 students)

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

A science of limitless possibilities

Presenter

Francesca Calati

St Helena Secondary College

Eltham Victoria Australia

Email: fc@sthelena.vic.edu.au

www.sthelena.vic.edu.au

www.shine.vic.edu.au

Nanotechnology in the classroom

A Daring innovation in the science curriculum

at

St Helena Secondary College.

Abstract

Abstract

Nantechnology in the classroom - A Daring Innovation in the Science Curriculum.

St Helena Secondary College, Bridge 8 Pty Ltd and Nanotechnology Victoria Ltd have formed a partnership to develop a curriculum that will be implemented in Victorian high schools from 2007. The approach taken by this collaboration is distinctive for three reasons. First, the curriculum is specifically focused on nanotechnologies for secondary schools. Secondly the partnership between Government, education, and industry has ensured the involvement of the broader nanotechnology community. Thirdly, the curriculum covers the science, its breadth of applications and implications for the community. It is this unique approach that delivers valuable skills for the Victorian and Australian community and positions these to capture the benefits of nanotechnology.

This session will be of interest to teachers who are thinking of incorporating nanotechnology into their science curriculum or just wish to see where nanotechnology is heading. A selection of teacher demonstrations, student activities, experiments and general resources will be presented.

Outline of Session

- Background
- Year 10 Unit
- Activities/Experiments
- Yr 11 Module
- Student work
- Samples of curriculum
- Questions

St Helena Secondary College

●St Helena Secondary College is a government school providing education for 1400 students from year 7 to 12.

● It runs an accelerated program for advanced students, compressing their required curricula needs for years 7-10 into three years, thereby allowing for extended learning.

●St Helena Secondary College is recognized for its approach to excellence in the sciences. In 2006, a team of seven teachers developed a specific nanoscience and nanotechnology program.

Why?

- To link science teaching to the real world by breaking the barrier between industry, universities and schools.
- To advantage students by providing them with information on cutting edge science careers and prepare them for possible entry into universities.
- Most importantly to excite and engage students in “cool” science without getting bogged down in difficult concepts.

Modules Yr 10

1 Scale
2 Properties
3 Performance materials
4 Health and medicine
5 Nano living
6 Consumer Science
7 Issues

Course structure

- The theory incorporated in the course is driven by the applications of the nanotechnology.
- Modules are flexible *-can be adapted to suit any science* course
- Each module has
  Power point presentation
  List of outcomes / content
  Links to activities, experiments, worksheets, web quests, videos /animations.

Course structure

Outcomes:

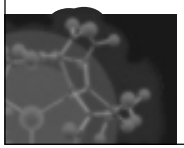
-these drive the assessment and are adjusted according to the class

Content:

-there is too much and teachers will need to choose

Delivery of the modules:

there are- Engaging " What if statements ? "
Cutting edge applications
Future applications
Short videos and animations



Course structure

Content (not in detail)

Module 1- Metric system ,Scale –comparison of sizes, scientific instruments, scientific method

Module 2 -Bulk properties (Classical effects), properties at the nanoscale (Quantum effects), nanoparticles, EMS, magnetism, ferrofluids, memory alloys, surface area, reaction rates, diffraction patterns (size of particle)

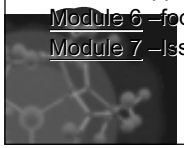
Module 3 -Bonding in carbon, graphite, diamond, fullerenes, nano carbon tubes , and polymers,aero gels, applications.

Module 4 –DNA, proteins, microbiology, transdermal patches, barcode, disease treatment

Module 5 –Surface chemistry,applying nanolayers to alter properties, applications- textiles, glass.

Module 6 –food and cosmetics

Module 7 –Issues-UTILITY FOG, media articles, guest speakers,



Course structure

Experiments/activities (not in detail)

Module 1- sorting, measuring small things using micrometers, microscopes, pipettes, simulations, writing a scientific report.

Module 2 –making gold nanoparticles, surface area, memory alloys, diameter of hair, reaction rates.

Module 3 – modelling nanotubes, making polymers, superman

Module 4 – electrophoresis, histology, simulations

Module 5 –surface properties, wetting, applying a nanolayer monolayer on silver.

Module 6 –making shampoos, creams, sunscreen, toothpaste.

Module 7 – UTILITY FOG, media articles, issues arising from units

What Colour is Gold? (VCE Chemistry)

- The element gold has been chosen to make students aware of how knowledge of simple chemistry principles and skills can be transformed into new technologies applied to cutting edge medical research. Gold is also a very good example to illustrate how bulk properties change at the nanoscale.
- Students make 13nm gold nanoparticles in the school laboratory by a simple chemical reduction reaction and can control the size of the nanoparticles by changing the concentration of one of the reagents.
- They use a laser pen to detect the presence of colloidal gold (suspended clusters of gold atoms which we call nanoparticles) and compare it to a solution of gold which does not scatter the light beam.
- They can determine the size of the np produced by using one of three methods:
- Electrophoresis, ultra filtration or size exclusion chromatography.
- The last experiment demonstrates how a simple colour change caused by the addition of sodium chloride to the red gold nanoparticles can model the coupling effect (the surface Plasmon resonance) which is used in medical diagnosis.

What Colour is Gold? (VCE Chemistry)

The module is designed to enable students:

- to understand how cutting edge application of nanotechnology research in medicine can be modelled in a school laboratory
- to appreciate that research scientists are using similar experimental procedures in their research labs
- to develop skills in the safe conduct of practical investigations including risk assessment, hazard identification and waste management
- be aware of ethics of scientific research that apply to investigations in chemistry
- to extend their knowledge of a transition metals using gold as an example

What Colour is Gold? (VCE Chemistry)

Content

History of gold

The Lycurgus Cup

The first nanotechnologist

Experiment 1: Synthesis of nanogold particles (approx13nm)

Experiment 2: Determining the size of the np

Experiment 3: Applications to detection of disease

Activity: Simple calculations using the diameter of the np to determine the volume of the nanoparticle and hence the number of atoms in the np cluster.

Student Work & Awards

Shine website www.shine.vic.edu.au

Art and sculpture at St Helena

Excellence Award for Innovation in Curriculum Development

I wish to acknowledge and thank the following for their continuing guidance, expertise and support.

Dr Peter Binks and his team at Nanovic
Dr Kristin Alford -Bridge 8 Pty Ltd
Dr John Fecondo – RMIT
Dr Paul Pigram - La Trobe University

Northern Region for Teacher Professional Leave.
Jane Niall –DIIRD

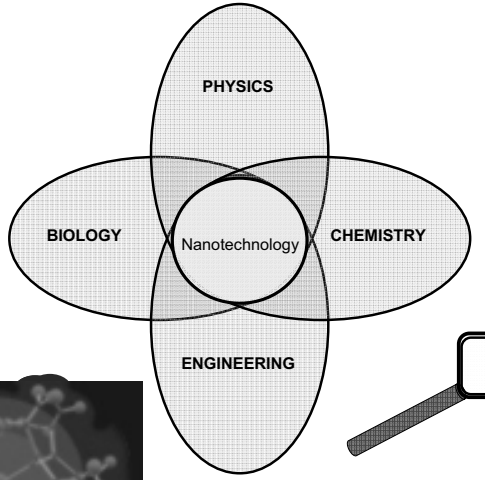
What is nanotechnology? Layman's definition

Nanotechnology is what you can do with things only **a billionth of a meter** in size.

Nanotechnology is being able to **engineer** ("to build") at the **atomic level.**

What is Nanotechnology?

Buzz word of popular press = Multidisciplinary science



Prefix	Symbol	Factor
exa	E	10^{18}
peta	P	10^{15}
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
deci	d	10^{-1}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}

Source: David Piper Latrobe University

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Lesson Design: Self-Assembly in Biology (生物自組裝)

Yen-Hung Pan（潘彥宏）

Biology Teacher, Taipei First Girls High School, Taiwan, R.O.C.
(北一女中)

Seed Teacher, Northern K-12 Regional Center of Nanotechnology Human Resource Development Program, Taiwan, R.O.C.

Motivation :

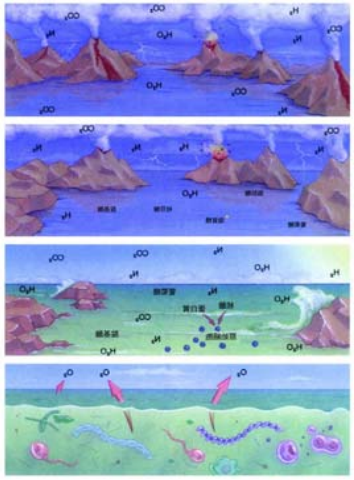
1. Understanding self-assembly phenomena in biology.
2. Understanding the application of self-assembly in nanotechnology and biotechnology.

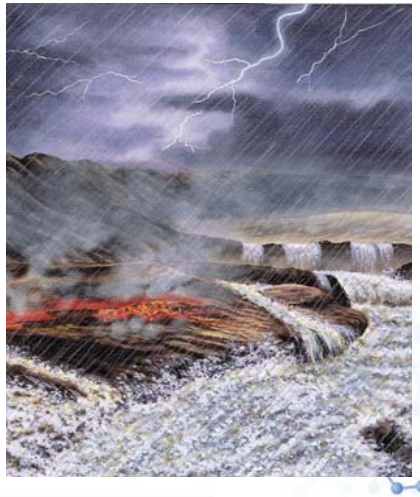
Prior knowledge :

1. Organic compounds of living cell.
2. Central dogma of molecular biology.
3. Basic perceptions about biotechnology and nanotechnology.

⇨ 11th or 12th graders in high school.

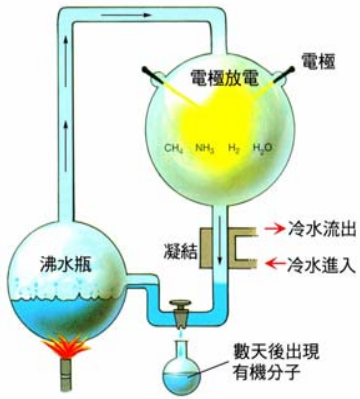
The Origin of Life（organic evolution）

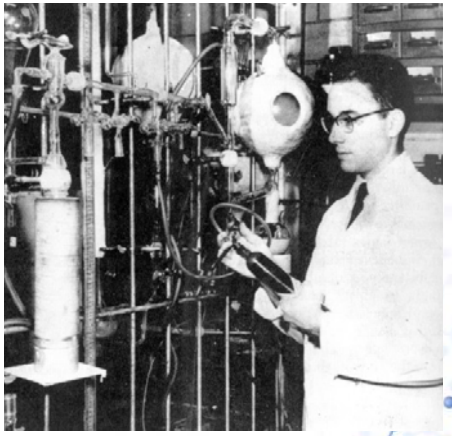




資料來源：龍騰文化，南一書局，生物上冊

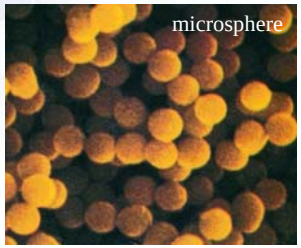
The Origin of Life (Miller & Urey, 1953)

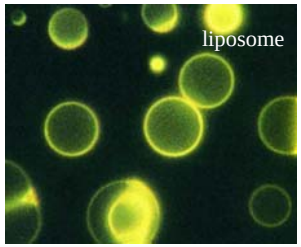


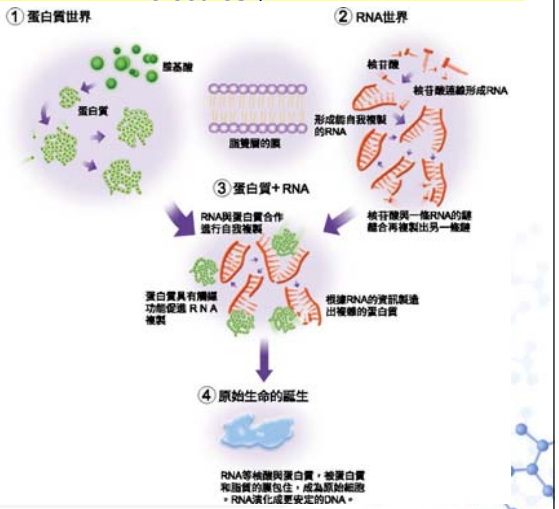


資料來源：龍騰文化，康熙圖書，生物上冊

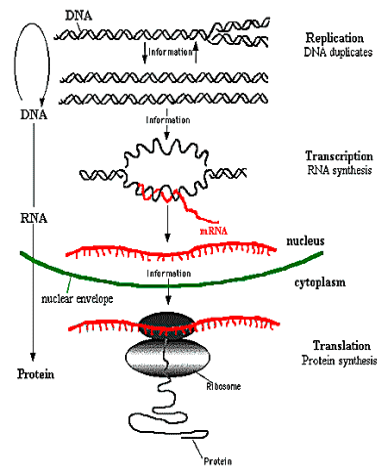
The Origin of Life （formation of large organic molecules ）

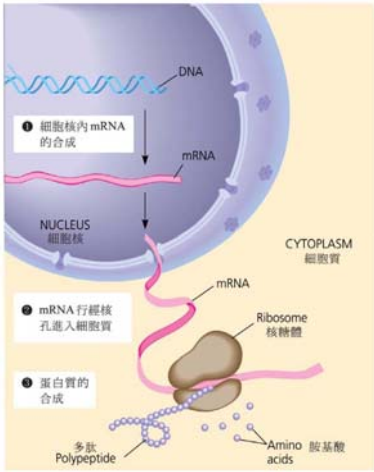




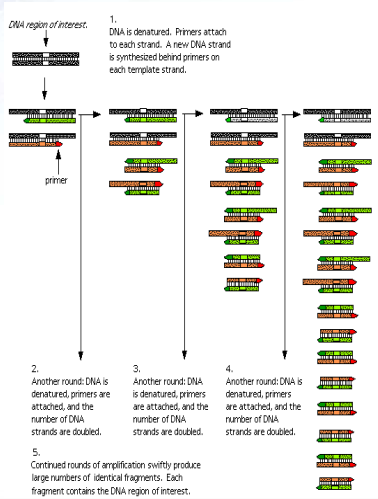


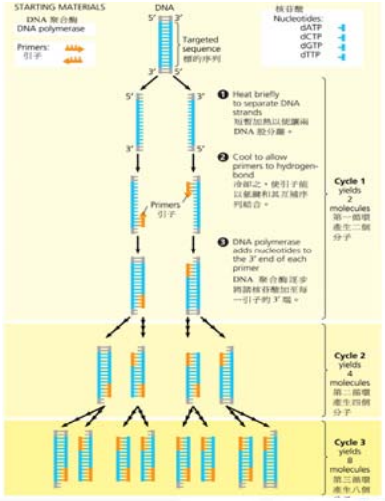
Life phenomena (central dogma of molecular biology)



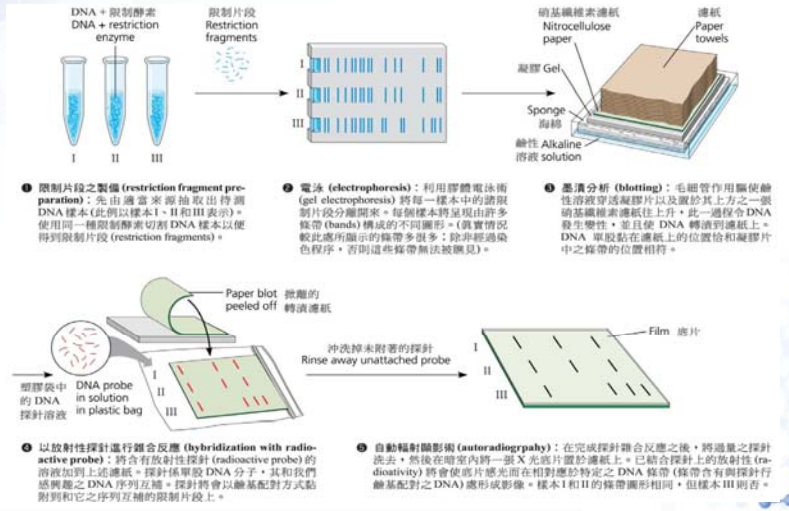


Biotechnology (Polymerase Chain Reaction, PCR)

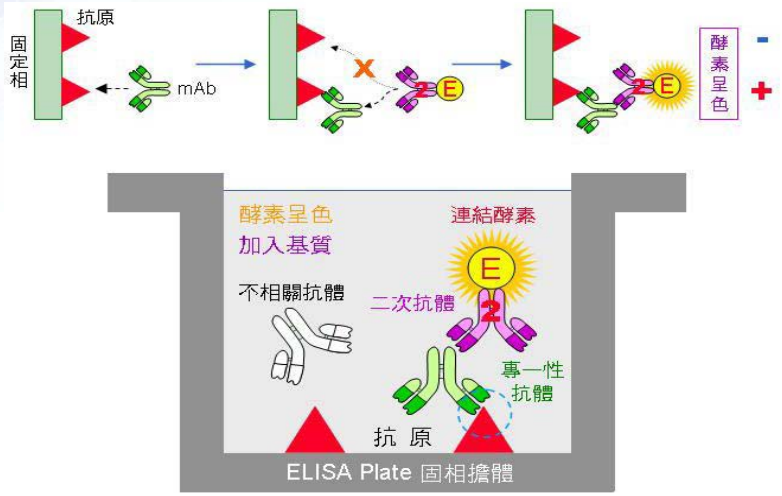




Biotechnology（Southern Blot）

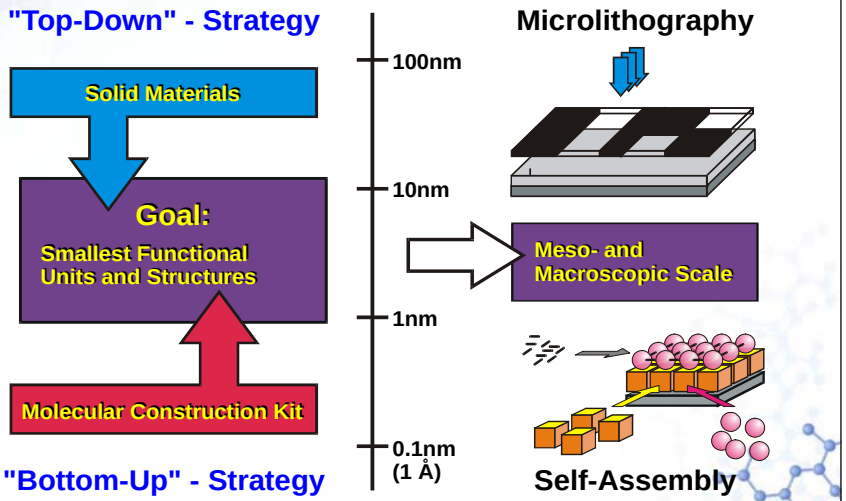


Biotechnology (ELISA)



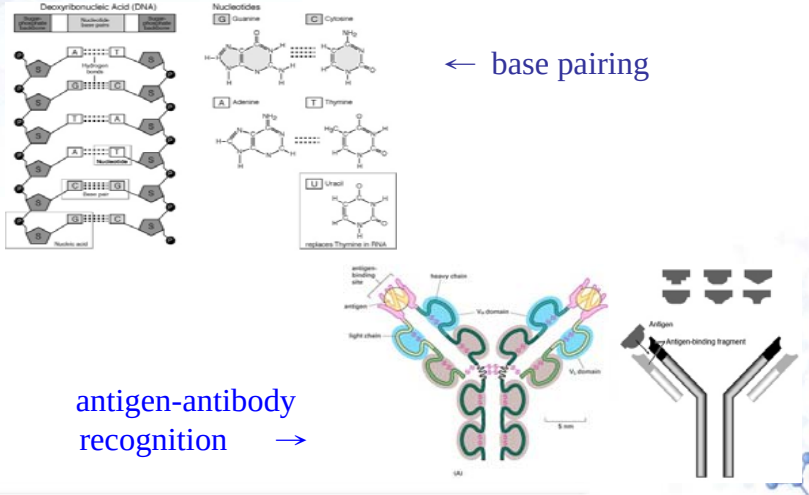
Reference：juang.bst.ntu.edu.tw/ ECX/monoclonal.htm

Nanofabrication（Bottom-Up strategy）

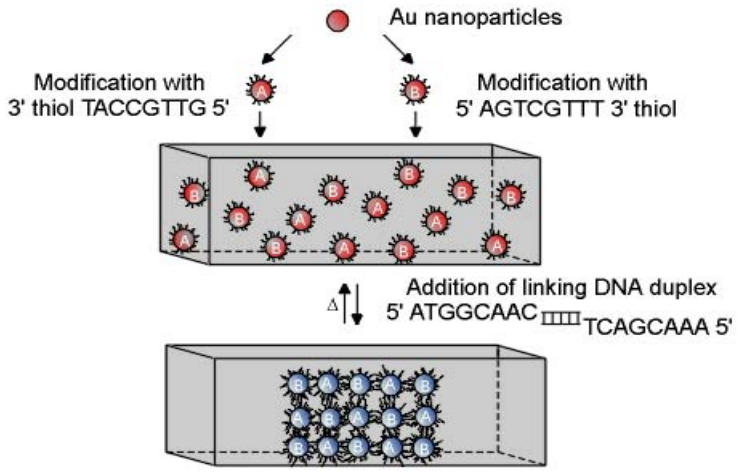


Reference：http://juang.bst.ntu.edu.tw/ ECX/monoclonal.htm

Nanofabrication (Biology approach)

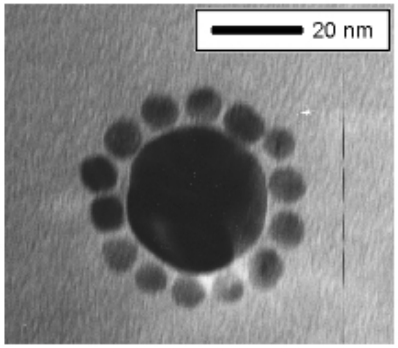


Nanofabrication (DNA hybridization)



Reference：Mirkin, Letsinger, Mucic, & Storhoff, Nature 382, 607-609 (1996)

Nanofabrication (DNA hybridization)



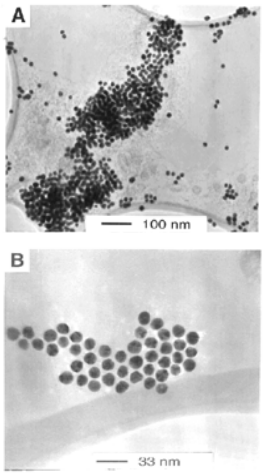


Figure 2. TEM image of a nanoparticle "satellite structure" generated from DNA-linked 8 and 31 nm diameter Au nanoparticles.

