DOCUMENT RESUME

ED 416 413		CE 075 945

AUTHOR	Lee, Lung-Sheng
TITLE	Implementation Possibility for Engineering Technology in Taiwan's Senior High Schools.
PUB DATE	1998-03-00
NOTE	17p.; Paper presented at the Korean Institute of Industrial Educators Conference (Taejon, South Korea, March 9-21, 1998).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Curriculum Development; Educational Research; Elective Courses; *Engineering Technology; Foreign Countries; High Schools; Industrial Arts; Program Development; Required Courses; *Technology Education
IDENTIFIERS	*Taiwan

ABSTRACT

Taiwan's senior high school technology education (TE) is moving from industrial arts (IA) to living technology (LT). However, senior high school LT faces two major challenges. First, LT, a required course, may be changed to an elective. Second, there is only a vague distinction between junior high school LT and senior high school LT. In terms of these challenges, engineering technology (ET) or engineering-based TE is suggested. A preliminary survey of 21 inservice senior high school IA teachers who participated in a 2-week LT workshop indicated the following: (1) 81 percent of respondents supported dividing LT into several 72 hours of TE elective courses and requiring all students to take at least 1 course; (2) 81 percent of respondents supported adopting ET as 1 of TE's elective courses; and (3) 52 percent of respondents assessed senior high school students' needs for ET. However, only 38 percent of respondents expressed competency to teach ET and 48 percent said they might integrate ET into LT. Consequently, the following conclusions are drawn: more dialogue concerning ET is needed among technology educators; ET may not be an appropriate course title; a math, science, and technology approach to TE is demanding; and international exchange of information should be promoted. (A syllabus outline for ET is appended.) (Author/YLB)

Running head: ENGINEERING TECHNOLOGY EDUCATION

Implementation Possibility for Engineering Technology in Taiwan's Senior High Schools

Lung-Sheng Lee
National Taiwan Normal University

Paper presented at
the 1998 Korean Institute of Industrial Educators (KIIE) Conference,
Taejon, Korea,
March 19-21, 1998

Abstract

Taiwan's senior high school technology education (TE) is moving from industrial arts (IA) to living technology (LT). However, senior high school LT faces two major challenges. First, required LT may be changed to an elective one. Second, vague distinction between junior high school LT and senior high school LT. In terms of these challenges, engineering technology (ET) or engineering-based TE is suggested. The author conducted a preliminary survey and found: (1) 81% of respondents supported dividing LT into several 72 hours of TE elective courses and requiring all students to take at least one course; (2) 81% of respondents supported adopting ET as one of TE's elective courses; and (3) 52% of respondents assessed senior high school students' needs for ET. However, only 38% of respondents expressed competency to teach ET and 48% said they might integrate ET into LT. Consequently, the following conclusions were drawn: (1) More dialogue concerning engineering technology in needed among technology educators. (2) Engineering technology may not be an appropriate course title. (3) An MST approach to technology education is demanding. (4) International exchange of information should be promoted.

Implementation Possibility for Engineering Technology in Taiwan's Senior High Schools

Technology Education in Taiwan Is Moving from Industrial Arts to Living Technology

The present primary and secondary school system in the Republic of China on Taiwan (henceforth called Taiwan) is based upon the 6-3-3 system: six years in elementary school, three years in junior high school (JHS) and three years in senior high school (SHS) or senior vocational school (SVS) (see Figure 1). In the 1996 school year, the percentage of SHS students was 34% and the percentage of SVS students was 66%. SHS students are commonly considered academically able.

School Year	1 2 3 4 5 6	7 8 9	10 11 12
	Elementary	JHS	SHS
	(Nine-year Compulsory Education)		SVS
			Five-year JC

JHS: junior high school SHS: senior high school
SVS: senior vocational school JC: junior college

Figure 1. Elementary and secondary schooling system in Taiwan.

Curriculum standards for each school level are determined and promulgated by the Ministry of Education (MOE). Each school's curriculum is planned and authorized textbooks are edited on the basis of the national curriculum standard. Present junior high school and senior high school curriculum standards went into effect in the 1984 school year, beginning August 1, 1984. Technology education (TE) in the present curriculum standard is called industrial arts（IA or "工藝"）. The newly revised junior high school curriculum standard began to go into effect in the 1997 school year while the newly revised senior high school curriculum standard will begin to go into effect in the 1999 school year. Technology education (TE) in the newly revised curriculum standard is called living technology (LT or "生活科技"）. That is, technology education in Taiwan is moving from IA to LT. In other words, in the 1997 school year the junior high school students in grades 8 and 9 (i.e., J2 and J3) are studying IA while those students in grade 7 (i.e., J1) are studying IA.

