

Toward a Comprehensively Interdisciplinary Nanoscience and Nanotechnology Personnel Training Program

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ABSTRACT: *The national program for nanoscience and nanotechnology that has been executed since 2003 has become one of the conspicuous National Science and Technology Programs in Taiwan. "The Central Taiwan Nanotechnology Personnel Training Alliance" is a multi-function educational program under the nanoscience and nanotechnology national science and technology program focusing on establishing interdisciplinary personnel training programs for nanoscience and nanotechnology. The alliance is composed of sixteen universities at the central Taiwan region. During the first year (2003) of executing, many successful results have been accomplished. The results include (1) an alliance belonging website that has been visited more than 1500 times (2) two across schools nanoscience and nanotechnology curricula (3) two web-based e-learning networks (nanobio and teaching materials for elementary school) (4) 10 alliance sharable course-handouts (5) the 1st national nanotechnology originality competition (6) three nanotechnology related camps for high school teachers and students (7) conferences and workshops. This paper addresses the planning, implementation, current status, and future development of the "Central Taiwan Nanotechnology Personnel Training Alliance".*

1 INTRODUCTION

Following the steam engine, the internal combustion engine, and the computer the fourth technological innovation has been being triggered by the nanotechnology [1-6]. It is estimated that the production value of the world wide nanotechnology industry will reach something over US\$70 billion in 2005, and will come to US\$1 trillion by 2010. The overall expansion is almost 13 times, and the field of communications electronics will grow by 25 times. In response to the global stream toward nanotechnology, the Taiwan government has determined to invest some US\$ 6.8 million over six year, starting in 2003. The national program for nanoscience and nanotechnology (Figure 1) [7-8] has become one of the conspicuous National Science and Technology Programs in Taiwan. The personnel training program that aims on establishing interdisciplinary nanoscience and technology curricula to efficiently provide sufficient experts to the academia and industry is one of the four scopes of this nanotechnology national program. Under the personnel training program, there are five regionally personnel training projects in according to the geographical distribution of Taiwan.

The Central Taiwan Nanotechnology Personnel Training Alliance is composed of sixteen universities around the central Taiwan region. The object of this alliance is to integrate the educational and research resources of the major universities in the central Taiwan region to (1) establish interdisciplinary nanoscience and technology curricula (2) promote academic-industry collaborating research and personnel exchange (3) assist enhancing basic nanoscience knowledge (from high school). In the establishment of interdisciplinary nanoscience and technology curricula, we elaborate on putting together the nanotechnology related curricula such as the fundamental science, applied engineering, biotech, and management among the members of the alliance to establish across schools nanoscience and nanotechnology curricula. Web-based e-learning networks, conferences and symposiums, and originality competitions are planned and executed to further realize the sharing mechanism. To efficaciously get the academia-industry collaborating research and personnel exchange program moving, extension programs such as workshops, on-job training courses, and industry-focused symposiums are proposed. To assist

enhancing basic nanoscience knowledge of the K-12 students, summer camps and teaching material compilation short courses are put in actions by those three normal universities in the alliance.

2 CENTRAL TAIWAN NANOTECHNOLOGY PERSONNEL TRAINING ALLIANCE

The organization of the Central Taiwan Nanotechnology Personnel Training Alliance is illustrated in Figure 2. The alliance is composed of 16 universities in the central region of Taiwan. Members of the alliance are: National Chung-hsing University, National Chung-Cheng University, National Changhua University of Education, National Chi Nan University, National Taichung Teachers College, Feng Chia University, Tunghai University, Da-Yeh University, National Chiayi University, National Yunlin University of Science & Technology, National Huwei University of Technology, National Chin-Yi Institute of Technology, Hsiuping Institute of Technology, WuFeng Institute of Technology, Chaouang University of Technology, Chien Kuo Institute of Technology. The steering committee that consists of the principal investigators of each member university meets quarterly to determine the guiding policies of the alliance. Eight experts of nanotechnology from academia and industry are invited to give guiding principle to the alliance. The alliance office serves as the communication center among the members and the project manager to monitor the progress of the program. In addition, the alliance office is in charge of establishing and maintaining the alliance belonging website.

3 ACCOMPLISHMENTS OF YEAR 2003

During the first year (2003) of executing, the alliance has been accomplished many successful results. The results include (1) an alliance belonging website that has been visited more than 1500 times (2) two across schools nanoscience and nanotechnology curricula (3) two web-based e-learning networks (nanobio and teaching materials for elementary school) (4) 10 alliance sharable course-handouts (5) the 1st national nanotechnology originality competition (6) three nanotechnology related camps for high school teachers and students (7) conferences and workshops.

(1) Alliance belonging website

The alliance belonging website (<http://centraltaiwan.nchu.edu.tw/>, Figure 3) was first announced on August 2003. There are more than 1500 visitors up to February 2004.