Reference：Mirkin, Letsinger, Mucic, & Storhoff, *Nature* **382,** 607-609 (1996)

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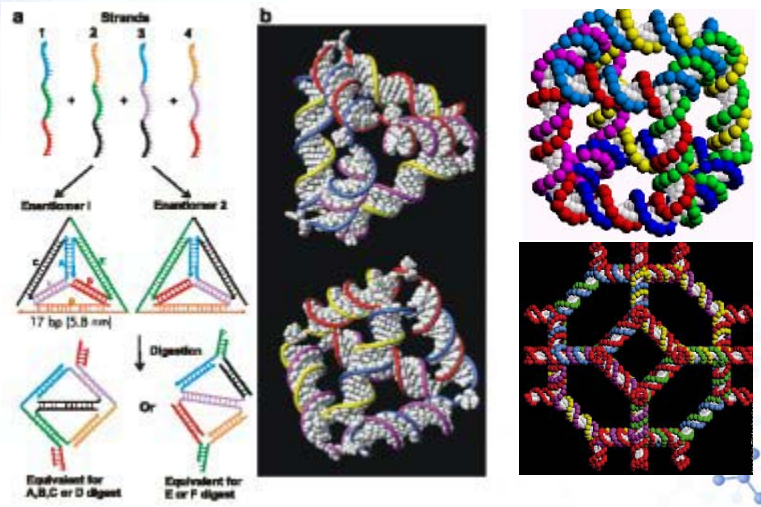
Nanofabrication (DNA hybridization)



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Application：Detection (Au nanoparticle）

without DNA linker　　with DNA linker

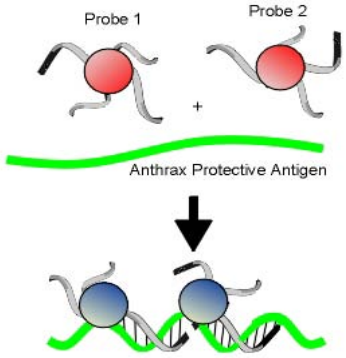

Figure 3. Scheme depicting the detection of the Anthrax Protective Antigen PCR product using Au nanoparticle probes.

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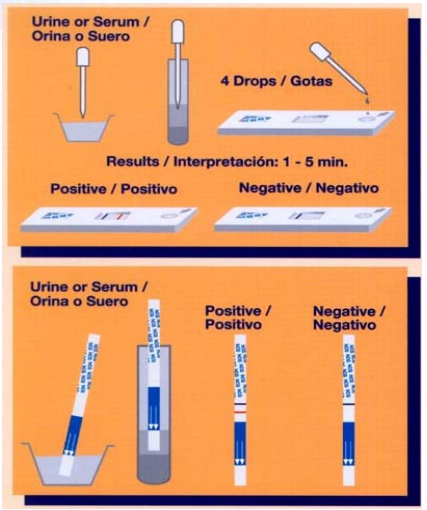
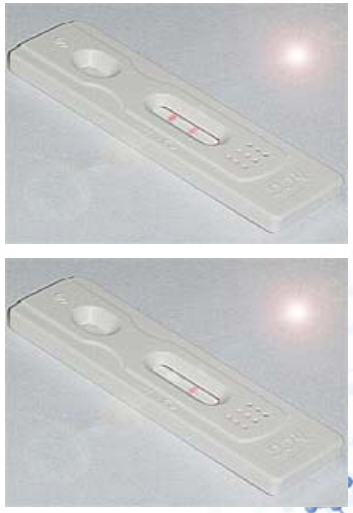
Application：pregnancy test strip (hCG test strip)





Reference：http://www.operon.es/_document/_catalogo/fichahCG.jpg

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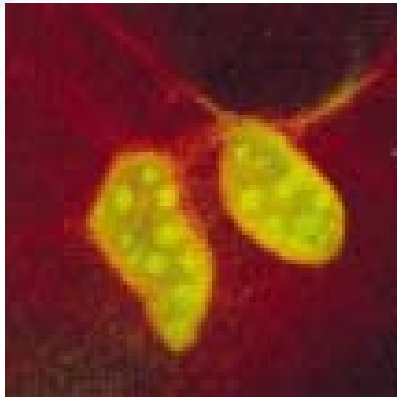
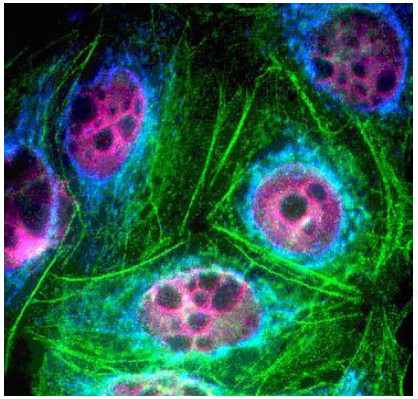
Application：labeling（core-shell, quantum dots）



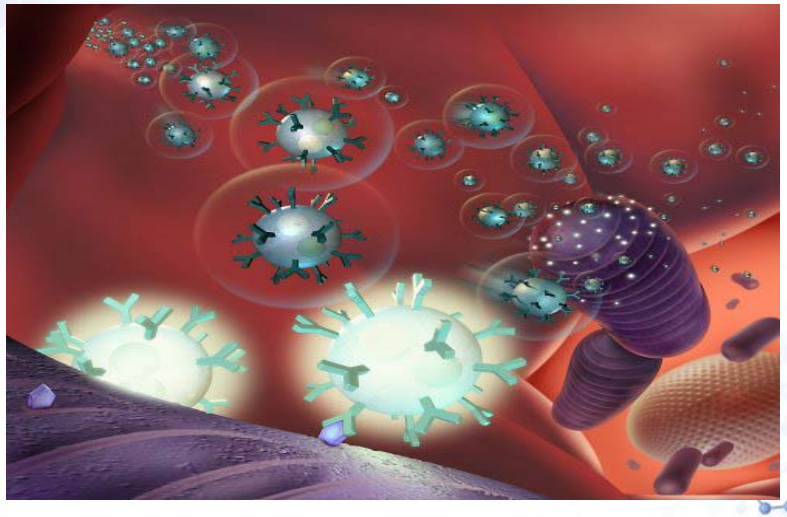
Fibroblast



Lung cancer cell

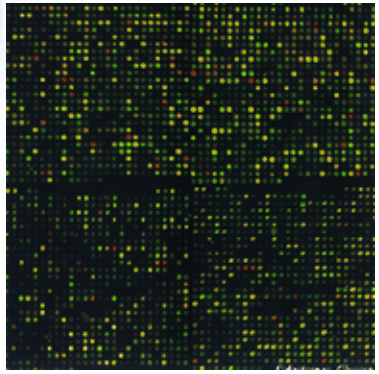
Reference：http://www.qdots.com/live/images/655-antibody.jpg

Nanoprobes set to spy on cell activity

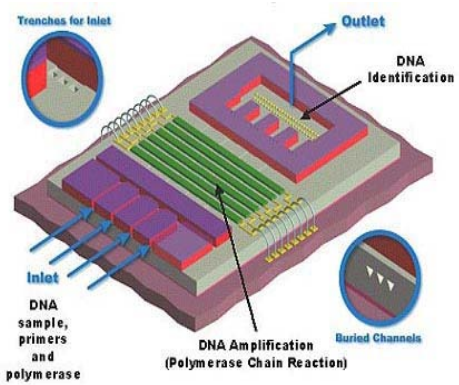


Reference：http://nanotechweb.org/articles/news/2/3/2/1

Application：Biochip

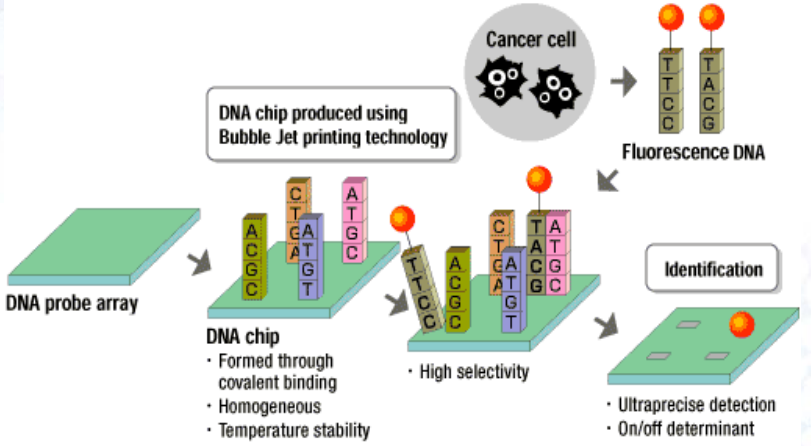


Microarray



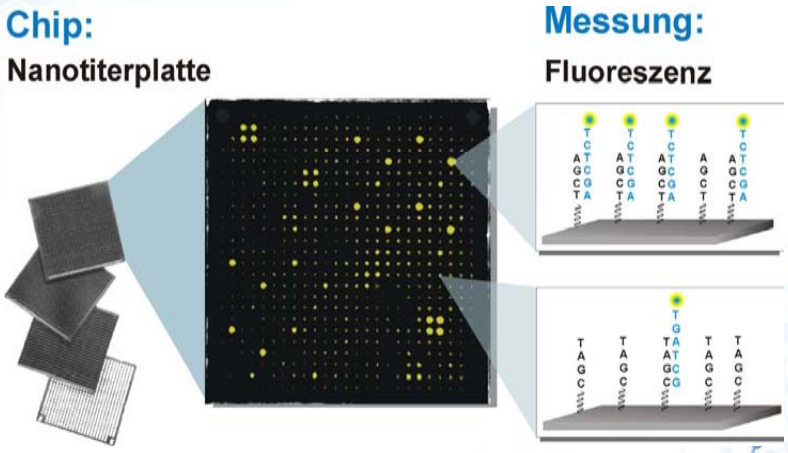
Lab-on-a-chip

Microarray (DNA hybridization, visualization)

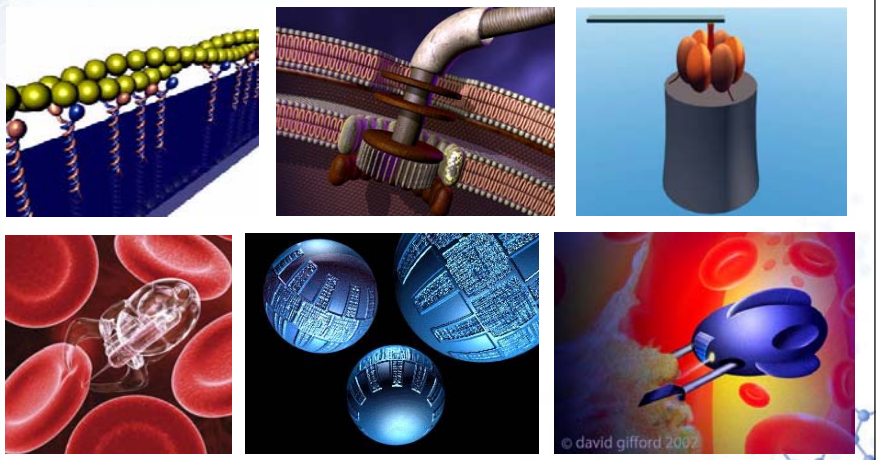


Reference： http://www.canon.com/technology/production/dna_chips/imgdata/05_01.gif

Microarray (DNA hybridization, visualization)



Not only self-assembly, but also self-maintenance,self-repairing and self-contained



Reference：Freites R. A., Nanotechnology 2(8): 8-15, 1996

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Thanks for your attention !

Acknowledgement

North Regional Center for K-12 Nanotechnology Education

Taipei First Girls High School

All seed teachers

潘彥宏（Yen-Hung Pan） Taipei First Girls High School

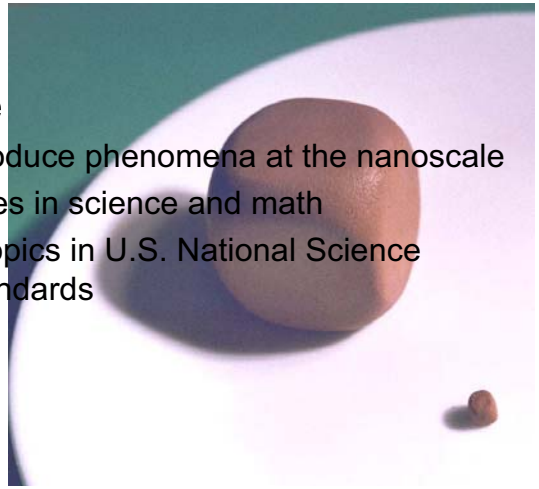
pyh@fg.tp.edu.tw

Introduction to the nano world through size and scale phenomena

John Paderi
Bioengineering, Arizona State University

Ben Campbell
School of Life Sciences, Arizona State University

Motivation



- Size and scale
  - Principles introduce phenomena at the nanoscale
  - Unifying themes in science and math
  - Overlapping topics in U.S. National Science Education Standards

Lesson Plan

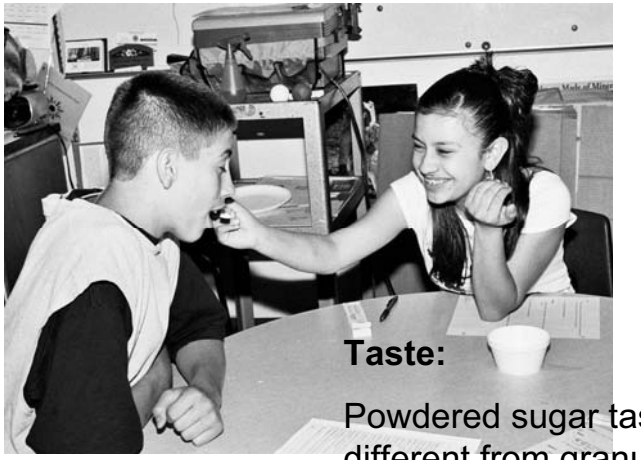
- Experiencing size phenomena through multiple senses

Sight:

Water droplets – large droplets fall while smaller droplet form a mist

Alka Seltzer – crunched up tablets react faster than whole tablets

Lesson Plan



Taste:

Powdered sugar tastes different from granulated sugar

Lesson Plan

Touch:

Corn starch sticks to you and feels differently than corn meal

Lesson Plan

Smell:

Cinnamon sticks smell differently than powdered cinnamon

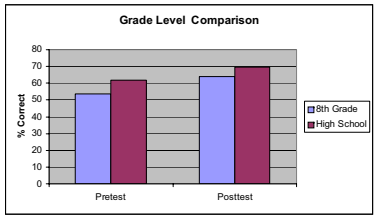
Lesson Plan

- Clay cubes
  - Cut into different sizes
  - Watch how they fall at different speeds in water

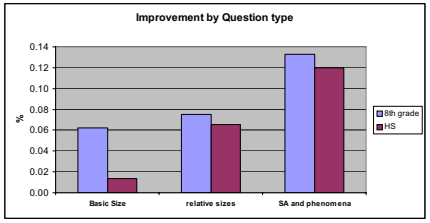
Lesson Assessment

- Pretest and Posttest
  - Identical multiple choice tests
  - General questions on size
    - Mass and volume
  - Surface area questions
    - How it changes with size relative to volume changes
  - Size phenomena
    - What would happen if we just made it smaller?

Results of Lesson Assessment

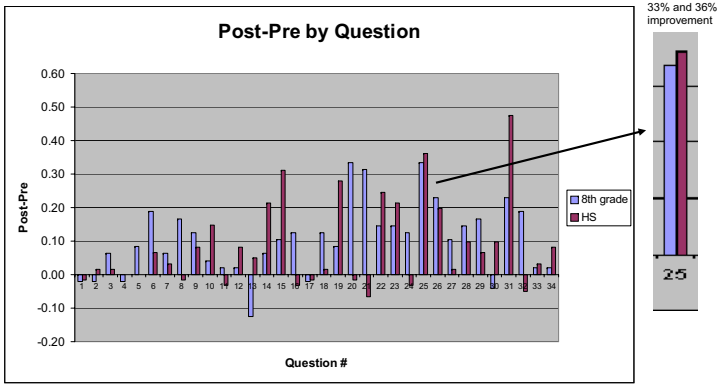


Results show improvement of **10.4%** and **8.1%** for 8th grade and HS levels respectively (p<.01).



Questions dealing with phenomena associated with size show the most improvement.

Results Continued



33% and 36% improvement

If we put the same amount of dry ice into two different containers of water, in the fist container, the dry ice is one block, and in the second, the dry ice is a powder, _____.

A) the block will turn to gas faster
B) the powder will turn to gas faster
C) they will turn to gas at the same rate

Thank You!

- **Acknowledgements**
  - **This work was funded by the Track II GK12 NSF grant #DGE0086465 to Dr. B.L. Ramakrishna**
  - **Thank you to our hosts in Taiwan, your hospitality is unprecedented!**
  - **Photographs by Sooz. www.gritphotography.com**

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Nano Lesson by Science fiction
(奈米科幻小說-科幻赤壁/決戰未來)

Shu-Chiung Liu (劉淑瓊)

Biology Teacher , National Taichung Girls High School, Taiwan, R.O.C.
Seed teacher, Mid-south K-12 Regional Center of Nanotechnology Human Resource Development Program, Taiwan, R.O.C.

My Idea

- Knowing doesn't mean understanding
- Surpass tradional pattern
- Compile different kinds of teaching material

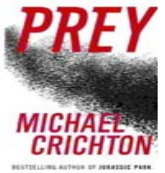
What is attractive？
With the idea to be

- Fun
- Imaginative
- Science-fictional
- Tell a well known story in a different way

Creative Work

2003：

I wrote "**The Nano World in Science Fiction**" based on the novel ***Prey.***

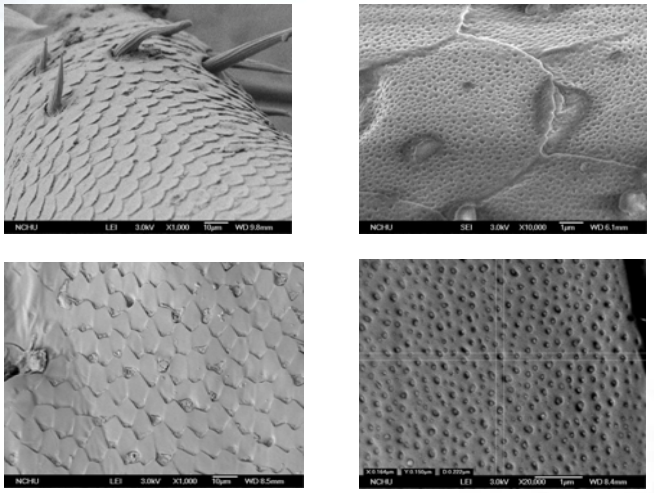


Creative Work

2004~2005：

- I made many speeches to disseminate the knowledge widely.
- I made a plan to write a popular science-fiction book.
- I directed nano-related experiments with my co-worker at school.

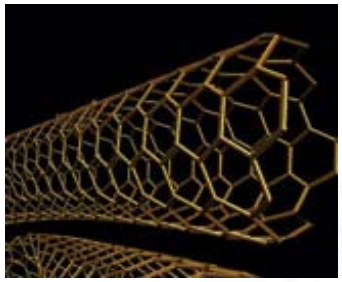
Cockroach's self-purification nano structure



pores with diameter 100-200nm on the scales' surface

Invisible killer~nano partical

nanotube influence nematode's behavior



Creative Work

2006：

- Our team made the DVD : **The Wonderland of Nanotechnology**
- With the help of the three professors and their assistant I made the animation : **Science Fiction Battle-Chibi with Nano Technology**
- I began to write a popular science fiction book:

  The Future of Science Fiction, Nano of Decisive Battle

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"The Wonderland of Nanotechnology" is made by the team
Another teacher will tell you more about this DVD

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Science F ional Battle
-- Chibi with Nanotechnology
(animated teaching disc)

- Why did I choose the story ?
- The battle of Chibi is a famous Chinese story
- I rewrite the story as a science fiction and present it in cartoons
- The cartoons are interesting and knowledgeab

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Creation and discussion of the team
We had many discussions




Creative Work

2007：

- Published

  animation : Science Fiction Battle-Chibi with Nano Technology

- Published

  "The Wonderland of Nanotechnology"

- I will Publish

"The Future of Science Fiction, Nano of Decisive Battle "

- I will compile **"Three dimensional book of nano"**

My nano-related activities
Shuang Shih junior high school

Science Activity
Shuang Shih junior high school

I applied my nano material to my class when it's proper

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I applied my nano material to my class when it's proper

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These are my students

2007ANF Teachers' Workshop

These are my students

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Arous wildely respons from the public

The students gave me this certificate of merit

Reflection on NanoTech Animation

There is a saying that every technology originates from the very heart of human beings. After watching this animation, I became more convinced than ever that this is true.