Based on the present and newly revised curriculum standards, a comparison of required IA and LT can be summarized as shown in Table 1. Compared to IA, LT is more systematic and design-oriented with an emphasis on gender equity. The main reason that LT provides all students in JHS's and SHS's with the same four domains is that a spiral curriculum is expected to be offered (see Figure 2).

Table 1.
Secondary School Technology Education (TE) Curricula in Taiwan.

	Present Subject	Newly revised Subject
Junior High (Grades 7-9 or J1-J3)	**Industrial Arts (IA)** *All students are required to select "Industrial Arts" (IA) or "Home Economics" (HE). *IA consists of two hours/week or about 216 hours in three years. *IA consists of 13 domains.	**Living Technology (LT)** *All students are required to take "Home Economics & Living Technology" (HE&LT), two hours/week. *LT in HE&LT consists of one hour/week or about 108 hours in three years. *LT includes 4 domains.
Senior High (Grades 10-12 or S1-S3)	**Industrial Arts (IA)** *All students in grades 10 and 11 are required to take IA or HE, but schools commonly assign boys to IA programs. *Two hours/week or about 144 hours in two years. *IA consists of the following five domains: (1) project planning and drafting, (2) industrial materials, (3) power and energy, (4) information industry, and (5) automation.	**Living Technology (LT)** *All students in grades 10 and 11 are required to take HE&LT, two hours/week. *LT in HE&LT consists of one hour/week or about 72 hours in two years. *LT includes the following four domains: (1) technology and life, (2) information and communication, (3) construction and manufacturing, and (4) energy and transportation. These four domains are the same as those in junior high school LT.

Note: In addition to the required IA and LT shown in Table, some elective courses related to IA and LT are recommended in both the junior high school and senior high school curriculum standards.

Source: Lee, 1997.

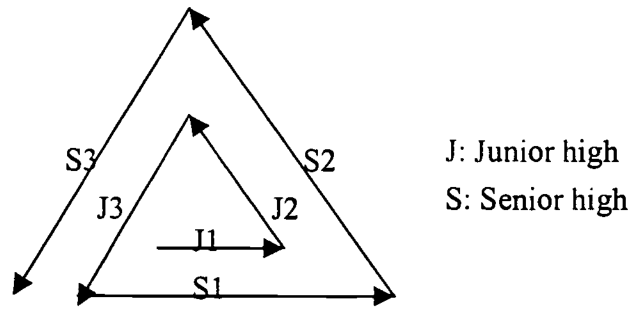

Figure 2. A diagrammatic concept of spiral curriculum.

Senior High School Living Technology (LT)'s Challenges

The lack of qualified teachers, and adequate equipment, insufficient financial support and teaching hours, and out-of-date curricula are common problems faced by many countries in the implementation of TE programs. In addition to these common problems, the following two challenges are also found faced by senior high school LT:

1. Required LT may be changed to an elective one.
   Due to the explosion of knowledge, available to senior high school students, they must endure an increasing number of courses. In order to relieve students' study loads, some courses will be integrated or changed. Some technology educators fear that the required LT may be changed to an elective one because it is not a required subject in Taiwan's college entrance examination.
2. Vague distinction between junior high school LT and senior high school LT.
   As mentioned earlier, a fully articulated junior high school LT and senior high school LT is expected to be found in a spiral curriculum. However, some technology educators fear that the difference between junior and senior high school LT may be too undetermined to demonstrate explicit student learning outcomes at these two schooling levels.

Engineering Technology (ET) May Be A Solution

In view of the above two challenges, finding ways to defend or enrich TE is necessary. Either implementing ET, rather than LT, in senior high schools or integrating principles of engineering into senior high school LT is a solution. For example, Land (1996) stated:

> The task ahead for technology in Taiwan is to build engineering-based technological literacy into the school curriculum with the collaboration of the science and engineering disciplines so that all students possess basic knowledge and competencies associated with technology and become well informed about

the nature, power, and limitations of technology. (p. 190)

Land's statement may be linked to Kozak and Plummer's (1995) argument: Emerging technologies, declining technology teacher education programs, and the evolution of engineering into multidisciplinary areas suggest that engineering and engineering technology might serve the needs of public schools better than technology education.