(2) Across schools nanoscience and nanotechnology curricula

Two across schools nanoscience and nanotechnology curricula have been established by the National Chung-Hsing University (NCHU) and the National Chung-Cheng University (NCCU), respectively. Websites of these two across schools curricula are:

- NCHU : <http://nanocenter.nchu.edu.tw/introduction/class.htm>
- NCCU : <http://www.ccunix.ccu.edu.tw/~deptgioom/news/news.php>

(3) Web-based e-learning networks

Two web-based e-learning networks, the nanobiology (Figure 4) and the teaching materials for elementary school (Figure 5), were created to provide regionwide web-based e-education mechanism. The networks have been continuously maintained and updated. The websites of these two e-learning networks are:

- Nanobiology : <http://nano.cyut.net.tw/>
- Teaching materials for elementary school : <http://ws3.ntctc.edu.tw/nanontctc>

(4) Alliance sharable course-handouts

Ten alliance sharable course-handouts regarding the nanoscience and nanotechnology were composed by the course instructors of the member universities during the year 2003. These ten course-handouts are placed in the alliance belonging website and free for access.

(5) Originality competition

Although it was interfered by the SARS, the 1st national nanotechnology originality competition (<http://www.phys.ncue.edu.tw>, Figure 6) was taken charge by the National Changhua University of Education and successfully completed. Thirty nationwide teams submitted their proposals. Nineteen teams were selected by the review committee to present their originality at the final exhibition.

(6) Nanotechnology camps

Three nanotechnology related camps for high school teachers and students were held.

- 2003 Nanotechnology camp for high school teachers: <http://www.dyu.edu.tw/~ee5040/> (Figure 7)
More than 80 regional high school teachers attended this camp at the Da-Yeh University. DIY was the main theme of this camp.
- Nanotechnology workshop for elementary school teachers: <http://ws3.ntctc.edu.tw/nanontctc>
This workshop arranged by the National Taichung Teachers College met once weekly for seven times. More than 50 trainees joined this workshop.
- 2003 Nanoscience camp for K-12 students: <http://www.nano.fcu.edu.tw>
The 2003 K-12 nanoscience camp was held at the Feng Chia University during the 2003 winter break. The main goal is to inspire the students with basic nanoscience through simple experiments and guided tour to the nanotechnology showroom at the Feng Chia University. More than 60 students attended the camp.

(7) Conferences and forums

- Nanotechnology forums: (<http://nanocenter.nchu.edu.tw/indexen.html>)
Many nanotechnology forums had been held within the alliance. In the National Chung-Hsing University, the Ph.D program students who were interested in nanoresearch were gathering together every other week. Students were scheduled to present their research results in turns. Several multi-field research teams have been organized through the forums.
- Nanotechnology conferences and symposiums:
Six symposiums which include two international and 4 national were held during the first year. Among them, the advanced molecular motor symposium taken place at the National Chung-Hsing University (NCHU) invited four well-known Japanese experts in molecular motor to give lectures and discussions. A molecular motor research team that is composed of five professors from different colleges has been formed in the NCHU.

4 CONCLUSION AND DISCUSSION

This article presents the efforts of the Central Taiwan Nanotechnology Personnel Training Alliance under the personnel training program of the national program for nanoscience and nanotechnology in Taiwan. During the first year (2003) of executing, the alliance has been accomplished many successful results. Based on the foundation of year 2003, the year 2004 proposal has been approved by the advisory committee of the National Nanotechnology Personnel Training Program. For the second year of executing, the alliance will focus on the integration and resources sharing within the member universities. In addition to the reinforcement of the alliance belonging website, two international symposiums regarding the nanobiomedicine and the carbon nano tube applications in panel display technology have been scheduled, four conferences have been designed, several new e-learning networks have been proposed, eight course-handout projects have been planned, the originality competition will be extended to the nationwide event, the nanotechnology camps and workshops will be continually executed.

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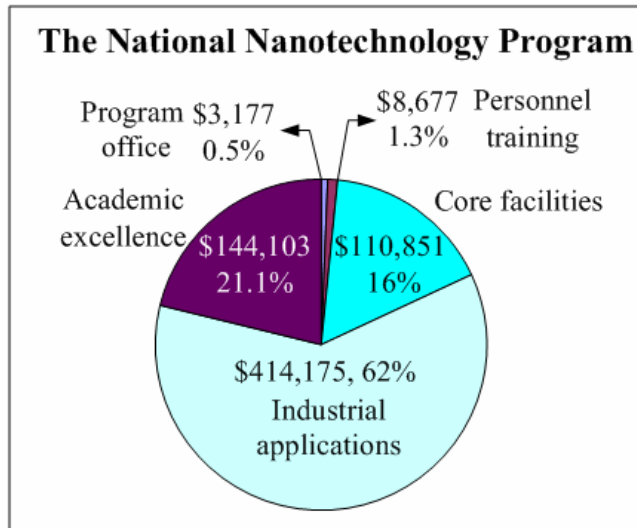