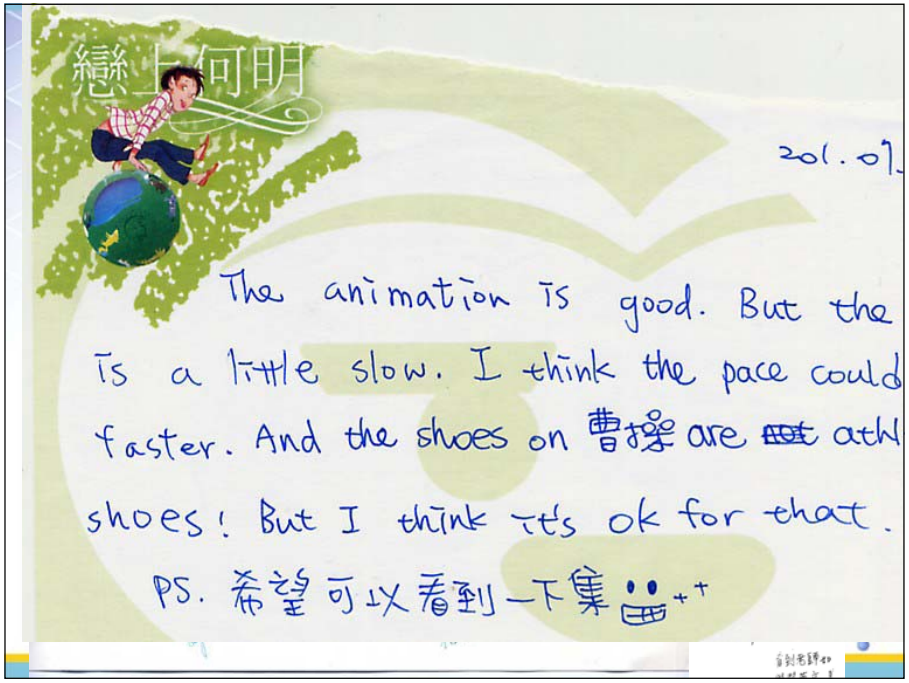
To give it a thought, the first time I heard about the word "nanometre" was when I was in seventh grade. I still remember seeing the picture of clear dewdrops on a lotus leaf. I was so amazed by the creation of the great nature. What I didn't know is that there would be a force even greater than the nature itself in the following years, which is the development of nano-technology.

The thing I want to put a thumb up for the animation is the combination of technology and history. The part that impressed me most is "the nano ladder" and the "invisible cloak". Through them I learned that man's imagination can stretch so far that leads us to the infinity.

Another thing I got from this animation is that the development of technology can be turned into disaster

After watching this film, my first thought was that it must be an interesting science-fiction one. Every thing inside seemed to be impossible to achieve. How can one person become invisible after wearing "special clothes"? Is that Harry Potter's "invisible cloak"? Also, is it possible build a high building to the moon? Theoritically, when one building builds higher, the more tough material such as steel it needs. But up to some height, the building might collapse due to the change of air pressure.

However, many science-fiction novels get realized day after day. Thanks to nanometer technology, those impossible become possible. Although recently, technology seems to bring some bad things to our life, I still have a possitive attitude to nanometer technology.



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Science Fiction Battle-Chibi with Nano Technology

Arouse widely respons from Elementary School

2007ANF Teachers' Workshop

Meeting with the press

2007ANF Teachers' Workshop

Newspaper's report

藉歷史故事、電玩 輕鬆學奈米

葉志雲／台中報導

三國時代，曹操就僅利用奈米科技，反敗為勝？台中女中生物老師劉淑瓊巧妙借用歷史故事情節融入奈米知識，製作的動漫畫光碟「科幻赤壁-決戰奈米」，內容老少咸宜，教育效果極佳，連她70幾歲的母親都看得懂，非常開心。

劉淑瓊並與該校化學李鶯芳、楊宏珩、生物邱伯勳、物理劉惠楚及台中一中化學陳孟宏、生物朱秋欣、物理凌美瓊等老師合製電玩遊戲「迷走星球」；兩部寓教於樂、深入淺出介紹奈米的光碟，昨天同時舉行發表會，都將免費贈送各界。

「科幻赤壁」寫的是孔明草船借箭，周瑜大敗曹操後，曹操算著一種神奇塗料塗抹在船帆上，讓周瑜士兵被不明炫麗光芒照耀而頭暈目炫，因而反敗為勝。

▲台中女中生物老師劉淑瓊（右）製作的動漫畫光碟「科幻赤壁-決戰奈米」及台中一中化學老師陳孟宏的遊戲光碟「迷走星球」。（葉志雲攝）

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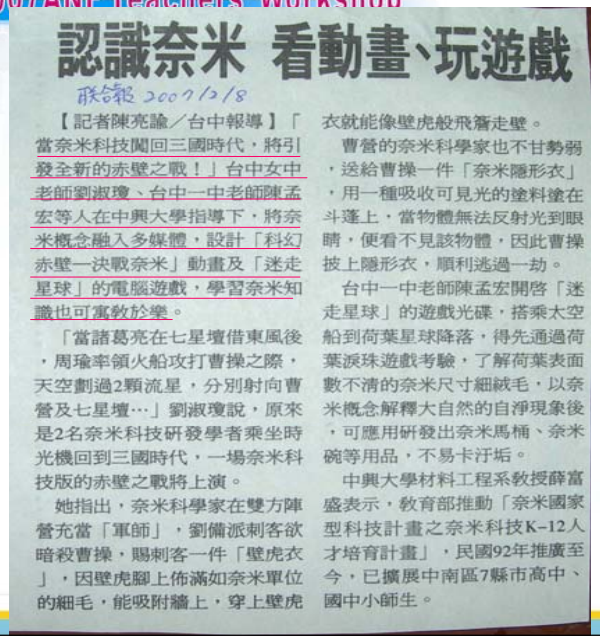
老師出招 奈米教學變線上遊戲

（記者蘇孟娟／台中報導）看電腦動畫或是打線上遊戲也可以學習奈米科技。台中一中與台中女中教師合作，把科學學習遊戲化，設計科幻的三國故事電腦動畫及迷走星球闖關線上遊戲，讓學生在深入淺出的說明中，認識科學中的奈米知識。

由中興大學主持「中南區奈米科技E化教育發展中心計畫」，推動中南區七縣市的高國中及小學師生奈米相關科學教育推廣，計畫主持人、興大材料工程系教授薛富盛指出，已培育一千六百名種子教師及協助一萬名學生參與課程。

此外，也協助高中教師設計學習軟體，台中一中與台中女中都有豐碩成果，台中女中生物教師劉淑瓊研發出結合二國故事的科幻電腦動畫片，敘述兩名現代奈米科技學者搭乘時光機回到三國時代，運用奈米科技設計武器，改寫三國故事，巧妙穿插奈米知識，劉淑瓊說，在動畫製作完成後，她拿給家中年逾七十歲的母親看，「連媽媽都看懂了奈米是怎麼回事」。至於台中一中與女中教師團隊則聯合另開發時下年輕人最喜愛的線上遊戲「迷走星球」，一中化學教師陳孟宏說，透過線上遊戲的方式能讓學生在過關中自然學得知識，遠比直接教授奈米知識更能吸引學生興趣。

台中一中教師陳孟宏與女中教師劉淑瓊創意設計線上遊戲與設計電腦動畫片，讓奈米科學趣味及故事化。（記者蘇孟娟攝）



認識奈米 看動畫、玩遊戲

聯合報 2007/3/8

【記者陳亮諭／台中報導】「當奈米科技闖回三國時代，將引發全新的赤壁之戰！」台中女中老師劉淑瓊、台中一中老師陳孟宏等人在中興大學指導下，將奈米概念融入多媒體，設計「科幻赤壁一決戰奈米」動畫及「迷走星球」的電腦遊戲，學習奈米知識也可寓教於樂。

「當諸葛亮在七星壇借東風後，周瑜率領火船攻打曹操之際，天空劃過2顆流星，分別射向曹營及七星壇…」劉淑瓊說，原來是2名奈米科技研發學者乘坐時光機回到三國時代，一場奈米科技版的赤壁之戰將上演。

她指出，奈米科學家在雙方陣營充當「軍師」，劉備派刺客欲暗殺曹操，賜刺客一件「壁虎衣」，因壁虎腳上佈滿如奈米單位的細毛，能吸附牆上，穿上壁虎衣就能像壁虎般飛簷走壁。

曹營的奈米科學家也不甘勢弱，送給曹操一件「奈米隱形衣」，用一種吸收可見光的塗料塗在斗篷上，當物體無法反射光到眼睛，便看不見該物體，因此曹操披上隱形衣，順利逃過一劫。

台中一中老師陳孟宏開啓「迷走星球」的遊戲光碟，搭乘太空船到荷葉星球降落，得先通過荷葉淚珠遊戲考驗，了解荷葉表面數不清的奈米尺寸細絨毛，以奈米概念解釋大自然的自淨現象後，可應用研發出奈米馬桶、奈米碗等用品，不易卡汙垢。

中興大學材料工程系教授薛富盛表示，教育部推動「奈米國家型科技計畫之奈米科技K-12人才培育計畫」，民國92年推廣至今，已擴展中南區7縣市高中、國中小師生。

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Response from the medium

Teaching with the aids of interactive multimedia,learning is more fun.

TV STATION

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My reflection

- Nano education is not a formal education in school yet. I even often have obstruction in my school. We, nano seed teachers, don't belong to any formal organizations. Other seed teachers in other fields can have fewer classes. Some even don't have classes and they get paid regularly.
- **So why are we still willing to go on? Are we fools?**

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My mother taught me

You should be brave to do any significant thing.

Thanks

- I'd like to thank three professors F. S. Shieu，Fu-Hsing Lu，Tzong-Ming Wu and their assistant Su Xian Hui.
- Finally I'd like to thank my husband who helped me through all the obstruction and tears ，and he cheered me up to hold on to my ideal.

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Thanks for your Attention!

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

A Science Camp of Nanotechnology for Elementary School Children & Their Parents (小學奈米親子營)

Presenter : Chin-Shueh Chen (陳錦雪)

Chin-Shueh Chen (陳錦雪), Pei-Ting Chen(陳佩婷), Yi-Chun Chen(陳怡君), Chia-Yen Feng (豐佳燕), Meng-Huei Huang (黃盟惠)and Chiu-Mei Shih (施秋梅)

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North K-12 Regional Center of NHRD Program, Taiwan, R.O.C

Outline

- Objectives
- Activities
- Conclusions



Objectives

1. To help children and their parents to increase knowledge about nanotechnology and its application in daily life.
2. To facilitate interaction children and their parents through hands-on activities of nanotechnology .
3. To encourage lifelong learning of popular science.



Activities

- Lectures
- Video shows
- Hands-on experiments
- Games and Computer Assisted Instruction (CAI)
- Tours to Lab and institute



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1.Lecture—What is nanometer ?

- Images of various scales –from galaxy to DNA
- Microscope development – from optical microscope to electronic microscope






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2.Hands-on activities—scale concept of nanometer

- Students cut a piece of paper in the length of one meter.
- Students further cut the paper into one tenth and again and again.
- Students compare different lengths of paper to learn the concept of scales.



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3.Hands-on activities— carbon buckyball

- Teacher explains the concept of nano buckyball.
- Students build buckyballs by combining pentagons and hexagons.



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4.Experiments—Nano-phenomena in nature (plant)

- Teacher explains the concept of Lotus Effect.
- Students experiment Lotus Effect by using different plant leaves.



5.Nano-phenomena in nature (animal)

- Students learn about self-cleaning function of animals skin.
- Students learn about color variation of butterfly wings .
- Students learn about the nano structure of animal teeth.



nano magnetics

Teacher explains the migration of birds and butterflies.

Teacher explains turtles and salmon's returning to the birthplace with biological compass.

Teacher explains why bees and ants never loss their way home.



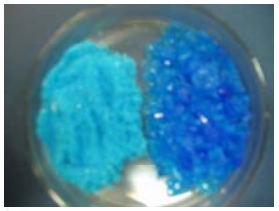
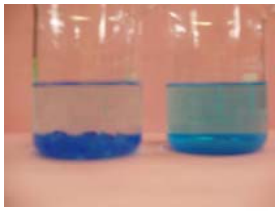
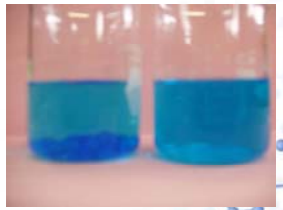


Experiments —physical characteristics of nano-scale materials

- Teacher demonstrates how copper sulfate ($CuSO_4$)

changes color and solubility when the size of particles change.

- Students have hands on Experiments.

Tour to Taiwan Textile Research Institute

Many nano textile material and products were presented by the Institute staff.

parents and kids learn about the application of nanotechnology in textile industry.

Games and computer Activities

- Maze and game card

Computer game

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Conclusions

- Parents and children indicated that they have better understanding about nano scale and nano phenomena.
- The feedback and questionnaires from parents and children showed that they have learned various nanotechnology applications.
- They felt gratitude to the teachers and to the program and wished to attend more advanced programs in the future.

Synthesis of Fullerene Derivatives under Ultrasonic Condition and Self-Assembled Fullerene- Gold Nanoparticle Films

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Department of Chemistry, Sahmyook University, Seoul 139-742, Republic of Korea

Sonochemistry

What is ultrasound ?

☞ **Ultrasound is customary to call acoustic oscillations of frequency above 20kHz**

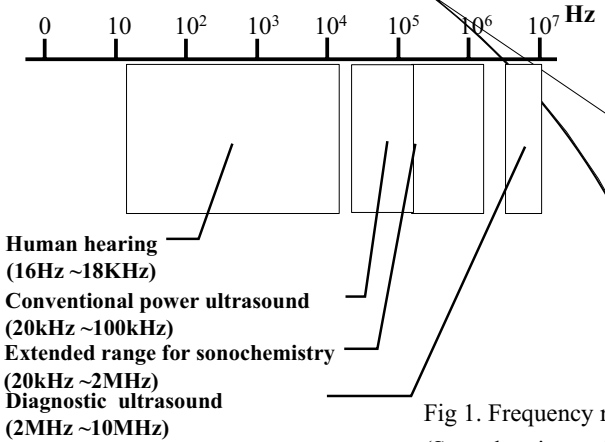


Fig 1. Frequency ranges of sound (Sonochemistry of T. J. Mason)

Application of ultrasound

Field	Application
Cleaning	Cleanign in aqueous media of medical Instruments and jewellery
Medicine	Ultrasonic imaging (2~10MHz) is used for obstetrics, lower frequencies (20~50 kHz) are used of the treatment of muscle strains
Biology, Biochemistry	Homogenization, Cell disruption Extraction from plants
Industrial processing	Pigments and solid dispersion, Crystallization, Filtration, Drying, Degassing, Defoaming, emulsification, Dissolution, Treatment of mineral slurry
Sonochemistry	Environmental Protection, Catalysis, Begin synthesis

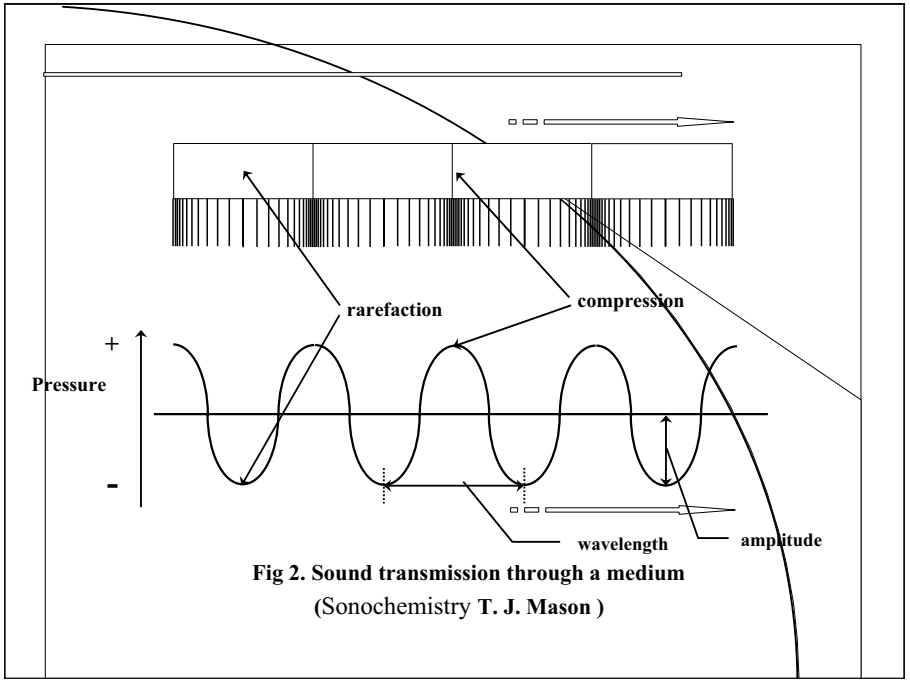


Fig 2. Sound transmission through a medium
(Sonochemistry **T. J. Mason)**

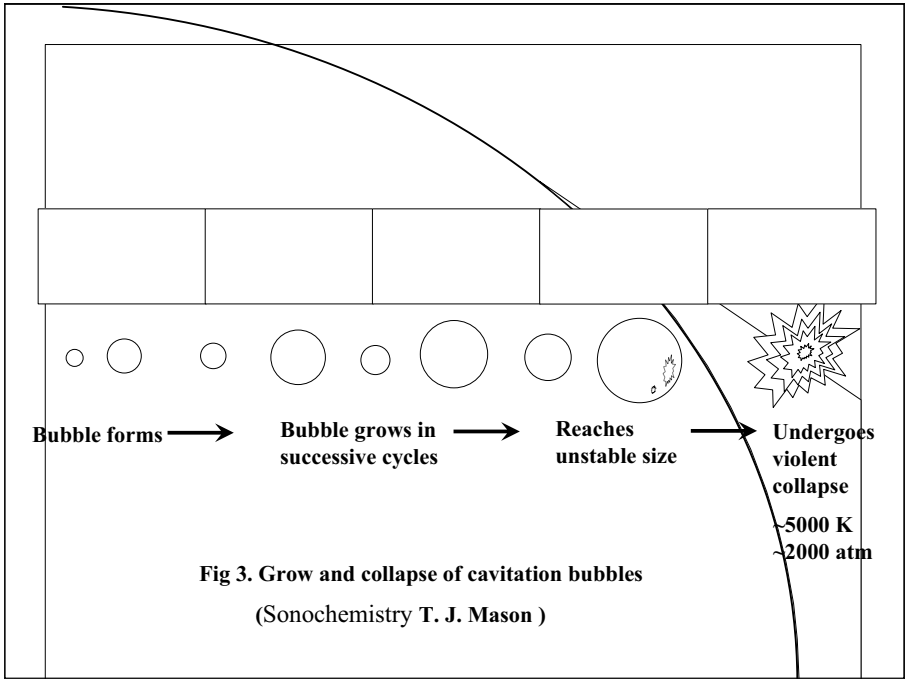


Fig 3. Grow and collapse of cavitation bubbles
(Sonochemistry **T. J. Mason)**

Cavitation bubble

What is origin of sonochemistry effects ?