As shown in Figure 3, senior high school students need to pay more attention than junior high school students in preparation for their careers. For Taiwan's parents, the engineering has as positive an image as medicine, law or accounting, so parents will also encourage their children to take up the engineering profession. Additionally, more than 50% of college students, which are mainly senior-high-school graduates, are in colleges of science and technology, including engineering (see Figure 3). Therefore, senior-high schools in Taiwan have a good potential to provide students with engineering technology or engineering-based technology education. However, it is important to know how senior-high-school IA teachers assess this potential.

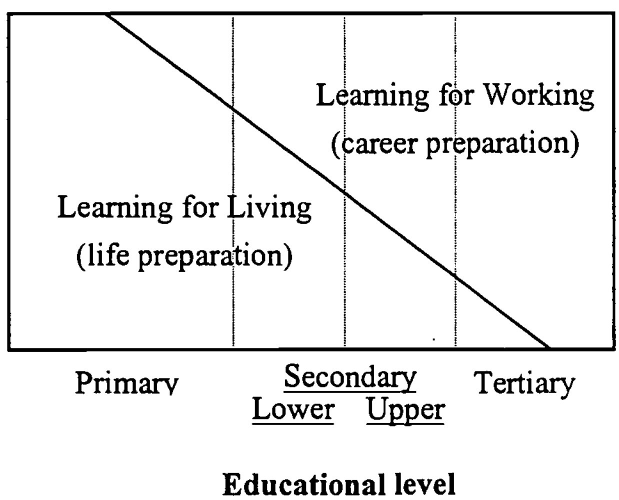

Figure 3. Articulated learning continuum.

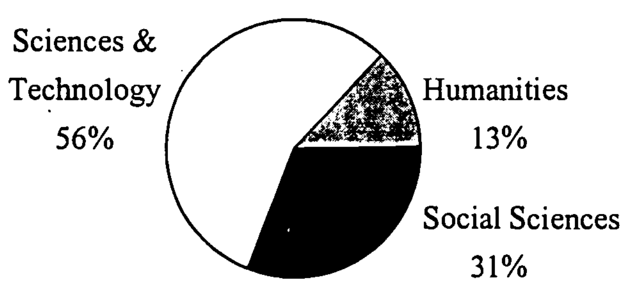

Figure 3. Distribution of higher education students by college category in the1996 school year.

Senior High School IA Teachers Assess Implementation of Engineering Technology (ET)

The State of New York implemented "Principles of Engineering" (PE) as an optional MST (math, science and technology) approach to high school (grades 9-12) TE. The goal of this course is to provide a one year introduction to engineering for academically able 11th or 12th grade students. As stated by the New York State Education Department (1997), PE is:

> a 1/2 or 1 unit integrative, hands-on, laboratory-based course which introduces students to concepts of engineering (ethics, design, modeling, optimization, systems, technology/society interactions). These concepts are applied to solving problems contained in "real world" case studies. Case study abstracts relate to auto safety computer automation and control, energy, communications, structural design and designing technology for people with disabilities. (p. 56)

In order to know how Taiwan's senior high school IA teachers assess the implementing ET in the senior high schools, the author adapted PE syllabus (The State Department of Education, 1995) to the ET syllabus outline shown in Appendix and conducted a preliminary questionnaire survey in February 1998. Twenty one in-service senior high school IA teachers who participated in a two-week LT workshop at National Taiwan Normal University responded to the questionnaire. The average length of teaching senior high school IA was 5.8 years, ranging from 1 to 28 years. Their average IA teaching load is 14.5 hours per week, ranging from 4 to 27 hours. Other basic data of those respondents are shown in Table 3.

Table 3.

Basic Data of Questionnaire Respondents.

Demographic Feature		N	%
Gender:	Male	20	95.2
	Female	1	4.8
School Affiliation:	Public	11	52.4
	Private	10	47.6
Qualified IA Teacher?	Yes	20	95.2
	No	1	4.7

Based on the ET syllabus outline shown in Appendix, five close-ended questions and one open-ended question were asked in the questionnaire. Respondents' opinions on the close-ended questions are shown in Table 4. There were 81% of respondents supported dividing LT into several 72 hours of TE elective courses and requiring all students to take at least one course; 81% of respondents supported adopting ET as one of TE's elective courses; and 52% of respondents assessed senior high school students' needs for ET. However, only 38% of respondents expressed competency to teach ET and 48% said they might integrate ET into LT. In addition, five IA teachers responded to the open-ended question, with comments or raised questions from the syllabus outline. Three of them were concerned about teacher enrichment for teaching ET, and two other responses were apart from the question.