Figure 1. The National Nanotechnology Program (Units: US\$ 1000)

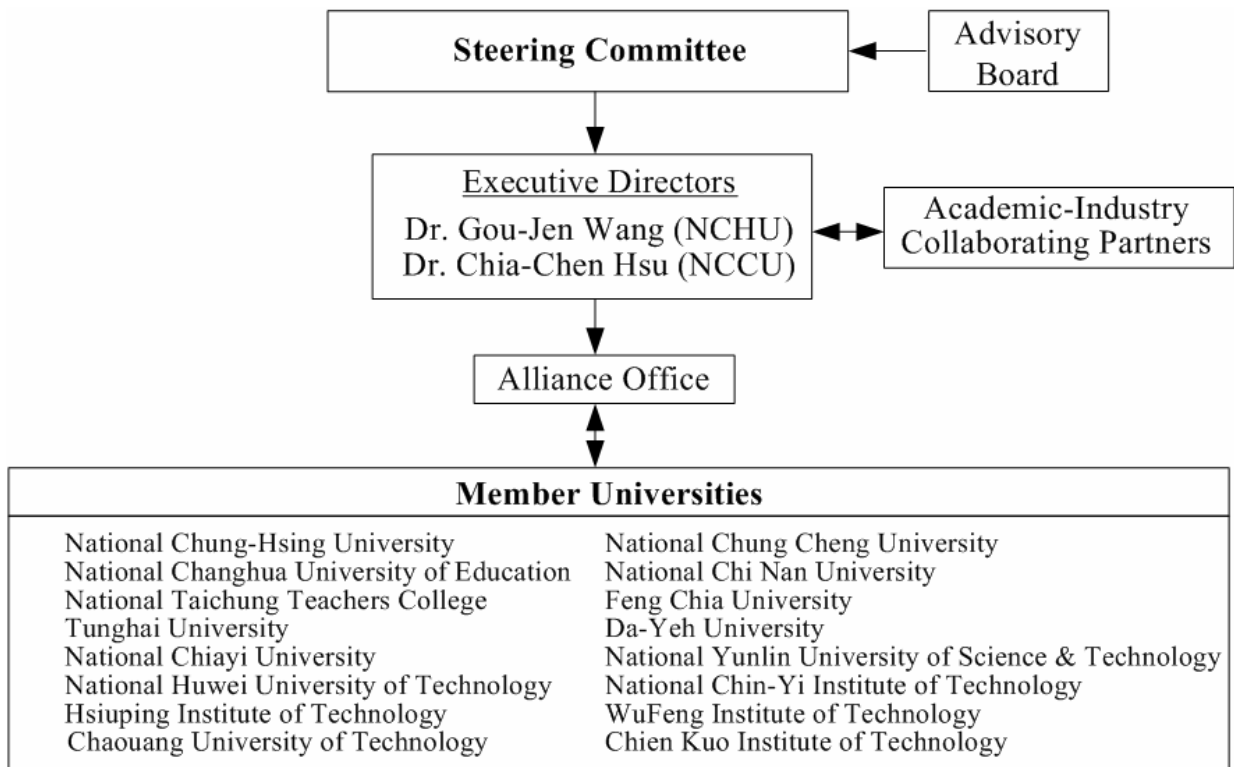


Figure 2. Organization of the Central Taiwan Nanotechnology Personnel Training Alliance



Figure 3. Home page of the alliance belonging website

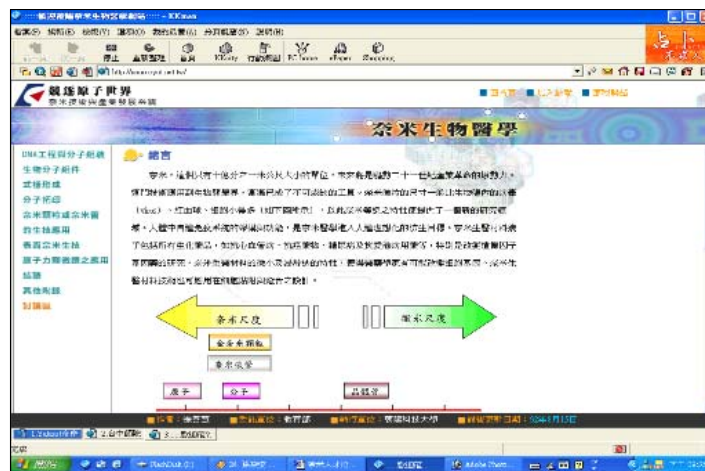


Figure 4. Home page of the nanobiology e-learning network



Figure 5. Home page of the teaching materials for elementary school e-learning network



Figure 6. Poster for the originality competition



Figure 7. 2003 Nanotechnology camp for high school teachers