☞ **Phenomenon of cavitation collapseing**

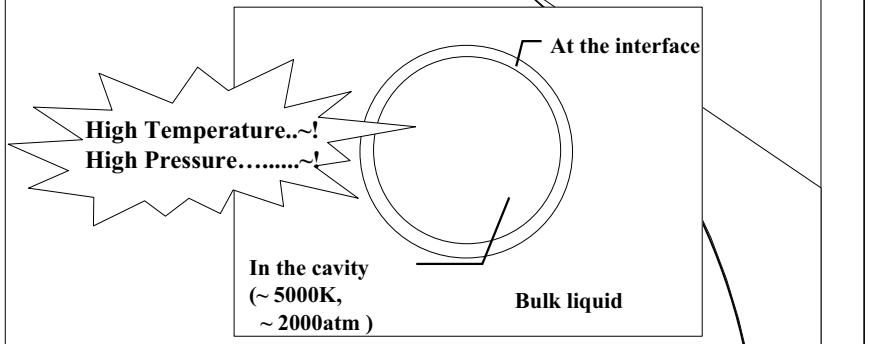


Fig 4. Cavitation bubbles in a homogeneous medium
(Caroline M. Ley)

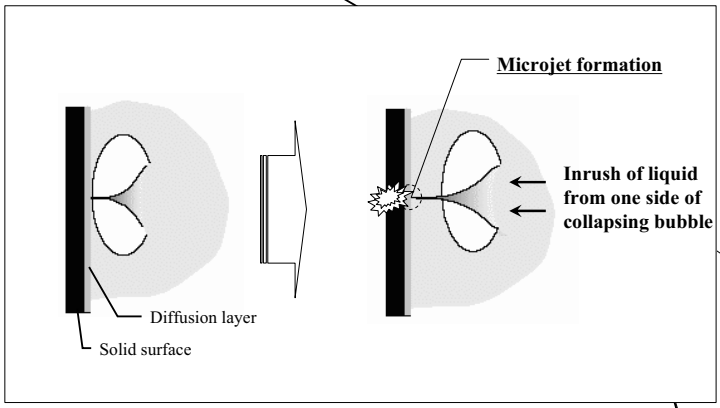


Fig 5. Cavitation bubble collapse near a solid surface
(Sonochemistry T. J. Mason)

Heterogeneous powder/liquid reactions

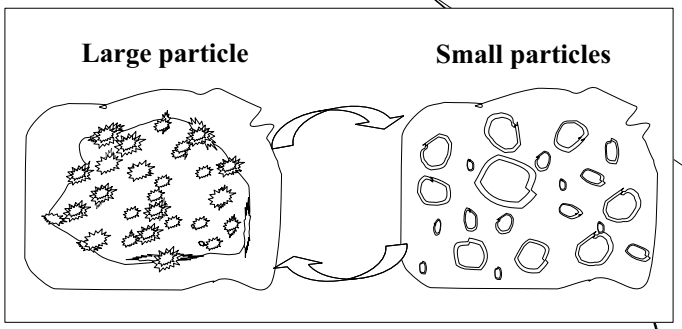


Fig 6. Cavitation bubble collapse in a powder suspension (T. J. Mason)

Heterogeneous liquid/liquid reactions

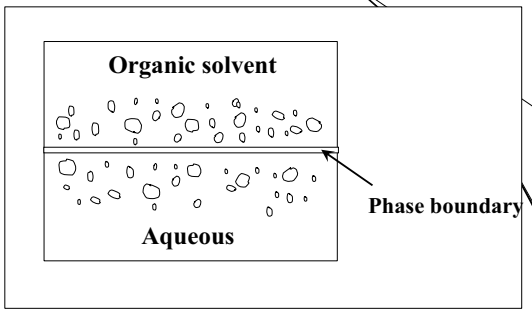


Fig 7. Cavitation bubble collapse in a biphasic medium (T. J. Mason)

Degradation of Polymer

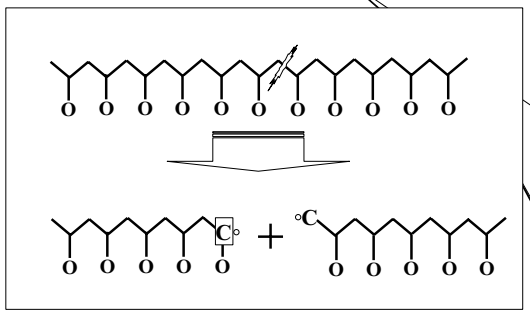
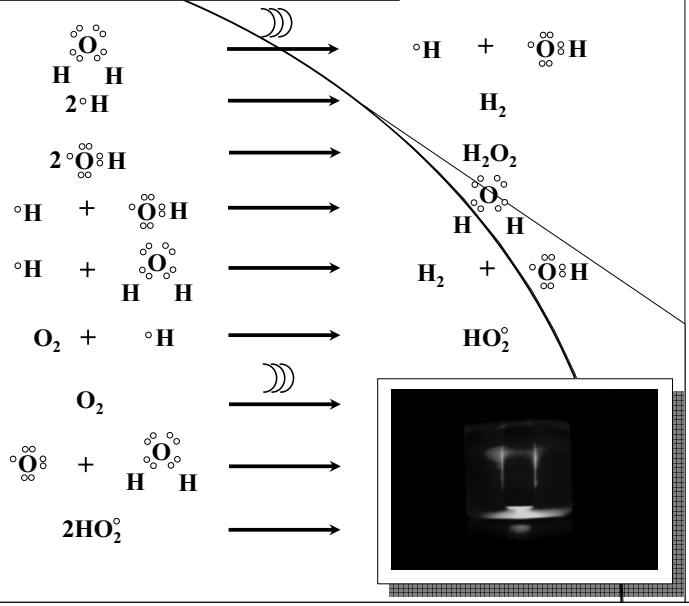


Fig 8. Effect of high intensity ultrasonic wave on the Degradation characteristics of PEO

Sonolytic decomposition of water



Bond energy of molecule

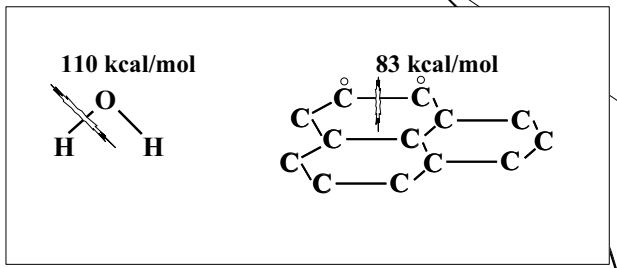
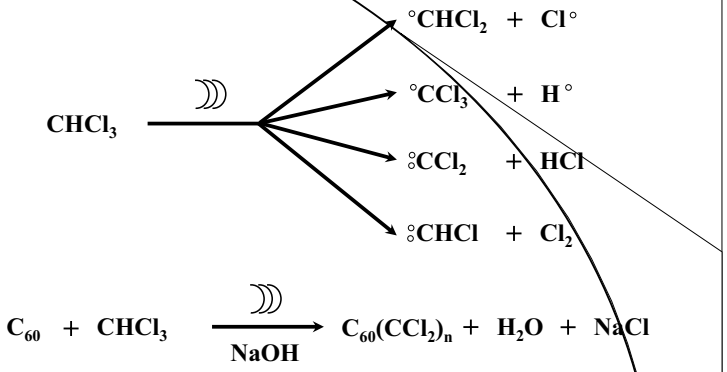


Fig 9. bond energy of water and graphite
(CRC handbook of chemistry and physics)

Synthesis of Fullerene Derivatives



Synthesis of Fullerene Derivatives under Ultrasonic Irradiation

Possible functional group on the surfaces of graphite

°ÖH	(Hydroxyl radical)
°H	(Hydrogen radical)
H_2O_2	(Peroxide)
O_2	(Oxygen)
H_2O°	(Peroxy radical)
O_2°	(Superoxide radical)
H_2O_2 °	(Peroxide radical)

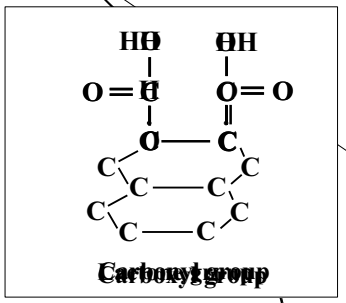


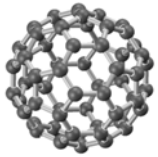
Fig 10. Functional group on the surfaces of graphite
(H.P. BOEHM)

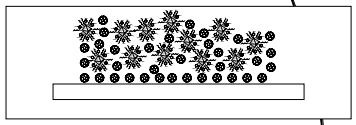
Beneficial effects of sonication on chemical reactivity

Application
✓ Accelerate a reaction
✓ Make a process more economical by the use of crude reagents
✓ Reduce the number of steps required
✓ Enhance catalyst efficiency
✓ Enhance radical reactions

Fig 10. Beneficial effects of sonication on chemical reactivity
(T. J. Mason)

Self-Assembled Fullerene-Gold Nanoparticle Films





1. Synthesis of fullerene oxides by fullerenes with various oxidants under ultrasonic irradiation.

1-1. Preparation of $C_{60}(O)_n$

$$C_{60} + \text{various oxidants} \xrightarrow[5hr]{US} C_{60}(O)_n \quad n=(1\sim2)$$

1-2. Preparation of $C_{70}(O)_n$ (n= 1~3)

$$C_{70} + \text{various oxidants} \xrightarrow[5hr]{US} C_{70}(O)_n \quad (n=1\sim3)$$

2. Synthesis of a water soluble fullerene[C_{60}] under ultrasonic irradiation

$$C_{60} + 3{:}1\ C\text{-}H_2SO_4{:}\ C\ HNO_3(v/v) \xrightarrow[\text{For 3 day}]{US} WS\text{-}C_{60}$$

$$C_{70} + 3{:}1\ C\text{-}H_2SO_4{:}\ C\ HNO_3(v/v) \xrightarrow[\text{For 3 days}]{US} WS\text{-}C_{70}$$

3. Synthesis of fullerene oxides by fullerene with various amine N-oxides under ultrasonic irradiation.

3-1. Preparation of $C_{60}(O)_n$

$$C_{60} + \text{various amine N-oxides} \xrightarrow[\text{For 24hr}]{U.S} C_{60}(O)_n + \text{various amine}$$

Various amine N-oxide

1. 3- picoline N-oxide
2. Pyridine N-oxide hydrate
3. Quinoline N-oxide
4. Iso quinoline N-oxide

3-2 . Preparation of $C_{70}(O)_n$

$$C_{70} + \text{various amine N-oxide} \xrightarrow[\text{For 24hr}]{U.S} C_{70}(O)_n + \text{various amine}$$

Various amine N-oxide

1. 3- picoline N-oxide
2. Pyridine N-oxide hydrate
3. Quinoline N-oxide
4. Iso quinoline N-oxide

4. Sonochemical synthesis of fullerenes oxides [$C_{70}(O)_n$] (n=1~2) using metal hexacarbonyl complexes $M(CO)_6$ (M= Cr,Mo, W) under Air atmosphere

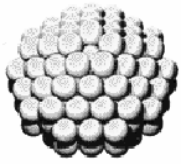
$$2M(CO)_6 + 17/2\ O_2 \xrightarrow[\text{ultrasonic irradiation}]{\text{hexane}} M_2O_5 + 12CO_2$$

$$M_2O_5 \xrightarrow[\text{ultrasonic irradiation}]{\text{hexane}} MO_3 + MO_2$$

$$C_{70} + O_2 \text{ in air} \xrightarrow[\text{hexane-ultrasonic irradiation}]{MO_3/MO_2} C_{70}(O)_n\ (n= 1\sim2)$$

M= Cr, MO, W

Fullerene-Nanoparticle Hybrid Nanostructures



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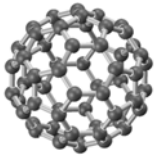


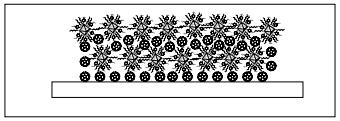
Device component
(electronics or optics)
Catalysis , Bio-marker

Good charge transfer property
Semiconductor
Biological activity

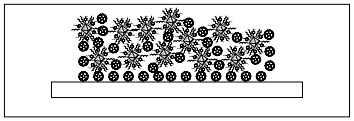
C_{60}-Conjugated Nanoparticles
C_{60}/Nanoparticles Hybrid Films

Photovoltaic Devices
Nanoelectronics
Sensing

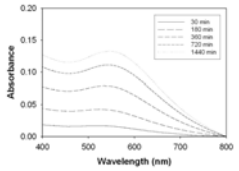
Controlled Assembly of C_{60} - Conjugated Gold Nanostructures



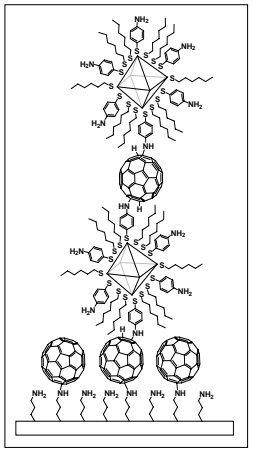
Layer-by-layer

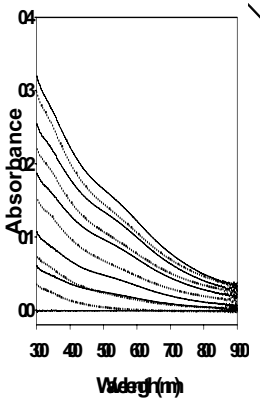


Dirt Ball



Controlled Assembly of C_{60} - Conjugated Gold Nanostructures





Summary and Future Directions on C_{60}-Nanoparticle Conjugated Systems

1. Molecular self-assembly process for C_{60}-gold nanoparticle hybrid solar cell has been developed.

2. Investigation of active film quantum efficiency and mechanism

3. Synthesis of other C_{60}- or C_{70}-nanoparticle hybrid systems (Subnanometer Au NPs [e.g. Au_{11}], TiO_2, ZnO, CdS, etc)

Ultrasonic, Chemical Stability and Preparation of Self-Assembled Fullerene[C_{60}]-Gold Nanoparticle Films

Layer by Layer Method

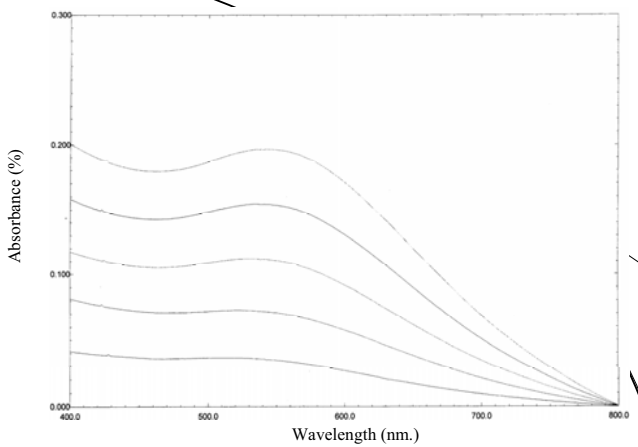


Fig.1. UV-vis absorption spectra of the layer-by-layer assemblies of C_{60}-gold nanoparticle multilayer films for the indicated time ; +24hr, +24hr, +24hr, +24hr, +24hr (from bottom to top).

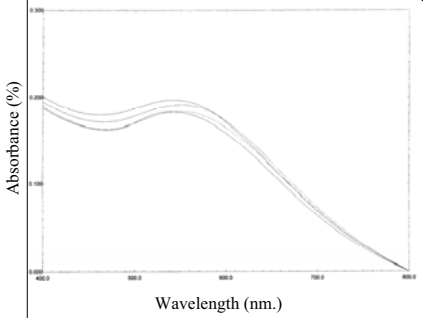


Fig.2. UV-vis absorption spectra of C_{60}-gold nanoparticle multilayers films in 0.1M-HCl solution for the indicated time for the indicated time; +0min, +60min, +180min, +360min (from top to bottom).

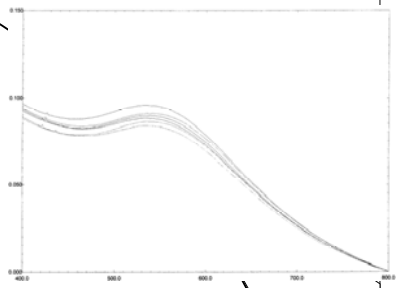
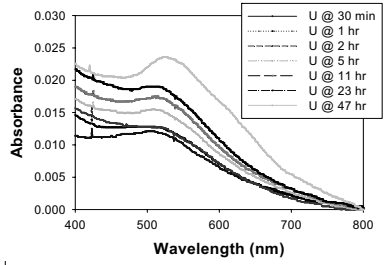
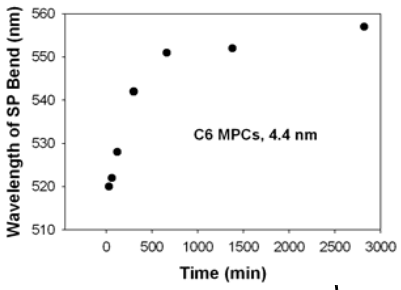


Fig.3. UV-vis absorption spectra of C60-gold nanoparticle multilayers before and after exposing the films to ultrasonic irradiated surrounding for the indicated time ; +0min, +60min, +180min, +360min, +720min, +1440min (from top to bottom).

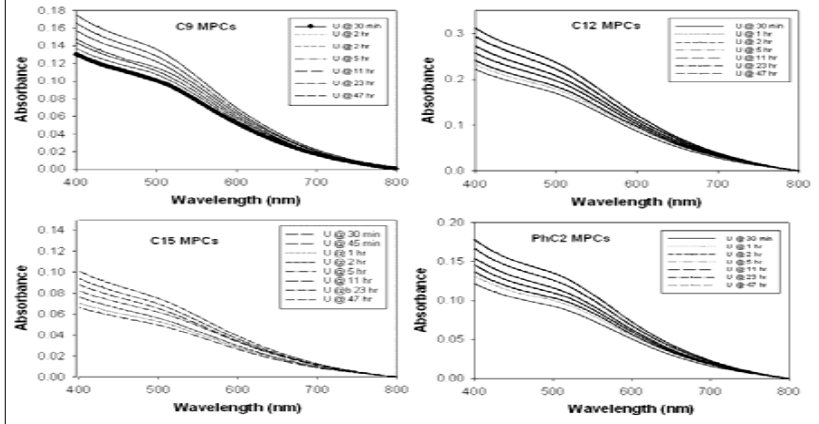
Ultrasonic Stability of Nanoparticles

Frequency 20 kHz, Power 750 W





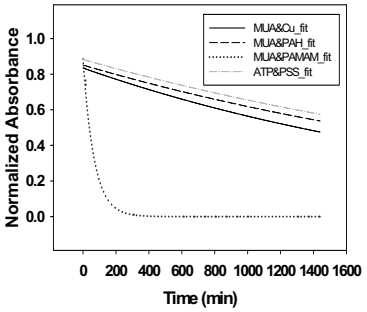
Ultrasonic Stability of Nanoparticles



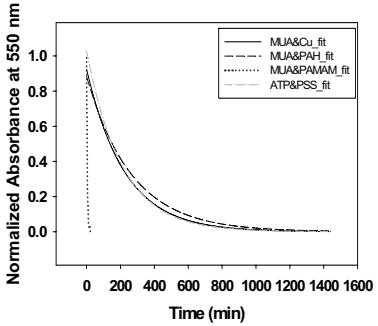
Frequency 20 kHz, Power 750 W

Chemical Stability of Nanoparticle Films

Desorption of Nanoparticle Multilayers in dil. HCl soln

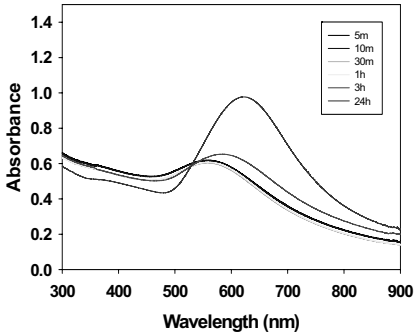


Desorption of Nanoparticle Multilayers in dil. KOH soln

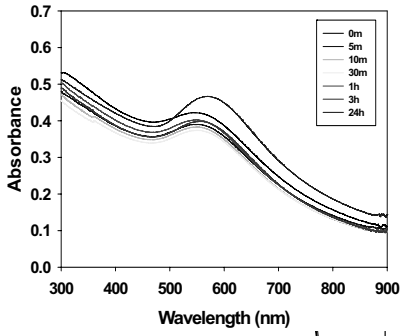


Thermal Stability of Nanoparticle Films

decomposition of MUA/Cu in Oven at 100°C

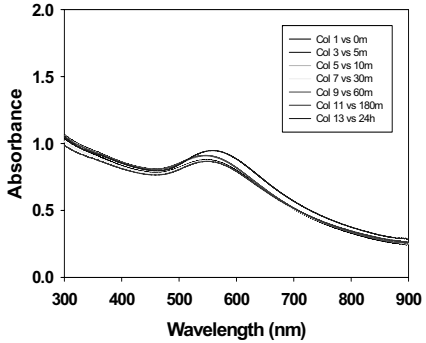


Annealing of PAH/MUA MPCs in oven (100°C)

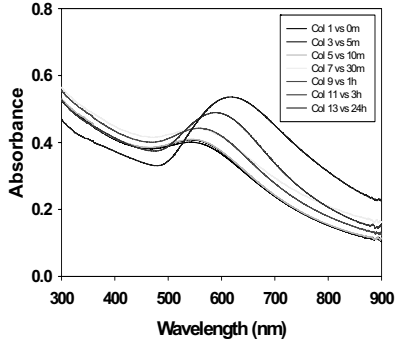


Thermal Stability of Nanoparticle Films

Anealing of PAMAM/MUA Films in Oven

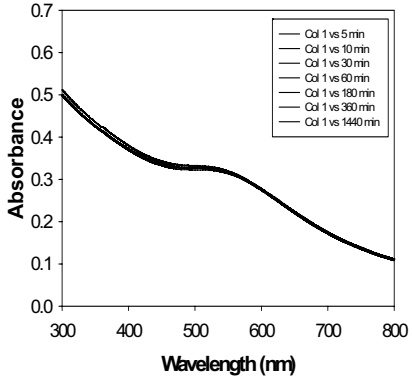


Annealing of ATP/PSS Films in Oven

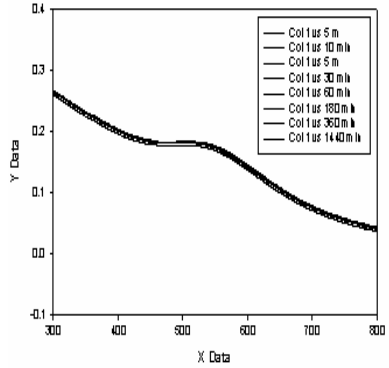


Ultrasonic Stability of Nanoparticle Films

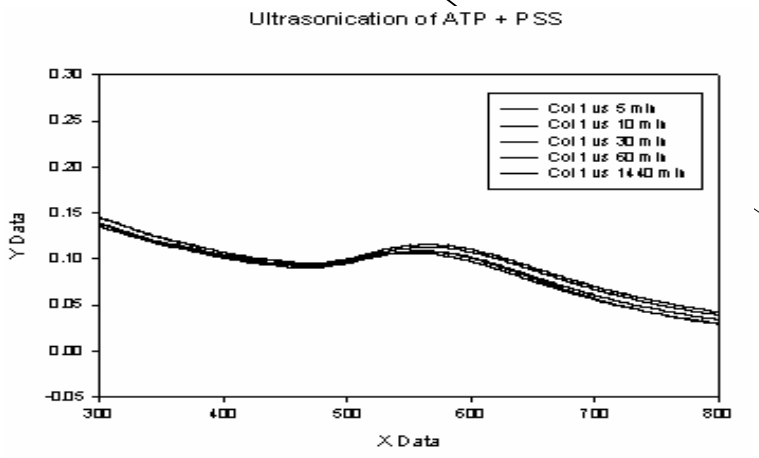
Ultrasonication of MUA MPCs + Cu^{2+}



Ultrasonication of MUA MPCs + PAH



Ultrasonic Stability of Nanoparticle Films



Summary on Stability of Nanoparticles and Nanostructures

1. Stability of MPCs is greatly influenced by the structure and functionality of monolayer surrounding a nanoparticle core