Table 4.
Questionnaire Responses.

	Extent/Strength				
Items	+2	+1	0	-1	-2
1. to divide LT into several 72 hours of TE elective courses and require all students to take at least one course	8 (38.1)	9 (42.9)	2 (9.5)	2 (9.5)	0 (0)
2. to adopt ET as one of TE's elective courses	5 (23.8)	12 (57.1)	1 (4.8)	3 (14.3)	0 (0)
3. to assess senior high school students' needs for ET	3 (14.3)	8 (38.1)	4 (19.5)	6 (28.6)	0 (0)
4. to express competency to teach ET	2 (9.5)	6 (28.6)	6 (28.6)	5 (23.8)	2 (9.5)
5. to integrate ET into LT	3 14.3	7 33.3	6 28.6	5 23.8	0 0

Conclusions

The results of the above survey cannot be generalized to conclude all senior high school IA teachers' responses, however, the following conclusions can be drawn:

1. More dialogue concerning engineering technology is needed among technology educators.

   The implementation possibility of ET into senior high schools will be more clearly provided with increased dialogue among technology educators relating to ET rationale, goals, content, methods, etc.

2. Engineering technology (ET) may not be an appropriate course title.

   According to Beck (1993), "the aim of engineering technology education, which is basically a post secondary process, is to train technical personnel (technicians and technologists--practical engineers) who ought to serve as a link between the academic engineer and the practical reality (involving skilled workers and/or automatic manufacturing)" (p. 269). That is, ET has been used in post-secondary vocational-technical education for a while. Senior high school students are academic-oriented and TE is a realm of general education. Thus, ET may not be an appropriate course title for senior high school students.

3. An MST approach to technology education is demanding.
   Technology and engineering may be roughly defined as "human innovation in action" (International Technology Education Association, 1997) and "human endeavor to turn ideas into reality," respectively. Much confluence may be found between technology and engineering. The main distinction between technology and engineering is the fact that engineering is more theoretical, analytical and thus greatly relies on mathematics and scientific principles. In view of the fact that senior high school students are considered academically able and many of them will pursuit further study in colleges of science and technology, they deserve an MST approach to TE.
4. International exchanges of information should be promoted.
   With a view of mutual benefit, the countries cherishing TE, ET, etc. should make efforts to facilitate international exchanges of information concerning innovations, ideas and experiences in TE, ET, etc.

In summary, the possibility to implement ET in the senior high schools in Taiwan is optimum but needs more supportive effort. Ongoing facilitation will be conducted.

References

Beck, T. J. (1993, June). A1 + 1 (+2) high-technology partnership in manufacturing engineering technology. Sweetwater, TX: Texas State Technical College. (ERIC Document Reproduction Service No. ED 365 877)

International Technology Education Association (ITEA). (1997). Standards for technology education. Reston, VA: Author, Technology for All Americans Project.

Kozak, M. R., & Plummer, M. C. (1995). A role for engineering in the public school curriculum. Journal of Technology Studies, 21(2), 70-73.

Land, M. (1996, March). Technological literacy: An engineering perspective. Paper Presented at the Workshop on Technological Literacy and Technology Education, Taipei, Taiwan, March 16.

Lee, L. S. (1997). Moving from industrial arts to living technology: The status of technology education in Taiwan, R.O.C. Paper presented at the 1997 International Conference on Technology Education in the Asia-Pacific Region (ICTE'97), Taipei, Taiwan, April 23-26.

The State Education Department. (1995). Technology education-Principles of engineering: An MST approach to technology education. Grades 9-12 Elective. Albany, NY: The University of the State of New York, Author.

The State Education Department (1997). Publications catalog (Winter 1997-1998). Albany, NY: The University of the State of New York, Author.

Author Note

Dr. Lung-Sheng Lee (李隆盛) is a professor and the Department Chair of the Department of Industrial Technology Education at National Taiwan Normal University (NTNU, or "國立台灣師範大學"), the secretary-general of the Industrial Technology Education Association (ITEA, formerly called the Chinese Industrial Arts Education Association--CIAEA), Taiwan, R.O.C., and an adviser to the Science and Technology Advisory Office, Ministry of Education (MOE), R.O.C. He thanks the Korean Institute of Industrial Educators (KIIE) who invited him to write this paper and make a presentation at the 1998 KIIE conference.

Correspondence concerning this paper should be addressed to Lung-Sheng Lee, Department of Industrial Technology Education, National Taiwan Normal University, 162 Hoping E. Rd., Sec. 1, Taipei 106, Taiwan, R.O.C. Electronic mail may be sent via the Internet to t83006@cc.ntnu.edu.tw.

Appendix:
A Syllabus Outline for Engineering Technology*

I. Course Description

This is an elective course aiming to provide academically able 10th or 11th grade students with 72 teaching hours of integrative hands-on and mind-on laboratory-based set of case studies.

II. Course Goals

This course is designed to assist students:

1. to stimulate interest in and access to careers in engineering and technology.
2. to explore the relationship between mathematics, science, technology (MST), and engineering.
3. to integrate the study of MST.
4. to enhance general technological literacy.

III. Instructional Environment

This course will be taught in a laboratory providing access to tools and materials for individual or grouping learning. Tools will include hand tools for processing wood, metal, plastics, electronic, and simple chemical projects as well as computers to be used for design, communication, and control.

IV. Case Study

Real world engineering problems, covering a wide range of content, are presented as case studies and posed to students. Each case study is an approximate 12 teaching hours unit. Major concepts are introduced at the beginning of the unit and are reinforced through students' involvement in individual, small group, and large group hands-on case studies. The following are possible case studies:

1. Auto Safety
2. Communications Technology
3. Encrgy Applications
4. Machine Automation and Control
5. Shelter Design
6. Designing for People with Disabilities

V. Instructional Contents

The major engineering concepts to be developed are as follows:

1. Engineering Design

   Identify needs and opportunities for solutions using engineering concepts; gather information and review prior attempts to solve similar problems; generate alternative designs; analyze strengthens and weakness of each alternative; determine the solution; test the results while assess the process and impact on humans and the environment.

2. Modeling

   Use mathematical models (e.g., charts, graphs, and equations), systems diagrams, and modeling hardware to design and build descriptive and functional models; explain the uses and limitations of physical, mathematical, and conceptual models; select and use simulation software to design, implement and test engineered systems.

3. Systems

   Describe systems in terms of inputs, processes, outputs, and feedback/control mechanisms; explain and demonstrate how systems are comprised of interrelated subsystems; contrast open- and closed-loop systems.

4. Optimization

   Apply algorithmic and trial and error techniques in decision making; explain consequences involved in making trade-offs; consider criteria and constraints in real-world decision making situations; demonstrate use of cost-benefit and risk-benefit analysis in decision making; use quantitative methods to analyze designs.

5. Technology-Society Interactions

   Explain how engineering effects our values, world view, and knowledge base; explain why experts sometimes disagree about a course of action on social issues related to engineering; describe the various ethical position in a controversial engineering endeavor; explain, with specific examples, how engineering relates to other areas of study; describe alternative approaches to the solution of socio-technological problems (e.g., education, legislation, technological fixes); take action in an effort such as lobbying, recycling, and/or developing a technological solution.

6. Engineering Ethics

   Consider the legal and professional responsibilities of contractual agreements and activities; exhibit social responsibility by considering benefits or risk to society, individuals, and the environment; assess long term vs. short term risk and gains in making decisions.

In each case study, the above concepts should be interlaced with substantial contents. For example, in the module "Gear Mechanisms," which may be one of the content areas of the unit "Machine Automation and Control," the following concepts are suggested:

1. Engineering Design: Design and build a gear mechanism that will transmit motion at right angles.
2. Modeling: Build a simple gearbox.

3. Systems: Explain the concepts of gear ratio and compound gear transmission.
4. Optimization: Explain the relationships between cost, speed, and strength.
5. Technology-Society Interactions: Explain the effect of the automatic transmission on society.
6. Engineering Ethics: Discuss the responsibility of auto manufacturers regarding the problem of transmission systems which "jump" from park to reverse when the car is parked with the engine running.