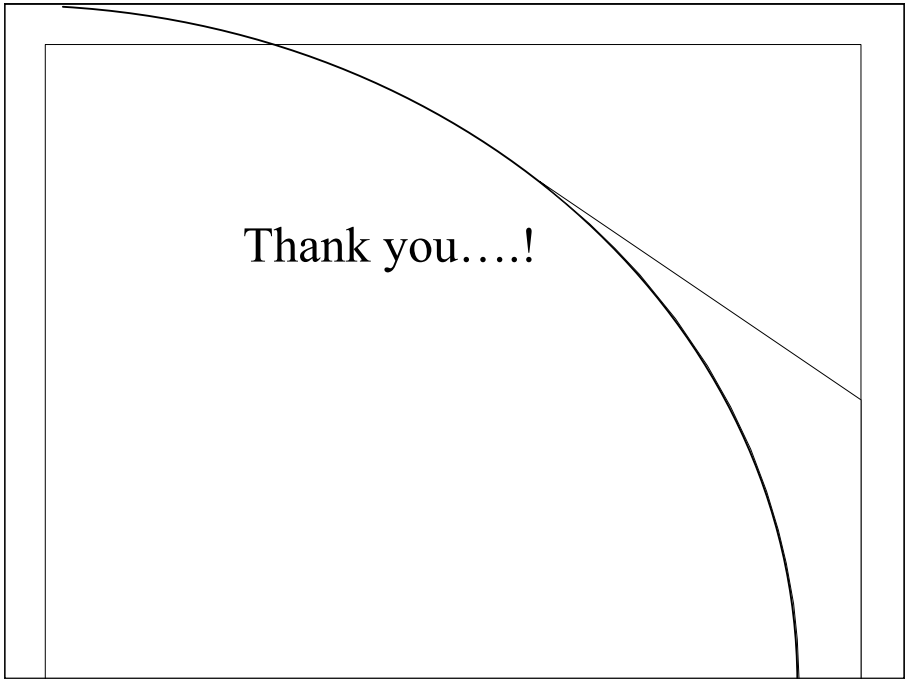
2. Both the monolayer composition of nanoparticles and the linkers used to build nanoparticle multilayer films govern the overall stability of hybrid nanostructures

Conclusions

- We have confirmed the $[C_{60}(O)_n]$, (n=1~3 or n=1) and $[C_{70}(O)_n]$, (n=1~2 or n=1) formed in the reaction of C_{60} and C_{70} with various oxidants under ultrasonic conditions.
- The "dirt-ball" assembly method is a convenient way to build nanoparticle multilayer films with a comparable layer thickness within 24 hours compared to several days with LbL assembly.
- Studies on chemical and ultrasonic stability of these films suggested that fullerene – gold nanoparticle multilayer films were quite stable in acidic condition and ultrasonic irradiated surrounding.
- Further understanding of properties of these nano Structures may lead to various device applications.

Prof. Weon-Bae Ko and Collaboration Research

- Expert of synthesis of Fullerene derivatives based sonochemistry
- Has been listed in the publication "2000 Outstanding Scientists of the 21st Century' published" by IBC(International Biographical Centre) 2006 , "Marquis Who's Who in the World" by Marquis Who's Who in the World 2006
- Reserch about "Sonochemistry & Nanochemistry" [with Western kentucky university(USA) & Hyogo university(Japan) & Dublin university (Ireland)]
- Research areas
- Carbon nanocolloid (CNC) and Ultrasonication
- Sonochemical synthesis of metal nanoparticle clusters
- Synthesis of Fullerene derivatives under non-classical conditions
- Self-Assembled Fullerene-Metal Nanoparticle Multilayer Films
- Synthesis of a water-soluble fullerenes


Thank you….!

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Nano Science Technology Hands on (奈米科技動手做)

Chung, Chih-Hui (鍾志輝) and Dai, Jia-Heng

Kaohsing county Lu-Chu Senior High School (路竹高中)
No. 292, Chung-Hua Road, Lu Chu Township, Kaohsiung County 82150, Taiwan, R. O. C.

Principle of design

- Encourage interests and recognition of students in nano by instruments of school's lab during one lesson.
- Exp. 1 Photocatalyst decontamination.
- Exp. 2 Photocatalyst Defog.
- Exp. 3 Lotus Effect.
- Exp. 4 Waterproof nano fabric

Exp. 1 Photocatalyst decontamination.

- Spray Titanium Dioxide SiO_2 onto surface of ceramic tile with Spray Pyrolysis.
- After dried, dip ink with wet paper towel and coat it onto surface of ceramic tile.
- Cover the half coated ink, irradiate it with an ultraviolet lamp for about 3 min, and then take it out to observe its color change.

Exp. 2 Photocatalyst Defog

- Prepare one set of mirror, coat photocatalyst over half of mirror surface but another half no do so.
- After dried, irradiate ultraviolet rays over one half, and another half no do so.
- About 20 minutes later, drop water drop at two sides of each half and observe whether character under glass is enlarged or not, there is any difference about shape of water drop.
- Put glass on one cup of hot water for a while.
- Take it away about 1minute later.
- Observe and confirm whether there is difference in definition of objects behind glass.

Exp. 3 Lotus Effect

- Liquor is mixed at scale of 1:3(Silica (SiO_2):Water).
- Clamp filter-paper to soak into liquor.
- Clamp it out and place on ceramic fiber net.
- Heat it with spirit lamp.
- Suck water and drop on paper with dropper after dried.
- Observe status of adherence of water.

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Exp. 4 Waterproof nano fabric

- Prepare liquid with 1liter water, 30g fabric and silicon dioxide.
- Soak fabric into liquid, and then take out to iron smooth with flat-iron.
- Dry fabric with hair-drier.
- Observe status of water adherence after dried.

Hands-on Activities for K12 Nano Science Education

（奈米動手做）

Chao-Ming FU (傅昭銘), Professor
Department of Physics, National Taiwan University
Email: chaomingfu@phys.ntu.edu.tw

Exp. 1 Synthesis of magnetic nano-particles

Magnetic nanoparticles of Fe_3O_4 (magnetite) can be easily produced by mixing Fe(II) and Fe(III) salts (Solution A) together in a basic solution (Solution B).

Materials:
$FeCl_2(H_2O)_4$.
M $FeCl_3(H_2O)_6$
HCl.
NH_3.

Procedures:
1) Prepare 2 M $FeCl_2(H_2O)_4$ in 2 M HCl (solution 1a) and 1.0 M $FeCl_3(H_2O)_6$ in 2 M HCl (solution 1b). The iron solutions have to be completely dissolved.
2) Add 1.0 mL of solution 1a and 4.0 mL of solution 1b to a 100 mL beaker, stirring evenly. (**Solution A**)
3) 50 mL of 1.0 M aqueous NH_3 solution. (**Solution B**)
4) Slowly **adding Solution B into Solution A**. After an initial brown precipitate, a black precipitate (magnetite) will be formed in the liquid medium.
5) Use a strong NdFeB magnet to attract the nano-ferrofluid at the bottom of the container. Pour off clear liquid, and rinse repeatedly.
6) So easily you have made the magnetic nanoparticles of Fe_3O_4 (magnetite)! Then, think, what are the applications by utilizing nano-ferrofluid?

Exp. 2 Synthesis of gold nanoparticles

The gold nanoparticles can be obtained by mixing 1.0 mM $HAuCl_4$ solution (Solution A) to a reducing agent (Solution B). The gold nanoparticles can be observed by a change in color due to nano-size effect.

Materials:
$HAuCl_4$.
Cetyl Trimethyl Ammonium Bromide (CTAB)
Ethanol
NaOH

Procedures:
1) Prepare 1.0 mM $HAuCl_4$ in distilled water. (**Solution A1**)
2) Prepare 1.0 mM $HAuCl_4$ with 0.05 M CTAB in distilled water. (**Solution A2**)
3) Prepare 1M NaOH in ethanol. (**Solution B**)
4) Slowly **adding Solution B into Solution A1**. After a while, a precipitate of nano-gold in the liquid medium is obtained. Watch! What is the color of nano-gold synthesized in this run?
5) Slowly **adding Solution B into Solution A2**. After a while, formation of nano-gold is obtained. Is the color of nano-gold synthesized in this run different from previous one?
6) Does the gold nanoparticles in the liquid medium exhibit as a colloidal suspension? (Use a laser pointer to emit laser bean into soultion. The presence of a colloidal suspension can be detected by the reflection of from the particles.) Can you guess the function of Cetyl Trimethyl Ammonium Bromide (CTAB)?

Reference:
1. Nanotechnology- Fundamentals, Applications and Hands-on, (in Chinese, English translation is undergoing), published by Gau-Lih Book Co., 2005.
2. Hands-on for K12 Nanoscience Education, CD version, Editor by C.M. Fu *et.el.*, K12 South Center, Taiwan, 2006.

(Additional experiments may be presented at the Workshop, depends on the time of schedule.)

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Nanotechnology Integrated into Senior High's Curriculum (奈米科技融入高中課程)

Presenter: Han-Chien Yang (楊漢倩)

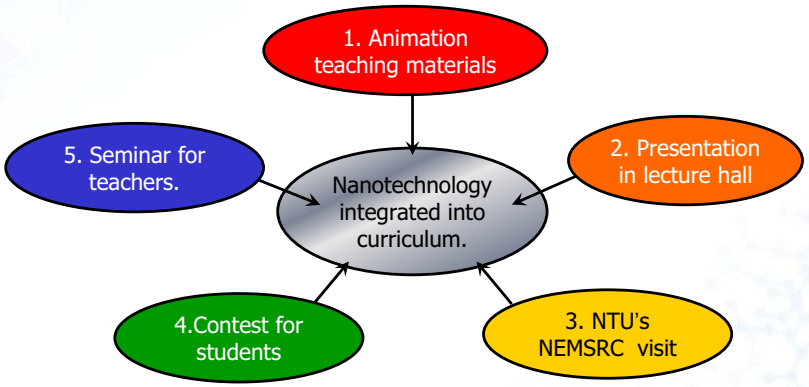
Hsin Tein Senior High School, Taiwan, R.O.C. (新店高中)
Team members: Ru-Zing Ko (柯如瑩), Po-Chung Huang (黃伯群)

Seed Teacher, Northern K-12 Regional Center of Nanotechnology Human Resource Development Program, Taiwan, R.O.C.

Nanotechnology is one of the most important technologies in the 21st century

- **Motivation**
  - Help students to understand the development of nanotechnology.
    (design some teaching materials)
  - Enhance the understanding of nanotechnology.
- **Goal**
  - Nanotechnology Integrated into Senior High's Curriculum.

How to achieve the goal?



1.Animation teaching materials

- **E-learning (3 Steps)**
  - **Attention：Attract senses of audience through pictures、animations、intonations、sounds…etc.**
  - **Encoding ：Combine the information above with background knowledge of audience.**
  - **Retrieval：Motivate them to use the encoded information at once by asking questions. (with reward!!)**

1.Animation teaching materials

3 Isolated lessons

- Physics ➔ AFM
- Chemistry ➔ Potocatalyst
- Biology ➔ When Biology Meets Nanotecnology

2. Presentation in lecture hall 2006,4,6

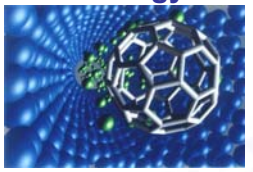
3. NTU's NEMSRC visit 2006,8,11

4. Contest for students 2006,12,15

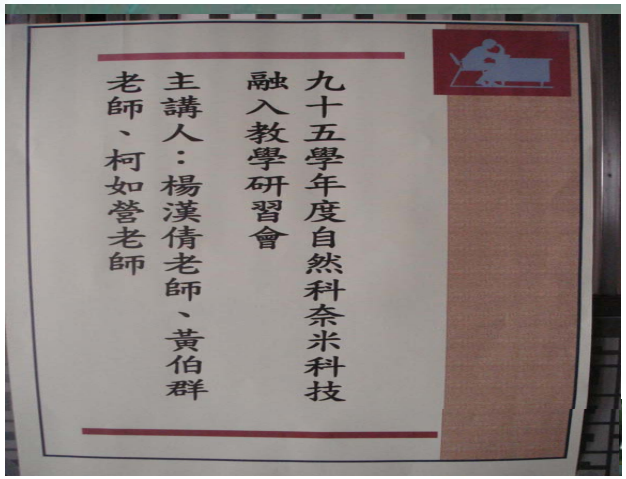
專題報告~~

奈米的應用與發展

Students did some short essays on nanotechnology.



5.Semina for teachers 2006,11,28



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Conclusions

1. We have integrated Physics, Chemsity and Biology teaching materials into our school's curriculum.
2. Animation teaching can deepen their impressions and reduce difficulties in learning.
3. Lab tours do stimulate students' interests in learning nanotechnology.

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Thank you for your attention !

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Animation for Nanotechnology Education – The Wonderland of Nanotechnology

(奈米動畫－迷走星球)

Meng-Hung Chen (陳孟宏)

Chemistry Teacher, National Taichung First Senior High School,(台中一中)
Taiwan, R.O.C.

Nanotechnology Game

- Presenting basic knowledge about nanotechnology with intriguing games , "The Wonderland of Nanotechnology" seeks to catch the students' eyes in order to lay the cornerstone of learning about nanotechnology.

- We set up Planet Crystal, Planet Electrode, and Planet Fable in "The Wonderland of Nanotechnology",which hold the knowledge of nanoscience in the field of chemistry, physic, and biology respectively. Each Planet has 4~6 movies and 2 games related to nanotechnology.

- With the advent of "The Wonderland of Nanotechnology", the primary education of nanotechnology has come to a new era. While students learn freely about nanotechnology, they are in fact building the firm foundation of the country's technology development.

- Now let`s enjoy “The Wonderland of Nanotechnology”.

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2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Experience of Nano Summer Camp (奈米夏令營經驗分享)

Presenter : Li-Hsueh Hsu (徐麗雪)

L.S. Hsu (徐麗雪) 、S.H. Chen (陳順和校長)、T.S. Tzeng (鄭自修)、S.H. Wang (王素慧) 、S.W. Li (李興雲) 、L.S. Lin (林豐盛) 、M.Z. Tsay (蔡明容) 、H.C. Chien (簡惠娟)

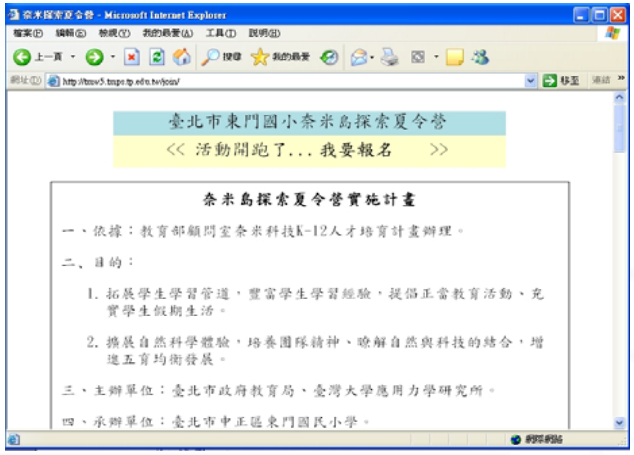
Dongmen Primary School (東門國小), Taipei, Taiwan, ROC

Seed Teacher, Northern K-12 Regional Center of Nanotechnology Human Resource Development Program, Taiwan, R.O.C.

Summer Camp Project

- **Title：The Exploration of Nano Island**
- **Dates：（1）July, 8th~10th, 2004**
  （2）July, 1st~3rd, 2005
  （3）July,12th~14th, 2006
- **Students：The fifth and the sixth graders from Northern Taiwan**
- **Total Enrolment：30 teachers and 150 students in 3 years**
- **Preparation of Summer Camp:**
  - **Lesson design and material development**
  - **Experimental kits**
  - **DVD and computer game**
  - **Handbook**

Announcement and Registration by Using Website



Schedule for 2005 Summer Camp

時間	7/12		7/13		7/14
08:40-09:00	工作人員準備時間				
09:00-10:20	9:00-9:15	報到	A班：NANO is possible !	B班：奈米小丸子-Part II	全體學員 奈米High翻天
	9:15-9:40	始業式			
	9:40-10:20	介紹奈米島 分組時間			
10:20-10:40	課間活動				
10:40-12:00	A班：奈米小丸子-Part I	B班：奈米好生活	A班：奈米小丸子-Part II	B班：讓想像力跳舞	成果發表 結業式
12:00-13:00	午餐及休息		午餐及休息		快樂回家
13:00-14:20	A班：奈米好生活	B班：NANO Impossible ?	A班：我的未來不是夢	B班：NANO is possible !	
14:20-14:40	課間活動				
14:40-16:00	A班：NANO Impossible?	B班：奈米小丸子-Part I	A班：讓想像力跳舞	B班：我的未來不是夢	
16:00	愉快回家				

Pictures of Teachers and Students of the Summer Camps

2004

2006

First day morning—registration and orientation

- **Preparation**
  - **Counselor Meeting**
- **Student Registration**
  - **Receiving T-shirts and handbooks**
  - **Making new friends**
  - **Filling in the questionnaires**
- **Inauguration**
- **Program Introduction**

Receiving T-shirts and handbooks

Making new friends

Filling in the questionnaires

Filling in the questionnaires

Program Introduction

Activity 1—Lecture and Experiments

One teacher explains the concept of nanotechnology.

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Students hands-on experiments




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Activity 2—Search Nano information by internet


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Activity 3—Social Science

- If you were a scientist, what kind of Nano research do you want to do?
- Please draw out what you thought.
- Imagine that after one hundred years, what progress will be made in food, clothes, residence, and traffic?


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Activity 4—Chinese Language

Part 1：Story of 「 PREY 」 (奈米獵殺)
- a. What is 「 PREY 」?
- b. The story of this novel
- c. The characters of this story

Part 2：Create a new story by using your imagination.
- a. topics of your story
- b. content of your story

Part 3：Present your story by using poster


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Activity 5—five-stops competition game

The 1st stop: Finding out the Nano structure in nature

Water droplets on leaf

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The 2nd stop: Assembling Buckyballs

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The 3th stop: **Question** answering

100 questions prepared.

Quicker answer gets higher score.

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The 4th stop: 3-person-and-4-leg Race

To know about the interaction of multiple molecules

The 5th stop: NM Magic House computer game

Final Day: Team presentation of their learning

Tell a story

Present a report

5 min. acting

Students' works

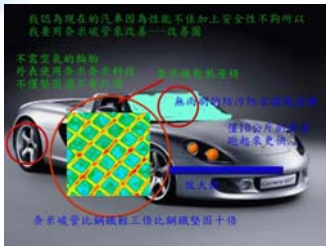
我 是 奈 米 小 精 靈

嗨！大家好，我是奈米小精靈，是從奈米王國派出來的使者，也是你們的嚮導。現在我就來帶領你們進入奈米的世界吧！

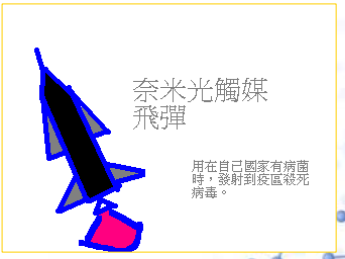
我們奈米世界的最大好處是可以不用打掃，夠酷吧！尤其呀！在食、衣、住行方面有非常多的好處喔！奈米是「長度」的單位名詞。1奈米等於10的負9次方米，也就是10億分之1米。牛頓雜誌曾經把我們和地球做比喻：「一米」與「一奈米」的大小相比較，相當於地球的直徑與地球上的一顆玻璃彈珠。可見我們是多麼的微小，不過你現在看到的我是放大版的喔！還有啊！說到我們的出產品，就要先從食說起，食的方面有：奈米酒、健康食品、汽水保特瓶、奈米膠囊……等。衣服呢？不用講，當然更多啦！例如：奈米內衣、奈米卡奇褲、奈米領帶、奈米保暖澄水衣……等。人總不能沒有家吧！所以住當然也有奈米的存在呀！例如：奈米磁磚、奈米油漆、奈米玻璃……等。行在我們的生活裡也佔有著非常重要的角色，所以就有了：奈米飛機、奈米汽車……等。哎呀！反正奈米產品多的不計其數，無法用言語形容啦！但是要有奈米國的註冊商標才是正宗的奈米物品喔！

我們的物品好到沒話說，連前任行政院院長唐飛先生穿了我們的內衣都讚不絕口呢！一口氣買了好幾件耶。可是，如果衣服都不用洗，會造成人們懶惰的習慣；雖然我們的產品有好的一面，也有壞的一面，總之你要用在哪一方面，完全要靠消費著的頭腦了！我的任務已經完成了，也是該回到奈米國的時候到了！bye-bye！希望你們有個聰明的頭腦，並祝你們用我們的產品用得愉快。後會有期喔！

Story written by student



Drawing of Future car



Drawing of Future car

Closing Ceremony

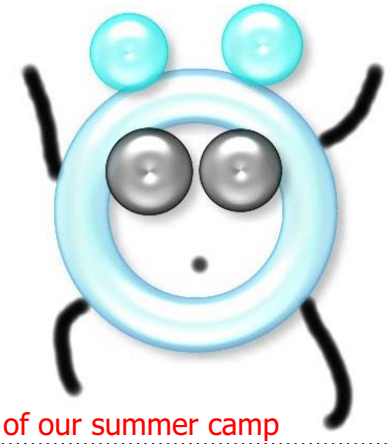
Certificate award

Prize Certificate award

Conclusions

- We have had three summer camps for 5th and 6th graders in recent three years. There were 50 students from northern Taiwan enrolled in each year.
- Students said that the lessons in the summer camp were interesting and stimulating.
- The present summer camp has high reputation among various summer camps.
- We are going to have this year's summer camp on this coming July 9th-11th.

Thanks for your attention!



Symbol of our summer camp

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

" Experiment and Experience " — Nanotechnology Lesson Design and Teaching in 7th Grade
(萬芳高中國中部奈米教案研發及實施概況)

Presenter：Xian-Lin Li (黎湘玲)

Team Members：溫翠燕、陳泰元、孫麗珠、汪璽佑、劉璋華、李秀珠

Wanfang High School（萬芳高中）, Taipei, Taiwan

No.1, Lane 115, Sec 3, Hsing Lung Rd. Wen-Shan Zone., Taipei, Taiwan R.O.C.

Seed Teacher, Northern K-12 Regional Center of Nanotechnology
Human Resource Development Program, Taiwan, R.O.C.

1.Goals

- **Since 2002 Wang-Fang High School launched "Experiment and Experience" lesson for all 7~9th graders.**
- **The aim of the course is to encourage the students to have hands-on activities and learn from hands-on experiment.**
- **From 2004 new lesson design concerning nanotechnology has been carried out.**

Goal

I hear, and I forget. (我聽過就忘了)
I see, and I remember. (我看過才記得)
I do, and I understand.(我做過才了解)

2. Teaching Plan

- Students:
  All 12 classes in the 7th Grade (460 students)
- Teaching hours:
  (1) Once a week (50 minutes .)
  (2) The entire teaching plan of nanotechnology is divided into four weeks.
  (3) Implemented in the second half of the school year in May and June.

3. Experience of Teaching Nanotechnology

- Aims of " Introduction to Nanotechnology " :
  (1) Cultivating the ability to examine products.
  (2) Introducing the newly established technology to the students.
  (3) Guiding the students to reflect on the scientific development.
  (4) Developing a self-learning ability.

4. Teaching Procedure

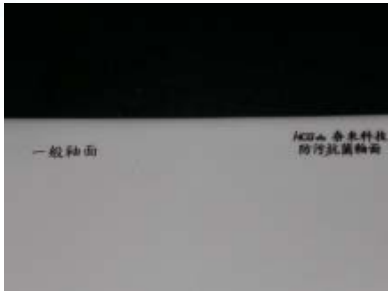
The unit is divided into 4 weeks.

Week I: Examine the nano-products found in daily life.
Week 2: An overall introduction to nanotechnology.
Week 3: Board game for buckyballs.
Week 4: "Nano express" poster

Contents of the 1st week of teaching ：

1、The difference between nano ceramic tiles and ceramic tiles.
2、A comparison of Permeability in nano cloth and non-nano cloth.
3、On the adhesive force with water of nano windshield demisters.
4、On the adhesive force with oil of nano windshield demisters.
5、On the adhesive force with water and dust of nanosand.
6、On the adhesive force with water and stain on different kinds of leaves

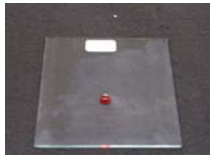
Experiment 1： The difference between nano ceramic tiles and ceramic tiles.

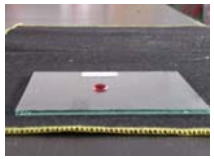


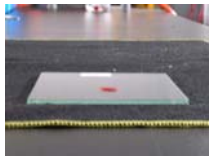
Experiment 2： A comparison of Permeability in nano cloth and non-nano cloth.

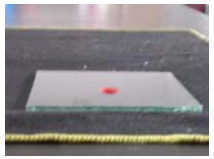
2007ANF Teachers' Workshop

Experiment 3： On the adhesive force with water of nano spray.



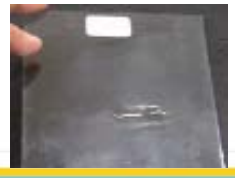


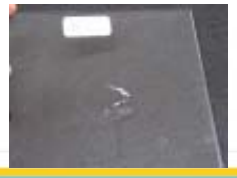


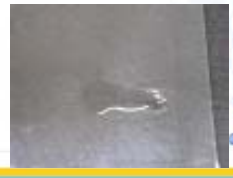


2007ANF Teachers' Workshop

Experiment 4. On the adhesive force with oil of nano spray.

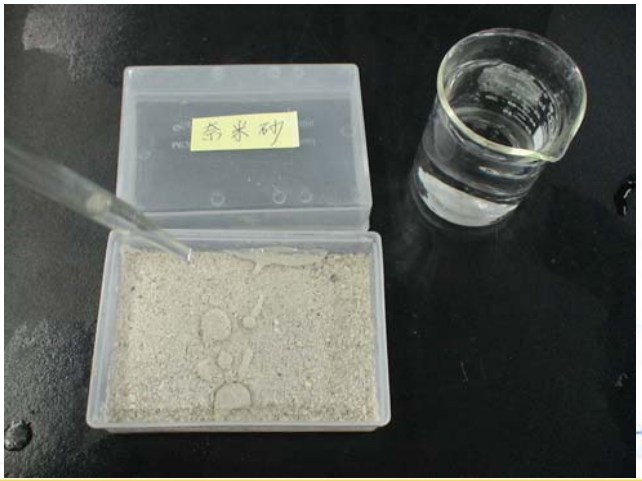






2007ANF Teachers' Workshop

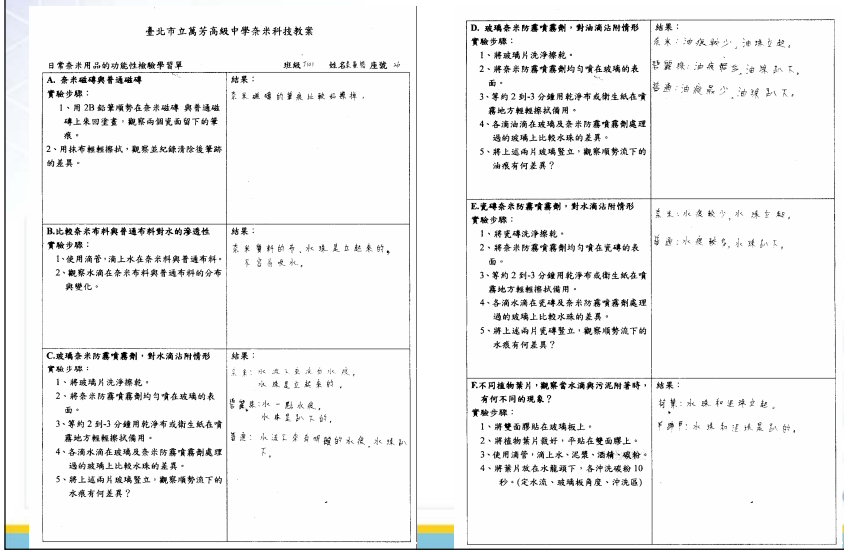
Experiment 5. On the adhesive force with water and stain of nanosand.



2007ANF Teachers' Workshop

Experiment 6： On the adhesive force with water and stain on different kinds of leaves

Assessment of 1st week lesson



臺北市立萬芳高級中學奈米科技教案

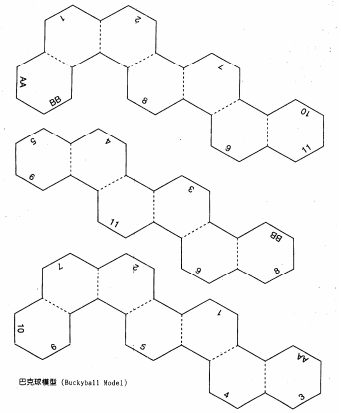
日常奈米用品的功能性檢驗學習單　　班級 Two　姓名[illegible]　座號 10

A. 奈米磁磚與普通磁磚 實驗步驟： 1、用2B鉛筆順勢在奈米磁磚 與普通磁磚上來回塗畫，觀察兩個筆面留下的筆痕。 2、用抹布輕輕擦拭，觀察並紀錄清除後筆跡的差異。	結果： 奈米磁磚的筆痕比較容易擦掉，
B.比較奈米布料與普通布料對水的滲透性 實驗步驟： 1、使用滴管，滴上水在奈米料與普通布料。 2、觀察水滴在奈米布料與普通布料的分布與變化。	結果： 奈米布料的布，水珠是立起來的。 普通布會吸水。
C.玻璃奈米防霧噴霧劑，對水滴沾附情形 實驗步驟： 1、將玻璃片洗淨擦乾， 2、將奈米防霧噴霧劑均勻噴在玻璃的表面。 3、等約2到3分鐘用乾淨布或衛生紙在噴霧地方輕輕擦拭備用。 4、各滴水滴在玻璃及奈米防霧噴霧劑處理過的玻璃上比較水珠的差異。 5、將上述兩片玻璃豎立，觀察順勢流下的水痕有何差異？	結果： 玻璃：水流下來水也快， 水珠是立起來的， 結果：小一點水痕， 水珠是扁扁的， 普通：水沒下來自然留的水痕，水珠扁下，

D. 玻璃奈米防霧噴霧劑，對油滴沾附情形 實驗步驟： 1、將玻璃片洗淨擦乾， 2、將奈米防霧噴霧劑均勻噴在玻璃的表面， 3、等約2到3分鐘用乾淨布或衛生紙在噴霧地方輕輕擦拭備用， 4、各滴油滴在玻璃及奈米防霧噴霧劑處理過的玻璃上比較水珠的差異， 5、將上述兩片玻璃豎立，觀察順勢流下的油痕有何差異？	結果： 玻璃：油痕較少，油珠立起， 結果：油痕都多，油珠扁下， 普通：油痕最少，油珠扁下，
E.光碟奈米防霧噴霧劑，對水滴沾附情形 實驗步驟： 1、將光碟洗淨擦乾， 2、將奈米防霧噴霧劑均勻噴在光碟的表面， 3、等約2到3分鐘用乾淨布或衛生紙在噴霧地方輕輕擦拭備用， 4、各滴水滴在光碟及奈米防霧噴霧劑處理過的玻璃上比較水珠的差異， 5、將上述兩片光碟豎立，觀察順勢流下的水痕有何差異？	奈米：水痕較少，水珠立起， 普通：水痕較多，水珠扁下，
F.不同植物葉片，觀察當水滴與污泥附著時，有何不同的現象？ 實驗步驟： 1、將雙面膠貼在玻璃板上， 2、將植物葉片做好，平貼在雙面膠上， 3、使用滴管，滴上水、泥巢、酒精、碳粉， 4、將葉片放在水龍頭下，各沖洗碳粉10秒，(定水流、玻璃板角度、沖洗區)	結果： 荷葉：水珠和泥珠立起， 羊齒：水珠和泥珠是扁的，

The 2nd week teaching session: Introduction to Nanotechnology.

The 3rd week teaching: Board Game



vertexes：_____

pentagons：_____

hexagons：_____

Assessment of the 3rd week lesson

Stage 1: Completing Buckyballs

Stage 2: Counting the number of vertexes，pentagons and hexagons on the Buckyballs

Stage 3: Finding the mathematical relationship

The 4th teaching lesson: " Nano Express " poster

Assessment of the 4th week lesson

(B) 1. 生物體是天然的奈米科技，以精子來說哪個部份是屬於分子馬達？
A 細胞膜 B 鞭毛 C 頭部

(C) 2. 哪種生物體內存在磁性的奈米粒子有羅盤的效果，可作為飛行時的自動導航讓它不會迷失？
A 蚊子 B 蒼蠅 C 蜜蜂

(B) 3. 蜘蛛腿節上那層是屬上的次微米結構，選擇性反射日光結果，次微米結構，是屬於？
A 光子晶體 B 反射作用 C 羅盤作用

(A) 4. 科學家實驗讓精疲力盡的什麼動物不讓它睡覺，取出腦髓中的睡眠素可以讓倒睡覺，也可以加速睡眠中傷口癒合？
A 老虎 B 大象 C 山羊

(E) 5. 蓮花表面有顆粒，可以讓不沾水珠，這種叫做什麼效應
A 光學效應 B 蓮花效應 C 顆粒效應

(B) 1. 為何海中的小生物無法附著在鯊豚體表？
A 鯊豚動作很大，小生物無法固定附著體表
B 鯊豚體表也有著奈米顆粒
C 鯊豚會相互把同伴身上的小生物啃掉

(C) 2. 細菌鞭毛的基部可驅動鞭毛旋轉，前進，凍細菌可以尋找食物或逃離傷害就如汽車的組件的哪一部分？
A 馬達 B 擋風鏡 C 齒輪

(A) 3. 壁虎腳下有數百根刚毛，可以產生什麼力來支撐身體？
A 反作用力 B 凡得瓦力 C 正向力

(A) 4. 什麼是奈米馬桶？ A 用奈米顆粒有自潔效果
B 沒有比較好的效果
C 很小的馬桶

(C) 5. 什麼是奈米探針？
A 小如病毒可以攜帶藥物
B 一般的針，只是針頭很細
C 有自潔效果的探針

(B) 1. 生物體是天然的奈米科技，以精子來說哪個部份是屬於分子馬達？
A 細胞膜 B 鞭毛 C 頭部

(C) 2. 哪種生物體內存在磁性的奈米粒子有羅盤的效果，可作為飛行時的自動導航讓它不會迷失？
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(B) 3. 蜘蛛腿節上那層是屬上的次微米結構，選擇性反射日光結果，次微米結構，是屬於？
A 光子晶體 B 反射作用 C 羅盤作用

(A) 4. 科學家實驗讓精疲力盡的什麼動物不讓它睡覺，取出腦髓中的睡眠素可以讓倒睡覺，也可以加速睡眠中傷口癒合？
A 老虎 B 大象 C 山羊

(E) 5. 蓮花表面有顆粒，可以讓不沾水珠，這種叫做什麼效應
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B 鯊豚體表也有著奈米顆粒
C 鯊豚會相互把同伴身上的小生物啃掉

(C) 2. 細菌鞭毛的基部可驅動鞭毛旋轉，前進，凍細菌可以尋找食物或逃離傷害就如汽車的組件的哪一部分？
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C 很小的馬桶

(C) 5. 什麼是奈米探針？
A 小如病毒可以攜帶藥物
B 一般的針，只是針頭很細
C 有自潔效果的探針

Implementation of the Lesson: A visit to Nanotechnology exhibition (Sept. 2006)

New Experiment extended to 10th Graders (2007): Lotus Effect —Basic Chemistry

Thanks

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Nanotechnology Promotion Experience of Ji-An Junior High School

(吉安國中推廣奈米科技教育經驗分享)

Presenter：Sian-Yuan Jhan (詹賢媛) and Kuang-Chi Ma (馬廣琪)

Program Leader： Principal Ming Hua, Li

Program Convener：Chief Xian-Yuan, Zhan

Program Team：Ji-an Junior High School (吉安國中)
Natural Science Instruction Research

2007ANF Teachers' Workshop

The Profile of the Nano-Technology in Chi-An Junior High School

- **Feature—**
  1.Develop the materials and support speeches with Western Neno Seeds Teachers
  2. Interact with the general public, elementary teachers and students
  Stress on the resources popularization and share of the Nano-technology

- **Parent-teacher Meeting—Pioneer the education of the Nano-technology to the householder**
- **Weekly Meeting and Class Meeting—Topic speech**
- **Afternoon of the chapter test—2005 Activities、2006 Magic shows of the Nano-technology**
- **Association—Topic Research—2005Go To Tribe、2006Go To Tribe**
- **Summer vacation—Camps**

2007ANF Teachers' Workshop

The Third, Four speeches per year

"Report on a special topic-Nano-Math" General Zi-an, Huang

Principal Ming Hua, Li "Preview of the industrial Nano-technology"

2007ANF Teachers' Workshop

The Fourth, Activities of the Nano-technology (1)

Lotus effect and Nano-paint

Nano-Diode

Nano and surfactant

Teacher Guang-Ji, Ma "Carbon Nanotube"

2007ANF Teachers' Workshop

The Forth, Nano Experience Sharing with elementary schools (2)

General Xian-Yuan, Zhan "Nano-News"

- 280 students of Tai-chng and Ji-an elementary schools. Learning by doing.

- Activities of the Nano-technology

2007ANF Teachers' Workshop

The seventh, 2006/10/17 Nano-Magic shows

Show of Face-Off

Enjoy CO_2

Contest of 『Bubbles-Volleball』

2007ANF Teachers' Workshop

The sixth, 2006/07/20 Summer Nano-Camp

2007ANF Teachers' Workshop

2006/07/20 Summer Nano-Camp

The efforts of our school

League—Encourage elementary school to join、 improve the innovative pedagogies of nine-year curriculum

The efforts of our school

- **Take responsible for "Hualien North Area Schools Association Nano Program-Teacher Workshop"**
- **Holds the summer media camps of the Nano-techmology**
- **Lecturer of the Nano-techmology in Tzu Chi University**

The efforts of our school

Development of the teaching materials

- National Dong Hwa University - physics、chemistry、biology
- Develop together, grow together and share together.

The fifth, Always share good things with friends

＊Boards of Nano-News

- **Requirement- Taipei Dazhi High School, Compulsory Education Advisory Group of the Taoyuan County Department of Education, Dahwa Junior High School, etc.**

- Support a lot of exhibits.

2007ANF Teachers' Workshop

The fifth,2006 Training course of Nano-technology Nano Vanguard-Go to school

- Nine Level students' rehearsal
- Eight Level students' show

2007ANF Teachers' Workshop

2006 Nano Vanguard-Go to school

- **June 11, 2006 in Tong Men elementary**
- Instructor Yue-Ling, Li

2007ANF Teachers' Workshop

2006 Nano Vanguard-Go to school (2)

- **June 11, 2006 in Tai-chang elementary school**
- **Instructor Guang-Ji, Ma**

2007ANF Teachers' Workshop

2006 Nano Vanguard-Go to school ！(3)

- **Sept. 9, 2006 in Nan Hua elementary shcool**
- **Instructor Guang-Ji, Ma**

2006 Nano Vanguard-Go to school (4)

- **Sept. 12, 2006 in Chi-An Elementary School**
- **The instructor, Meng-Chao,**
- **Wu**

2005 Nano Vanguard-Go to Tribe(5)

- Formosa Television recorded Nano Vanguard (Tai-chug community, Meiya church)
- Nano Vanguard were interview in Juan.

Nine Level Nano Vanguard invited by Police Radio Station in Hualien

The eighth, Arizona State University Visits the Chi-An Junior High School

- **Dr. Ramakrishna and Dr. Snyder** shared with Nano Vanguard. They talked about the nano science

Features of the Nano-courses in Chi-An Junior High School

- Nano Vanguard-Go to Tribe

1. 2005—the spread of 3 school districts
2. 2006—the spread of 4 school districts
3. 2007—『Trip of eco-Nano－**Discover of the Beauty of Ola Nano**』will declare to visitors and community pople in each sightsee place in Hualien county.

Teacher Ma Guang-Ji will introduce, "Nano Vanguard students-instructional skills and achievements"

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Teacher-designed Curriculum and Instructional Material of Nanotechnology

(奈米科技課程與教學自編教材設計)

Presenter : Li-Chen Chou (周利貞)

Li-Chen Chou (周利貞), Meng-Ju Hung (洪孟珠), Mei-Sheue Shyr (石美雪), Hsiu-Mei Chen(陳秀美), A-Man Tseng (曾阿滿), Fun-Yu Tsai (蔡芳瑜), Yu-Pu Chan (詹羽菩), Yu-Ying Yang (楊玉英), Lin-Hua Hung (黃怜華), Hui-An Yu (于回安), Chih-Che Teng (鄧志哲), Hung-Yi Yen (嚴鴻毅)

National Taipei University of Education Experimental Elementary School(國立台北教育大學附設實驗國民小學)

Seed teacher, Northern K-12 Regional Center of NHRD Program, Taiwan,

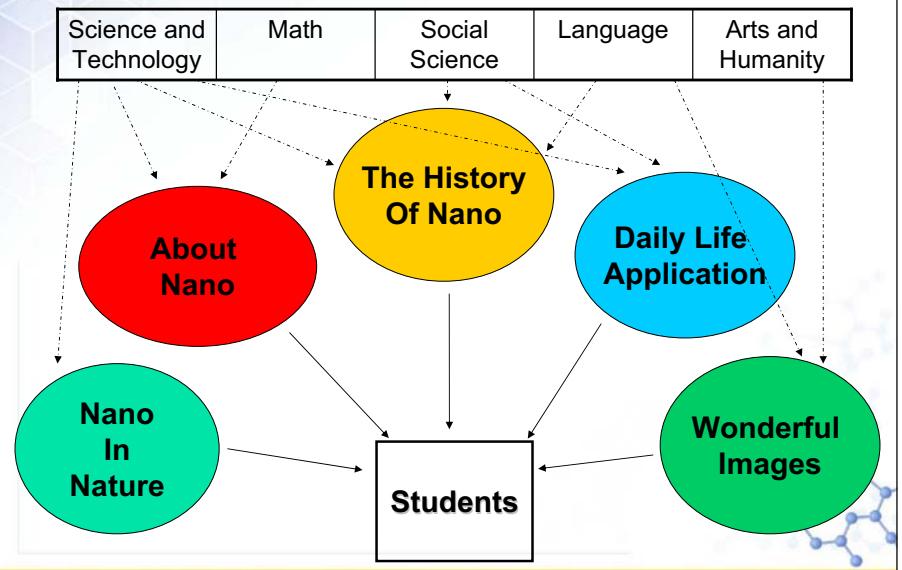
2007.06.15

Program Development

Year / Curriculum Areas	2005	2006	2007
Science and Technology	5th Grade	1, 2, 3, 5, 6 Grades	1-6 Grades
Social Science			
Math			
Language			
Arts and Humanity			

First Year Program-2005

Objective: To teach 5th graders to explore the world of Nanotechnology.



Lessons learned in the first year

1. Students exhibited enthusiasm and were capable of learning about Nano information
2. There are ample information that can be taught to students of all grades.
3. Spiral structure can be used for the curriculum design.

Second Year Program-2006: Curriculum Expansion

Objective: To develop Nano curriculum with progressing complexity for 1-6 grades to explore the knowledge of Nanotechnology.

Curriculum Objectives

5- 6 grades

1. To learn about the discovery of Nano world
2. To understand the Nano Scale
3. To learn about the history of Nano research
4. To know about the Characteristics of Nano-scale materials
5. To know about the daily life application of Nanotechnology
6. To think through the potential impact of Nanotechnology on human life
7. To build up the ethics in developing Nanotechnology

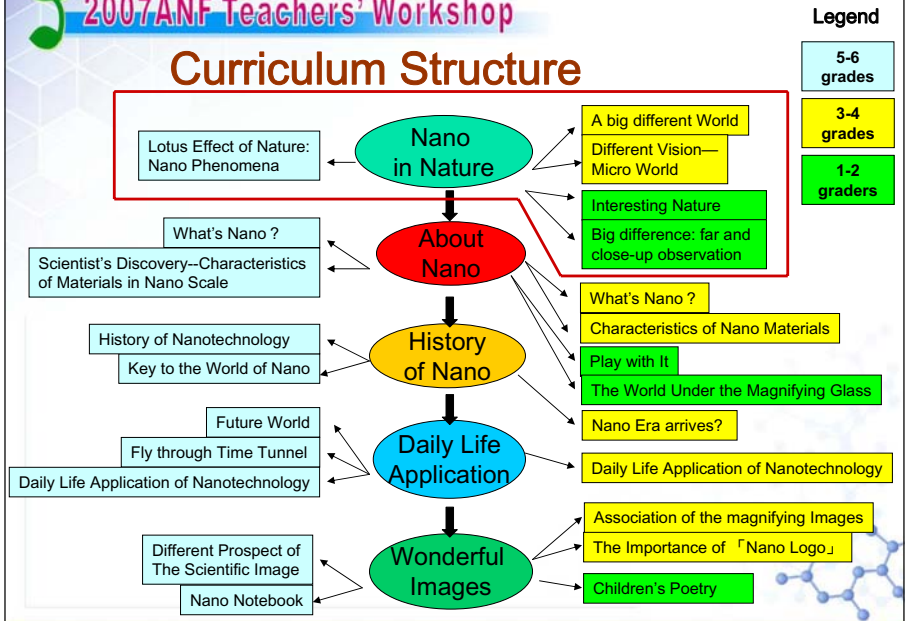
3-4 grades

1. To know about "micro scale" and "macro scale"
2. To learn about "Nano scale"
3. To know about the characteristics of Nano scale materials
4. To learn about the daily life application of Nanotechnology

1-2 grades

1. To cultivate the interest in Nanotechnology via exploration of the nature
2. To learn about the bigger world and smaller (micro) world via activities
3. To experience the changes occurred when things get smaller

Curriculum Structure



Lesson Example 1：
Interesting Nature (1-2 grades)

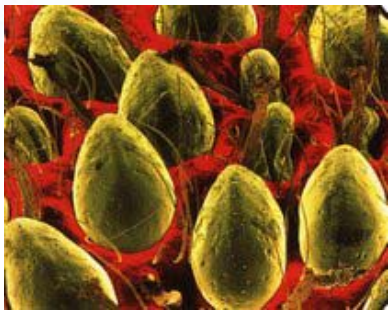
Pouring water on different leaves.
What would happen？

Lower Grades : Interesting Nature (2)

Water moves around like a marble on the leaf！

Why？

Lesson Example 2：Big difference—
far and close-up observations (1-2 grades)



Sweet, juicy fruit

Strawberry

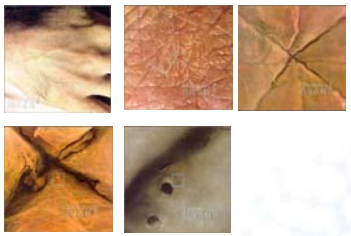
Heather Amery、Jane Songi 合著，微觀世界，牛頓出版公司，1997

Lesson Example 3：
A big different world — seeing is believing? (3-4 grades)

Lesson Example 4 : Different Vision—Micro World (3-4 grades)

What will you see after greater magnifying ?

Observe magnified skin



皮膚不斷放大後的動畫

http://www.shm.com.cn/review/2005-01/14/content_675543.htm

Experience the difference between visual and microscopic world.

Lesson Example 5 : Lotus Effect of Nature : Nano Phenomena (5-6 grades)

Nano Phenomena of the Nature - Lotus effect	Biomimetics - Develop high technology from mother nature
· Self clean function of Lotus effect – hydrophilic and hydrophobic	● Nanotechnology product: 防水防污的木板、布料、盤子、砂 ●Nano paper : 製作奈米紙
1. Hands-on exploration 2. Explanation of the physical characteristics of the lotus leaves. 3. Viewing animations	1. Demonstration of nano material 2. Making of the nano paper.

Encourage students to create the products by using Nanotechnology with their imagination

Conclusions(1)

- The program produced innovative curriculum design and many lessons in our school.
- There are growing collaboration among teachers.
- Different topics and methods are needed for children of different grade levels.

Conclusions(2)

- More in-depth knowledge is needed for teachers to prepare for instructional material.
- The curriculum is stimulating. Many teachers and students learned more by self learning.

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2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Instructional Design for Kindergarten to 2nd-Grade Students

(幼稚園至小二教案開發經驗分享)

Presenter: Chi-Lan Cheng (鄭及蘭)

Phoebe Po Lee (李珀校長) Shen Chang (張慎) Li-Li Yang (楊莉莉)
Chin-Yen Lin (林金燕) Li-Yueh Ha (哈麗月) Sheng-Man Wang (王聖蔓)

Taipei Fuhsing Private School, Taipei, Taiwan,ROC
(台北市私立復興實驗高級中學) http://www.fhjh.tp.edu.tw

Seed Teacher, Northern K-12 Regional Center of Nanotechnology Human Resource Development Program, Taiwan, R.O.C.

Curriculum Development

Grade Level	Contents of The Program
Kindergarten	Learn to compare the size of objects through games and activities.
1st & 2nd Grades	Guide students to discover all the possible length measurement units in daily life and in the nature.
3rd & 4th Grades	Collect and read the related information of nano-related products from their surroundings.
5th & 6th Grades	Guide students to further explore and learn the production process and materials used in nanotechnology products.
7th to 10th Grades	Learn from actual hands-on experiments and field trips.

Lesson 1: Cram, Shake and Count!

『篩篩塞塞，數一數』

Grade: Senior Kindergarten (6-year old kids), 2nd semester

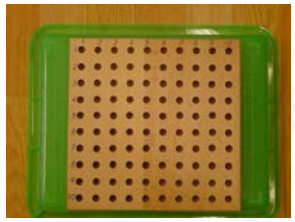
Objective: Let students to learn that different sizes of objects of same volume will give different outcomes.



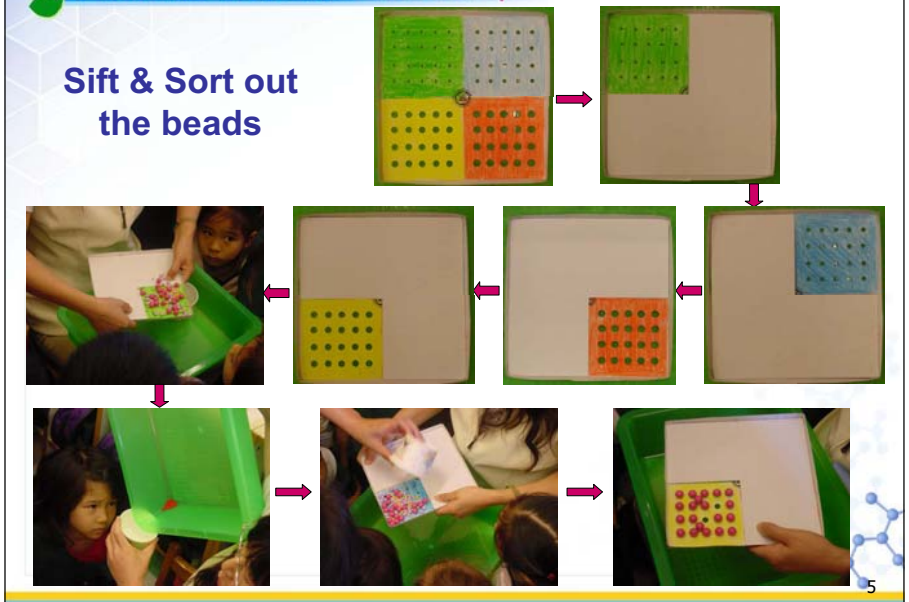
Lesson Design:

- **Fill a " Twist Egg " (children's toy) with same-sized beads.**
- **Then, open the egg and count the total number of beads.**
- **Repeat with a " Twist Egg " of exactly the same volume, but using a set of larger or smaller beads.**
- **The total count should vary according to the size of the beads.**





Sift & Sort out the beads



Cram and Count

Lesson 2: Knead and Cut -- Look!

『揉揉搓搓，看得見』

Grade: Grade 1, 1st semester

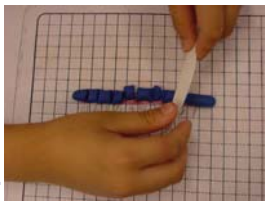
Objective: To illustrate the concept of negative exponents.

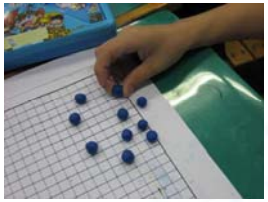
Plan :

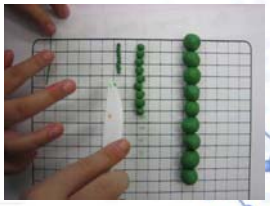
- An object can be divided into 10 equal sections; each one of these 10 sections can be further divided into smaller 10 sections.
- This process may be repeated until the object is no longer physically divisible.

Teaching Method:

- Using flexible and extendible material, such as children's plasticine, knead the material into a long roll which can be cut into ten equal sections.
- Taking one of the ten individual sections, roll it into a ball and knead this into another long roll equal in length to the first.
- Cut this slightly thinner roll into another ten equal sections and repeat the process.
- From this, children will understand the meaning of 1/10, 1/100, 1/1000, etc.





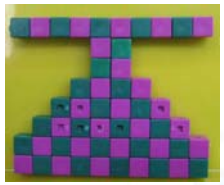


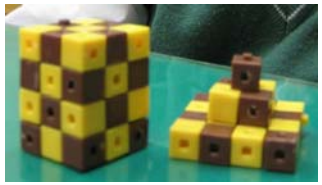
Lesson 3: Pile Them Up. Knock Them Down!

『排排堆堆，想一想』

Grade: Grade 1, 2nd semester

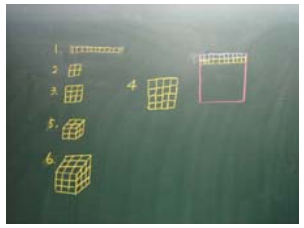
Objective: Let students understand that any object with a fixed volume may be taken apart, rearranged, and reassembled without altering the volume of the object while increasing or decreasing its surface area.




Teaching Method:

- Arrange a fixed number of cubic blocks in any configuration, e.g. rows, stacks, piles, etc.
- Then compare the different surface areas for each configuration.

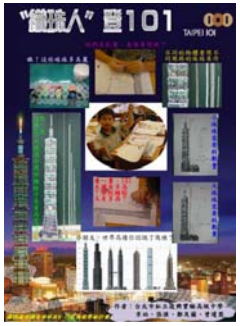



Lesson 4: Big Tower, Little Tower!

『大珠小珠，比一比』

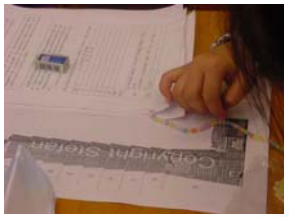
Grade: Grade 2, 1st semester

Objective: To compare the heights of various landmarks using the concept of ratio.

Teaching Method:

- With a string of equal-sized beads, measure the height of any recognizable tall building, such as Taipei 101, using the number of beads as the basic unit of measurement (e.g." Taipei 101 is eighteen beads tall.")
- With the same string of beads, measure the height of another familiar building (e.g. school Bell Tower) and compare.
- How many times is Taipei 101 taller than the school Bell Tower?
- Measurements are taken from buildings previously drawn on paper scaled with the same proportion.




Lesson 5: Why can't you see it? Now, you know!
『看不見，原來如此』

Grade: Grade 2, 2nd semester
Objective:

- **To demonstrate the concept of scale.**
- **Thing we can't see doesn't mean it doesn't exist. It is there if we can magnify it.**

Teaching Method: Use magnifying glasses of different magnifications (4x, 10x, 22x) to observe smaller objects around us.

Conclusions

- Fuhsing joined Nanotechnology education program (NHRD) since 2006.
- Within one year, we have developed 5 lessons for K~2nd grades from Math to Science curriculum area.
- These lessons are firstly designed specifically for kindergarten children in Taiwan.
- We have inspired student's interest and learning enthusiasm in Math and Science.
- We will extend lessons from Math to Science, Arts, and Language, and will extend to 12th grade students in the near future.
- We will incorporate this program into the science curriculum in our school.

Thank you!





Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Spring of Nano-Technology Instruction
The Nano The Future
(奈米的春天與發芽)

Fan-Pai Wei (魏汎百) and Po-Chou Chu

Ta-Tung Elementary School, Kaohsiung, Taiwan

Prominent Team


魏汎百


曾秀玉


何夏枝


姚慧磯


朱柏州


吳浚彰

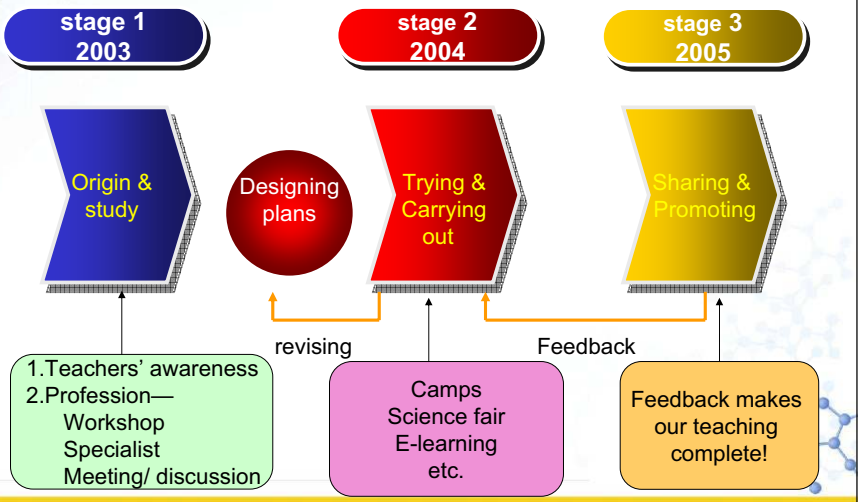

蕭勳鍾

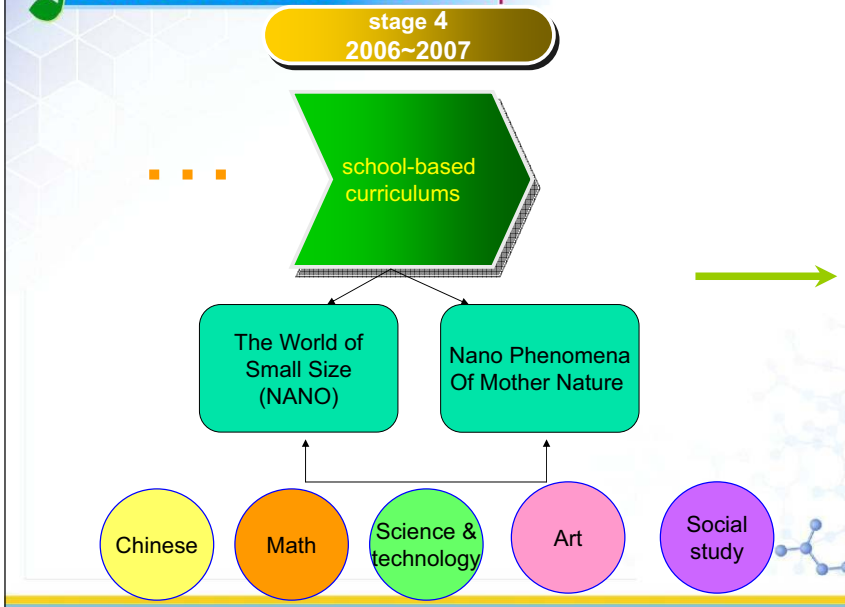

李德水

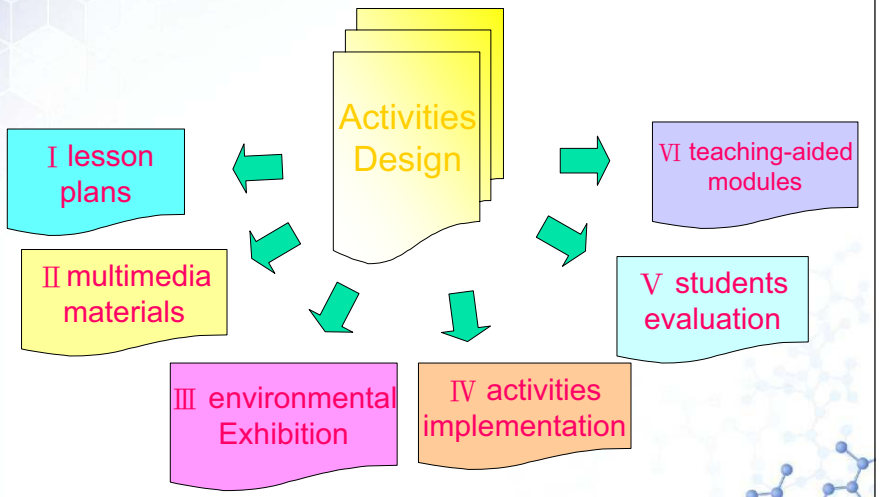

簡木全


林國雄

Developing Process







Lesson Plans

編號	領域(domain)	單元名稱 (Lessons)	設計者 (designer)
1	語文(chinese)	非常奈米、非常語文	姚慧磯
2	自然與生活科技 (science and technology)	蓮花效應之啓示與應用	何夏枝
3	自然與生活科技 (science and technology)	奈米碳球、奈米碳管	朱柏州
4	自然與生活科技 (science and technology)	小尺寸大表面積之實作與應用	曾秀玉
5	自然與生活科技 (science and technology)	奈米磁顆粒	朱柏州
6	自然與生活科技 (science and technology)	奈米光觸媒	何夏枝
7	自然與生活科技 (science and technology)	奈米融入教學	魏汎百
8	社會(social study)	各種標章認識	曾秀玉
9	數學(math)	尺寸大不同	魏汎百
10	社會(social study)	奈米科技的省思	何夏枝

Multimedia Materials Ⅰ

Slides of science & other curriculums

Multimedia Materials Ⅱ

Building Websites

Self-made film

NM magic house (CD)

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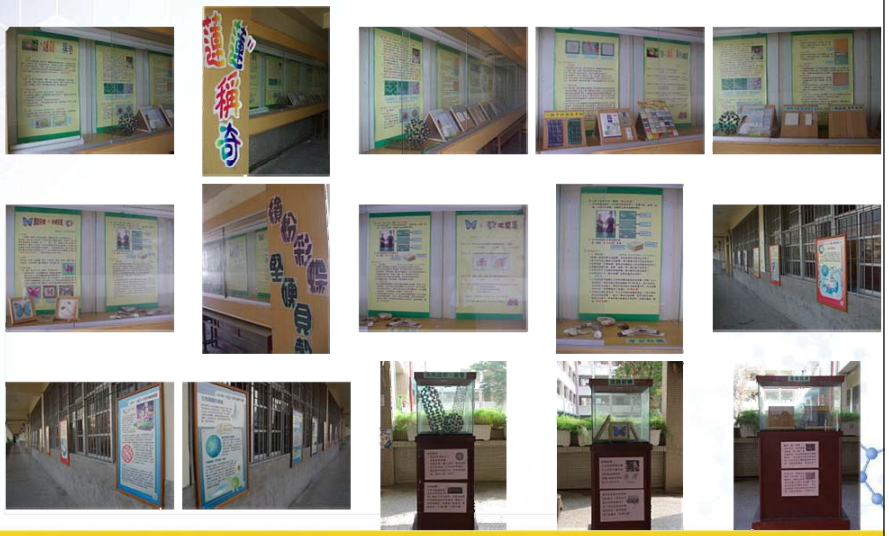
Environmental Exhibition



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Environmental Exhibition

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Learning Activities

- 2004 First tryout: camps
- 2004 Creative drawing & poster contest
- 2005 Nano -Bachelor, Master, Doctor selected
- 2005 NM魔力屋(magic house): online games
- 2005 Science fairs
- 2006 E-learning: Moodle Website
- 2006 奈米報馬仔(Nano-paparazzi)
- 2006 Interested waterdrops relay
- 2007 Nano story-book making (oncoming)

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Camps

- participants: grade 3~6 students (100 total)

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Nano -Bachelor, Master, Doctor Selected






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E-learning The Nano Moodle

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Nano - Paparazzi

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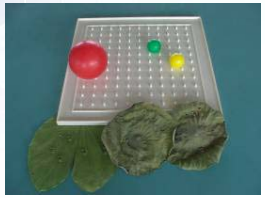
Teaching - aided Modules



蓮花效應

小尺寸效應

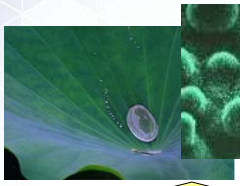
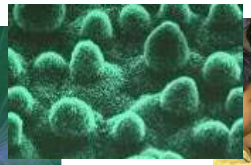
奈米瞧一瞧

防水磁磚玻璃

彩蝶效應

防水布

Experiment

Lotus effect

Simulating Lotus effect



Nano-sand made

outcome

Experiment




Nano-glass

Nano-tile

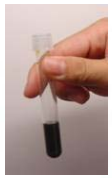

Nano-cloth made

Experiment

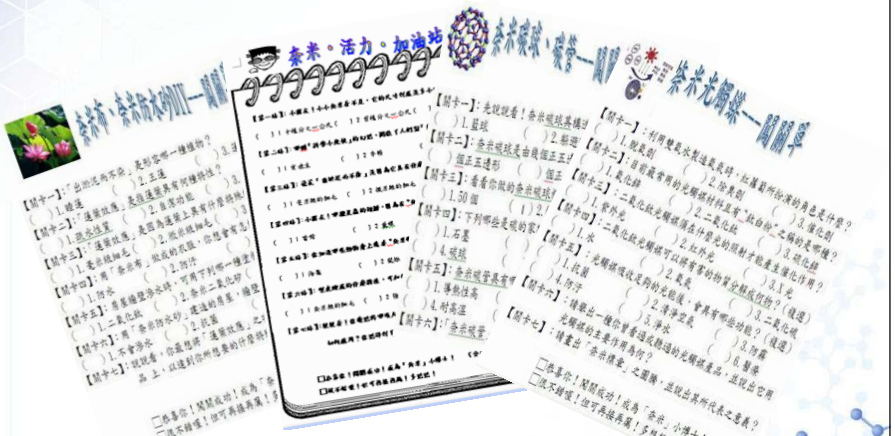

Photonic crystals

Magnetic nano-particles


Buckyball




Evaluation



2007ANF Teachers' Workshop

Evaluation

主題	名稱	作業型態	繳交日期	已送出	分數
1	作業1-快說，你到底有多高?	線上編輯	Monday, 20 March 2006, 11:55 PM	檢視 378 份已繳交作業	100 / 100

新增一個主題

討論	開始於	回覆	最新文章
八週的作業全交了沒？	何 夏枝	8	9603 佳惠 Tue, 23 May 2006, 09:38 PM

以 Excel 格式下載　以 文字檔格式下載

以類別排序

學生 依姓排序 依名字排序	無分類 統計 點數(800)	百分比	總分 統計 點數(800) ↓↑	% ↓↑	學生 依姓排序 依名字排序
○佳ㄔ蒨●, ～	300	37.5%	300	37.5%	○佳ㄔ蒨●, ～
一傑, 白	600	75%	600	75%	一傑, 白
之佑, 羅	450	56.25%	450	56.25%	之佑, 羅
亦加, 96d06	400	50%	400	50%	亦加, 96d06
仕豪, 95b12	100	12.5%	100	12.5%	仕豪, 95b12
伃縵, 宣	200	25%	200	25%	伃縵, 宣
伊庭, 96a11	100	12.5%	100	12.5%	伊庭, 96a11
佩珊, 95b25	800	100%	800	100%	佩珊, 95b25
佳惠, 9603	700	87.5%	700	87.5%	佳惠, 9603
佳榕, 楊	400	50%	400	50%	佳榕, 楊
佳錦, 96c20	800	100%	800	100%	佳錦, 96c20

2007ANF Teachers' Workshop

Education Promotion






Total :3980

2007ANF Teachers' Workshop

There is plenty of teaching at the Nano World.

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6/14、15 ANF Teachers' Workshop

K-12 Nanotechnology Education Program
Living in a Nanotechnology Era
(國小奈米科技教學活動 — 奈米科技生活家)

Chen-Chen Liu (劉蓁蓁)

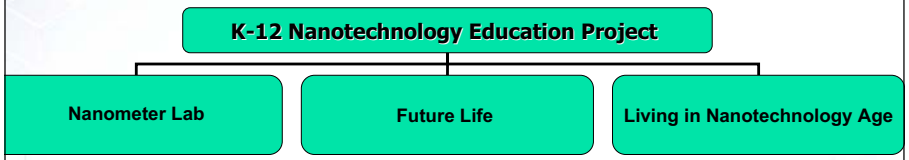
Tainan Municipal Jinsyue Elementary School (進學國小) Tainan, Taiwan

Seed Teacher, South K-12 Regional Center of Nanotechnology Human Resource Development Program, Taiwan, R.O.C.

Project Goal

- **Through interesting hand-on activities and powerpoint presentations, elementary school students will understand the concepts and practical applications of nanotechnology.**

Project Structure



Unit One :Nanometer Lab

- **Learning Objective**

Through various games and hand-on activities, students will learn the characteristics of nanophotocatalyst.

Unit one :Nanometer Lab

Learning Activities:

1. **Lotus Effect (Self-cleaning) hand-on activity**
2. **What Is Nanometer?**

2007ANF Teachers' Workshop

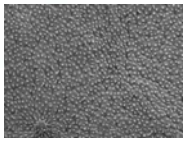
Unit one :Nanometer Lab

1. Lotus Effect (Self-cleaning) hand-on activity

2007ANF Teachers' Workshop

Unit one :Nanometer Lab

2. What Is Nanometer?



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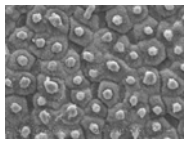

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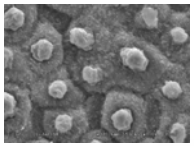

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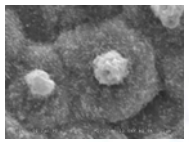

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2007ANF Teachers' Workshop

Unit Two: Future Life

- **Learning Objective**

  Through films and powerpoint presentation, students will learn the history, nanomark, and applications of nanotechnology.

2007ANF Teachers' Workshop

Unit Two: Future Life

- **Learning Topic:**

1. What is nanotechnology?
2. The development history of nanotechnology
3. Applications of nanotechnology
4. A taste of future - nanotechnology
5. Characteristics of nanotechnology
6. Characteristics and functions of nanotechnology products
7. Nanomark
8. How does nanotechnology impact our daily life?

2007ANF Teachers' Workshop

Unit Three : Living in a Nanotechnology Age

- **Learning Objective**

Students investigate how nanotechnology helps humans solve the current environment pollution problems.

2007ANF Teachers' Workshop

Unit Three : Living in a Nanotechnology Age

- **Learning Activity :**

1. Discuss Current pollution problems
2. Lead a healthy life presentation
3. Designing nanotechnology products

2007ANF Teachers' Workshop

The Results

1. **Promoted students' imaginations.**
2. **Increased students curiosity for nanotechnology.**
3. **Students engaged in various learning activities and learned the important concepts of nanotechnology.**

Suggestions for Teachers

1. **Collaborative teaching**

1. **Adapt instructional plans to meet students' needs and characteristics**

2. **Expend the knowledge of nanometer and nanotechnology**

Taiwan Nano 2007

2007 ANF種子教師研討會

6/14、15 ANF Teachers' Workshop

Nanotechnology and Science Teaching in Junior High School (奈米科技融入國中教學)

Presenter: Wun-Bang Liao (廖文邦)

Mao-Cheng Lin, Chun-Siou Lin, Mei-Chen Jhou,
Ming-Hsiao Tsai, Chia-Ming Liang, Wun-Bang Liao

Guang-Wu Junior High School (光武國中)
Hsinchu, Taiwan

Purpose and Goal

- To popularize the knowledge of nanoscience and nanotechnology through summer camps and designed curricula practiced at school.
  - Students can obtain basic concepts of this advanced technology,
  - To start the advanced science from the very fundamental level.

The Project

- The project can be divided into two parts
  - Summer camps
  - Curricula practiced at school

Teaching Plan for "Nanometer"

- Nano is a modern term
- Hard to find any relation to junior high classes
- Design teaching plans suitable for junior high students ~ impossible
- Rely on many professors' assistance

Finally～

- Our teaching plan is-
  「 Big difference in the tiny world 」

Syllabus

- **Introduction to basic concept of nanometer**
  - Simple test
  - Measurement
- **Tiny size effect**
  - Special optical property
  - Special thermal property
  - Special magnetic property
  - Special mechanics property
- **Surface effect**
  - Experiment of tinder bar
  - Experiment of steel velvet
  - Experiment of tiny iron powder
- **Phenomenon related to nanometer（video）**
- **Modern Nano science and technology（video1）**

The Way to Proceed

- **Integrate curriculum teaching**
- **Hours：**
  - Participants： Grade 6 to 7 students who used to participate in Summer Nano-camp before
- **Summer Nanometer Science Camp：**
  - Summer Nano Science Camp 2005 (For grade 6 to 7 students from Guang-Wu junior high)
  - Summer Nano Science Camp 2006

  (For students from Kung-Wu junior high and schools in I-Lan, Taipei, and Nan-Tao counties)
- Club activities

Summer Nano-camp~our textbook

- Time：8/9~8/12
- Teaching materials：
  Big difference in the tiny world
- Participants：
  Grade 6 to 7 students

Popularization of Teaching

- Students：
  - Summer Nano Science Camp
  - Societies Time
- Teachers：
  Research and development workshop of teaching notes (for science teachers of middle school)
  - Research of teaching plans for students：
    Hulin Junior High School、Pei-Ying Junior High School、Guang Wu Junior High School
  - Teaching method introduce

Teachers' Workshop

Thank you for your attention

新竹市立光武國中
Hsinchu Municipal Guang Wu Junior High School
http://mail.gwjh.hc.edu.tw/main.asp

ANF MALAYSIA

TAIWAN NANO 2007

Nanotechnology Education Awareness Program

Current education standard

- Malaysia currently embraces an education system that incorporate quality education in terms or gender equality, social inclusion, for life and sustainable development , it pursues a policy of quality in education with a focus on key role of teacher. *extracted from the DEV OF EDUCATION NATIONAL REPORT by MOE (31-7-04)*

Nanotechnology Education Awareness Program

- **Learning and working together with Asian Nano Forum (ANF)**
  - Taiwan Nano 2007 – Teachers' Workshop.
  - Progressive learning via several activities hinging on creativity and leveraging on environmental conditions.
- **Government of Malaysia and Creative Science**
  - Public awareness programmes via parenting seminars, events and entertainment programmes.
  - Teachers' training with district heads of science
  - Holidays kids camps and enrichment programmes

Nanotechnology Education Awareness Program

Our Program…

•Focus on science educational enhancement

- Creative Science with its partner, Science Weekly formulated an Educational Training Programme suitable for use by Asian teachers using time tested science literacy technologies and modern creativity techniques
- Proven Successful as it does not bring about sudden changes and therefore enable the appreciative learning of new skills in areas of Nanosciences and Nanotechnology.

Nanotechnology Education Awareness Program

- Forging Nanotechnology awareness in collaboration with Creative Science International utilising creativity literacy and innovative technologies
  - Basic understanding of Nanotechnology to our children i.e. “our future and our hope”
- Taiwan Nano 2007 ANF Teachers’ Workshop as a platform to start work on collaboration to introduce a standardize and common Nanotechnologies Awareness “toolkits”.
  - Share our individual experiences
  - Working as a Team, “ANF as a team WE CAN”

Nanotechnology Education Awareness Program

- **Creative Science International hereby propose the introducing a special edition on Nanotechnology awareness toolkits**
  - Consistent message or understanding on Nanotechnology for all ANF member countries
  - Tailored workshops and seminars for teachers, parents, young adults and kids to simulate understanding
  - Emphasizing on hand-on learning process, i.e. learning through creativity modules including musicals.

Nanotechnology Education Awareness Program

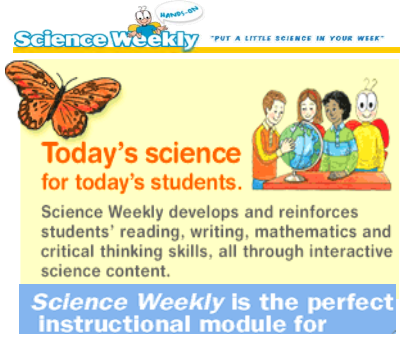
- **Research has firmly documented (Dr.Claude Mayberry)**
  - some students depend on the left side of the brain during the cognitive stages of development, while others utilize the right side
  - need an instructional process that helps accommodate for these varied learning styles of all students.
- **Nanotechnology toolkit**
  - designed to supplement (teachers and parent) efforts to assist students in developing higher-ordered and critical thinking skills.
  - provides the opportunity for students to exercise their curiosity about the world around them.
- **Comprehensive Teaching Notes**
  - Enhance teaching knowledge of the featured topic.

Nanotechnology Education Awareness Program

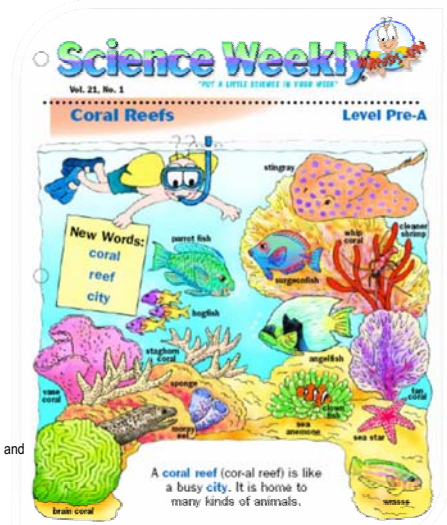
Nanotechnology Education Awareness Program

Creative Science Participation at various international events

Nanotechnology Education Awareness Program



- ✓ Hand-on Activities
- ✓ Up-to-date topics kids love
- ✓ Reading and writing in content area
- ✓ Reinforces scientific process
- ✓ Develops critical-thinking and problem solving skills
- ✓ Multi-disciplinary presentation – science lab activities, reading, writing and math in every issue
- ✓ Written to comply with National Eductio Standards
- ✓ Comprehensive teacher's note
- ✓ 15-time award winning publication

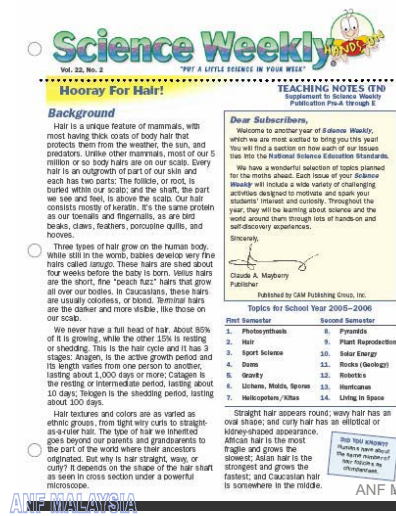


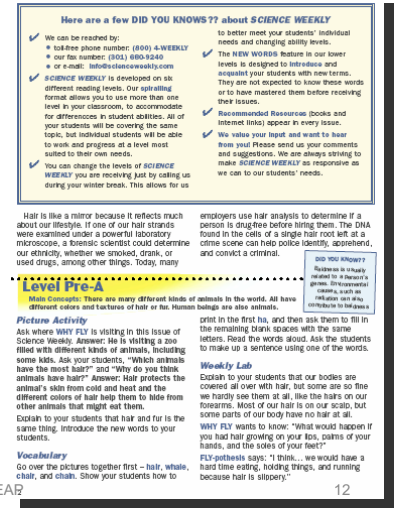
NAESP **Science Weekly is a NAESP educational Partner.**

Nanotechnology Education Awareness Program

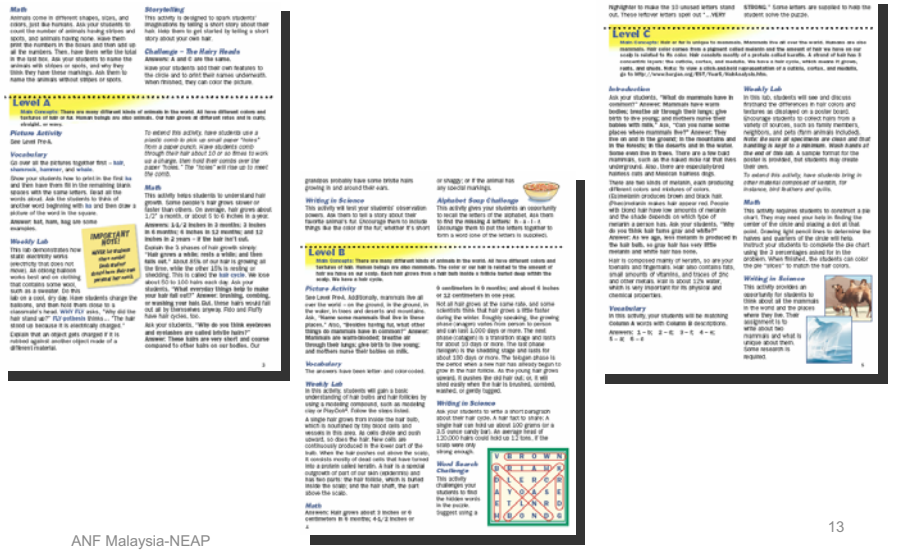
Nanotechnology Education Awareness Program

Sample of Science Weekly – Teachers Guide Notes

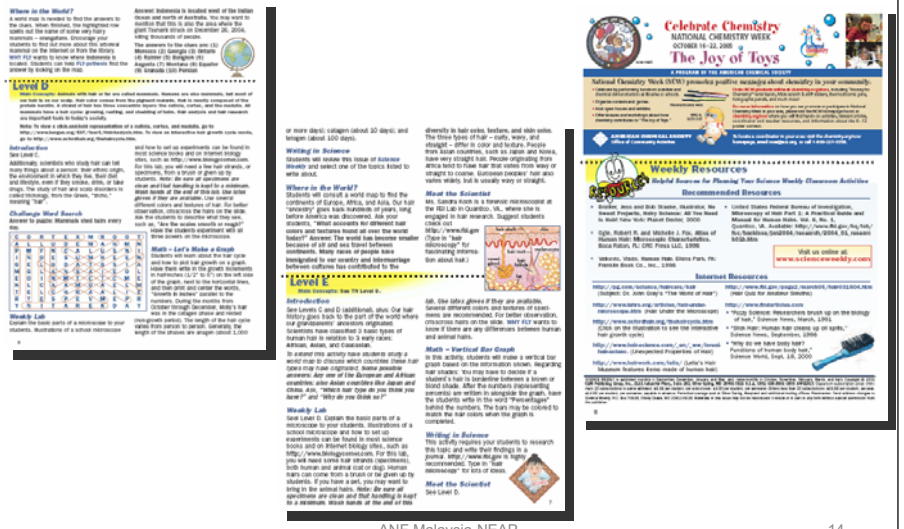




Nanotechnology Education Awareness Program



Nanotechnology Education Awareness Program



Nanotechnology Education Awareness Program

COGNITIVE SCIENTISTS SEVEN PROCESSES OF

1.Observing:	~Weekly Lab	~Vocabulary
2.Communication:	~Story Telling	~Writing For Science ~Vocabulary
3.Comparing:	~Weekly Lab ~Challenge	~Weekly Problem
4.Organizing:	~Weekly Lab ~Weekly Problem	~Writing For Science ~Vocabulary
5.Relating:	~Weekly Lab	~Puzzle
~Weekly Prob.		~Challenge
6.Inferring:	~Weekly Prob.	~Challenge
~Weekly Lab	~Puzzle	
7.Applying:	~Weekly Lab ~Writing For Science	~Weekly Prob. ~Challenge

Nanotechnology Education Awareness Program

- **Malaysia Nanotechnology Public Awareness Programme**
  - A Nanotech playground has been proposed to be showcased during ANF Summit at Kuala Lumpur in Nov 07 (Require support from public sector)
  - Workshops for kids, out-reach program i.e. teachers seminar and parenting are planned to be held in various regions within Malaysia
  - Support from ANF member countries.
  - Support from corporate Sponsorships.

Nanotechnology Education Awareness Program

ANF MALAYSIAN TEAM – TAIWAN NANO 2007

Government of Malaysia

Prof. Halimaton
Prof. Mohd Nazlan
Ms Tengku Sharizad
Ms Salwa
Mr. Azahar

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Ms. Mandy Yeen Yook Thang
Ms.Rose M.Nawi
Ms. Gloria
Ms. Win Nee Lim
Mr. Koo-Hoo Loo
Mr. Herbert Kong – Hoe Wong
Mr. Hung – Ge Chai

Advisors:

Dr.Claude Mayberry, Science Weekly, Washington DC
Mr. David Lim Chee Cheong, ExxonMobil (Malaysia)

A HUGE
Thank You to ANF Taiwan

for seeding a dynamic opportunity in forging international public educational awareness programmes on Nanotechnology .