VI. Learning Outcomes

A. Students will demonstrate the following broad-based skills:

1. Communication Skills

   Communicate as person to person, person to group, person to machine, and machine to machine; assist classmates as individuals, and while working in teams; present oral reports; program computers and computer-aided machines to solve problems and to communicate with another machine for the purpose of controlling its activity; present written reports that describe the engineering solution.

2. Skills in Using Technical Tools, Resources, and Processes

   Use computer-aided design and drafting (CAD-D) software, computer simulations, application software, and computer hardware including interfaces for computer-aided manufacturing (CAM); develop skills in using hand tools, machines, equipment and instruments; access and use sources of information including community-based resources, subject-matter experts, electronic data bases, and text. Select and process materials based upon their properties, cost, availability, suitability, and ease of disposal.

3. Measurement

   Develop and refine skills in using various measuring devices to measure distance, area, volume, time, force, mass, velocity, and acceleration; calibrate measuring devices against known standards.

4. Applying Mathematics and Science

   Develop and refine skills in mathematical problem solving, reasoning, communication, and connections between topics in mathematics and between mathematics and other disciplines; develop and refine skills in computation through estimation, use of calculators, and computers; develop and refine skills in scientific inquiry, and expand knowledge of science concepts and principles related to case studies (e.g., calculating mechanical advantages vs. velocity ratios in gear mechanisms)

B. Students will demonstrate their understanding that:

1. Science, technology, and society interact.

2. Technology can be used to solve human problems.
3. Technology is a part of a larger system.
4. Humans should use technology to their best long term advantage.
5. Engineers personnel must maintain high standards of ethical conduct and competence.
6. In the performance of their professional duties, engineering personnel shall hold paramount the safety, health, and welfare of people.

VII. Student Assessment

Student assessment will be accomplished through various means, including assessment of student performance on tasks related to the case studies; paper and pencil tests using questions related to the major concepts and content of the case studies; and discussions between teacher and student, and teacher and student teams. Students will be expected to keep a portfolio which will document their efforts at finding and generating alternative solutions to the case study design problem. The design portfolio should include: the statement of the problem, investigation and analysis, alternative designs/solutions, identification of the chosen solution and reasons for the choice, drawings and sketches, plans, and testing/evaluation procedures and results.

* Adapted from: The State Education Department. (1995). Technology education-Principles of engineering: An MST approach to technology. Grades 9-12 Elective. Albany, NY: The University of the State of New York, Author.

2. Technology can be used to solve human problems.
3. Technology is a part of a larger system.
4. Humans should use technology to their best long term advantage.
5. Engineers personnel must maintain high standards of ethical conduct and competence.
6. In the performance of their professional duties, engineering personnel shall hold paramount the safety, health, and welfare of people.

VII. Student Assessment

Student assessment will be accomplished through various means, including assessment of student performance on tasks related to the case studies; paper and pencil tests using questions related to the major concepts and content of the case studies; and discussions between teacher and student, and teacher and student teams. Students will be expected to keep a portfolio which will document their efforts at finding and generating alternative solutions to the case study design problem. The design portfolio should include: the statement of the problem, investigation and analysis, alternative designs/solutions, identification of the chosen solution and reasons for the choice, drawings and sketches, plans, and testing/evaluation procedures and results.

* Adapted from: The State Education Department. (1995). Technology education- Principles of engineering: An MST approach to technology education. Grades 9-12 Elective. Albany, NY: The University of the State of New York, Author.

CE 075 945

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

ERIC®

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Implementation Possibility for Engineering Technology in Taiwan's Senior High Schools

Author(s): Lung-sheng Lee

Corporate Source: National Taiwan Normal University

Publication Date: March 14-21, 1998

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to all Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 1	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2A	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2B
Level 1 ☑	Level 2A ☐	Level 2B ☐
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy.	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only	Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here,→ please

Signature: Lung-sheng Lee

Printed Name/Position/Title: Lung-sheng Lee, Professor

Organization/Address: National Taiwan Normal University, Department of Industrial Technology Ed. 162 Hoping E Rd, Sec 1 Taipei 106, Taiwan

Telephone: +886-2-2321-3864

FAX: +886-2-2392-1015

E-Mail Address: t83006@cc.ntnu.edu.tw

Date: March 3, 1998

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, *or*, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

Acquisitions Coordinator
ERIC Clearinghouse on Adult, Career, and Vocational Education
Center on Education and Training for Employment
1900 Kenny Road
Columbus, OH 43210-1090

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to: