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ABSTRACT

In Taiwan, technology education has traditionally been covered by two courses: Craftwork and Industrial Arts (IA). At present, all students in grades 1-6 take Craftwork. At the junior and senior high school levels, IA is considered a subordinate subject, and students must elect IA or home economics. In accordance with Taiwan's new national curriculum standards, which will take effect in 1998, IA will be replaced by courses titled Living Technology (LT). At both the junior and senior high school levels, the new LT courses will emphasize the study of technology to equip youth with the living skills needed in a technological society. At present, male students take two periods of IA weekly. To reflect the value of gender equity education, all students (male and female) will be required to take both the LT and home economics courses. The present number of hours required in IA will be cut in half to accommodate the increased number of students taking the LT course. Compared with IA, LT will be more systematic and interdisciplinary and place more emphasis on higher-order thinking skills (design and problem solving processes). Implementing the transition to LT will require the retraining of IA teachers. (MN)

Running head: TECHNOLOGY EDUCATION IN TAIWAN

Moving from Industrial Arts to Living Technology: The Status of Technology Education in Taiwan, R.O.C.

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Abstract

Technology education in Taiwan, R.O.C. is mainly covered by the elementary-school subject--craftwork, and the secondary-school subject--industrial arts. This paper describes these two subjects based on their national curriculum standards and introduces the transition of secondary-school technology education from industrial arts (IA) to living technology (LT). In this transition, the following obvious formal and substantial changes are observed: (1) a name change from industrial arts to living technology, (2) an expansion of its clients from a percentage of students to all students, (3) a reduction in classroom hours, (4) a restructuring of content domains, and (5) an emphasis on higher-order thinking. In addition, the efforts made to pragmatically implement the new LT curricula are explained.

Moving from Industrial Arts to Living Technology: The Status of Technology Education in Taiwan, R.O.C.

For more than four decades, the Republic of China on Taiwan (henceforth, called the R.O.C. or Taiwan) has been called "Free China," to distinguish it from the people's Republic of China (P.R.C.) on the mainland which is often referred to as "mainland China" or "communist China." As one of the six "Asian Dragons" or Dynamic Asian Economies (DAEs) along with Hong Kong, Malaysia, Singapore, South Korea and Thailand, Taiwan is often praised for its economic prosperity and political democratization. For example, Nomura Research of Japan has predicted that several high-tech industries in Taiwan, including information, telecommunications, semiconductors, computer software, and aerospace, will maintain double digit annual expansion from 1996 to 2005 (Business Briefs, 1996). As another instance, according to a recent IMD (Lausanne, Switzerland-based International Institute for Management and Development) survey of 46 countries, Taiwan made progress in technological strength, ranking 11th, up six notches from the 1996 rating (Benedicto, 1997). It is recognized that through hard work and a willingness to learn, the people of Taiwan have enabled this nation hold its head high (DuPont, 1996).

The present school system in Taiwan is based upon the 6-3-3-4 system: six years in elementary school （國小）, three years in junior high school （國中）, three years in senior high school （高中） or senior vocational school（高職）, and typically four years in college or university[1]（大學）. Curriculum standards for each school level are determined and promulgated by the Ministry of Education (MOE), and each school's curriculum is planned and authorized textbooks are edited on the basis of the national curriculum standard. The curriculum standard is commonly revised approximately every 10 years. Present elementary-school, junior-high-school and senior-high-school curriculum standards were implemented in the 1978, 1984, and 1984 school years[2] respectively, and their newly-revised curriculum standards will go into effect in the 1996, 1997 and 1998 school years respectively.

Industrial Arts Has Been Swimming Up Stream and Is Evolving into Living Technology

Technology education（科技教育, pronounced *ke-jih-jiau-yuh* in Chinese) is prescribed in school curriculum standards. The main subject of technology education at the secondary school level is called industrial arts（工藝, pronounced *gong-yih* in Chinese） in the present curriculum standards and will be called living technology（生活科技, pronounced *sheng-hwo-ke-jih* in Chinese） in the new curriculum standards. Thus, technology education in this paper is seen as a general term covering industrial arts and living technology. According to the present and new elementary, junior-high-school, and senior-high-school curriculum standards, the main subjects of technology education can be summarized as in Table 1.

Table 1.

A Brief Summary of Technology Education Programs Prescribed in the Present and New Curriculum Standards.

	Course Title and Synopsis	
Level	Present Curriculum Standard	New Curriculum Standard
Elementary (Grades 1-6)	**Craftwork** （美勞） -Required for all students. -2 hrs/wk for grades 1 and 2, and 3 hrs/wk for grades 3-6. -Consisting of three domains; in the domain of Presentation and Practice[3], painting, sculpture, design, industrial arts, horticulture and home making are incorporated.	**Craftwork** （美勞） -Required for all students. -2 hrs/wk for grades 1 and 2, and 3 hrs/wk for grades 3-6. -Consisting of three domains; in the domain of Life Practice[4], living technology is emphasized as well as applied arts.
Junior High (Grades 7 -9)	**Industrial Arts** [5] （工藝） -All students are required to select "Industrial Arts" (IA) or "Home Economics" (HE), but schools commonly assign boys to IA programs. -IA consists of 2 hrs/wk or about 216 hrs in 3 years (i.e., grades 7-9). -IA consists of 13 domains.	**Living Technology** （生活科技） -All students are required to take "Home Economics & Living Technology" (HE&LT), 2 hrs/wk. -LT in HE&LT consists of 1 hr/wk or about 108 hrs in 3 years. -LT includes 4 domains.
Senior High (Grades 10 -12)	**Industrial Arts**[6] （工藝） -All students in grades 10 and 11 are required to take IA or HE, but schools commonly assign boys to IA programs. -2 hrs/wk or about 144 hrs in 2 years (i.e., grades 10 and 11). -IA consists of 5 domains.	**Living Technology**[7] （生活科技） -All students in grades 10 and 11 are required to take HE&LT, 2 hrs/wk. -LT in HE&LT consists of 1 hr/wk or about 72 hrs in 2 years. -LT includes 4 domains, the same as those in junior-high-school LT.

Source: Lee, 1996; Lee, 1997.

As shown in Table 1, craftwork is required for all elementary-school students, but actually few components of technology education are incorporated into this wide-ranging subject. The main reason is that craftwork teacher training departments/programs in teachers colleges have provided pre- and in-service elementary-school craftwork teachers with abundant fine arts courses. Fortunately, the number of technology teacher educators in craftwork teacher training departments/programs has gradually increased. They could make a difference.

As is also shown in Table 1, currently, male secondary-school students (7-12 graders) in grades 7-11 are required to take two periods (50 minutes/period) of industrial arts weekly. However, implementation of any curriculum standards requires a balance in the supply of and demand for qualified teachers, appropriate facilities and equipment and adequate instructional materials.

Regarding the number and quality of teachers, the balance between the demand for and the supply of industrial arts teachers has been observed and controlled by educational authorities because secondary-school teachers in Taiwan have mainly been produced by the normal universities. There have been two departments of industrial technology education (formerly called the departments of industrial arts education) located at National Taiwan Normal University (NTNU) and National Kaohsiung Normal University (NKNU) respectively. These two departments have primarily aimed to train secondary-school pre-service and in-service industrial arts teachers and currently offer undergraduate and master's degree programs. In order to become qualified industrial arts teachers, undergraduate students in the two departments, who mainly graduate from senior high schools and pass the nationwide College Joint Entrance Examination (CJEE), have to satisfactorily complete a four-year on-campus course of study and a one-year secondary-school-based internship. During their four years on campus, students receive a tuition-waiver and partial living expenses.

The pre-service teacher preparation curriculum has three principal components: general/liberal coursework, technical/specialty coursework, and pedagogical/professional coursework. Although a minimum of 20 credits of designated technical coursework and a minimum of 20 credits of specified pedagogical coursework are mandated in the current secondary-school teacher certification requirements, teacher preparation programs commonly offer their students more than the minimal requirements. For instance, the minimum credit number for graduation for undergraduate students in the Department of Industrial Technology Education at NTNU is 148--28 credits in required general coureswork, 63 credits in required technical coursework, 26 credits in required pedagogical coursework, and 31 elective credits from the above three components.

However, the teacher preparation system in Taiwan is changing. Under the

"Teacher Preparation Law," revised in 1994, all public and private universities and colleges which have approved colleges, departments, graduate institutes and/or programs specializing in education may participate in teacher training. After taking a close look at this "open-door policy," many teacher educators began to be concerned about whether the quality of future industrial arts/living technology teachers could be assured. Also influenced by this policy, the two departments of industrial technology education at the two normal universities--NTNU and NKNU--began to expand their offerings. For example, the department at NTNU began to offer human resource development (HRD) and industrial technology (IT) programs to prepare employees for industry.

In order to help in-service industrial arts teachers to continue to develop competency, educational authorities offer many in-service professional training and development opportunities such as short-term workshops and master's-degree-track or non-degree-track graduate study. Many of these opportunities are provided free of charge. Incentives to encourage industrial arts teachers to participate in ongoing professional training and development are usually salary-based. Since school teachers' certificates are good for life and there is no teacher ladder to push them to participate in in-service training, it is a valid criticism that educational authorities only provide in-service teachers with a "carrot" but no "stick."

With respect to industrial arts facilities and equipment, in order to establish the minimum facility and equipment requirements for school subjects, secondary-school equipment standards are normally promulgated by the MOE after each curriculum standard revision. However, it has been found that almost none of the secondary schools meet the requirements prescribed in the present industrial arts equipment standards. Some schools even have no industrial arts laboratory.

Regarding instructional materials, the present industrial arts textbooks are compiled and printed by commercial publishers, but these textbooks must be approved by the MOE before distribution. Coupled with approved textbooks are handouts developed by school teachers.

In addition to the above contextual factors in the implementation of curriculum standards, the following four routine events can also be considered as support: (1) The Chinese Industrial Arts Education Association (CIAEA), now located in the Department of Industrial Technology Education at NTNU, devotes its energies to improvement of industrial arts education at all levels through recognition of outstanding industrial arts educators, conferences, publications, etc. (2) Funded by educational authorities and edited by the Department of Industrial Technology Education at NTNU, the "Journal of Industrial Arts Education" is disseminated monthly, free of charge, to secondary-school industrial arts teachers. (3) The yearly randomly selective and

recommended-by-teacher junior-high-school students' industrial arts contest is held in Taipei. (4) An industrial arts consultative team, composed of industrial arts teachers, supervisors, and principals, is organized in every county and city to serve junior-high-school industrial arts teachers.

Although industrial arts has the above support, technology education still must swim upstream because it faces the following three main challenges:

1. Industrial arts is seen as a subordinate subject.

Secondary-school industrial arts has not been included among the required subjects for advanced entrance examinations. This leads most people to see industrial arts as a subordinate, unworthy subject, and causes industrial arts programs to lack desirable expectations and effective support.

2. The public's perceptions are not aligned with the field.

Industrial arts has commonly been perceived as the equivalent of handicraft or DIY (do-it-yourself). It is exhausting for technology educators who have to continuously communicate the principles of industrial arts to the public.

3. Teachers struggle with huge class sizes and limited teaching resources.

Instruction in industrial arts is largely defined by activities. However, most industrial arts teachers are confronted by huge class sizes (in the 1994 school year, junior high classes had 43 students and senior high had 46 on average) and limited teaching resources--laboratories, equipment, supplies, teaching materials, etc.

As mentioned earlier, administered by the MOE, the school curriculum standard is revised by a tentative curriculum revision committee approximately every 10 years. The subject-specific revision committee normally consists of administrators, teacher educators, school teachers, and curriculum specialists. In terms of a school subject, goals, time allocation, content profile, and implementation approach (suggesting the selection, compilation and organization of instructional materials, instructional strategies and keypoints, instructional facilities and equipment, and instructional evaluation) are prescribed in its curriculum standard. It has been a criticism that the curriculum revision cycle is too long to keep up with technological advancement and social change and no particular curriculum development mechanism is set to continuously work on curriculum planning, implementation and evaluation.

Also revised by tentative curriculum revision committees, the new LT at least has the following obvious formal and substantial changes from the present industrial arts (IA) (Lee, 1996):

1. Formal Changes

1.1 A name change from industrial arts to living technology

In order to emphasize the study of technology to equip youth with the living skills needed in a technological society, IA has undergone a name change to LT.

1.2 An expansion of its clients from a percentage of students to all students

In order to reflect the value of gender-equity education, all male and female students will be required to take both LT and home economics.

1.3 A reduction in classroom hours

In order to increase its clients, the present total number of classroom hours in IA will be cut in half.

2. Substantial Changes

2.1 A restructure in content domains

In order to organize the complicated content domain of IA, the content domain of LT will be more systematic and interdisciplinary.

2.2 An emphasis on higher-order thinking

In order to strengthen students intellectual skills, more design or problem-solving processes will be integrated with various technical processes in LT than in the current IA.

Since the new LT curriculum standards were promulgated, many school teachers have questioned how the new curriculum standard can be effectively implemented in their school laboratories. If IA teachers are unwilling and/or unable to implement LT curriculum standards in their classrooms, the ideals of LT will become "flowers in a mirror and the moon in water" (鏡花水月; i.e., "things appealing but unreal," "pie in the sky"). In order to help school teachers timely and appropriately implement the new LT curricula, some exemplary technology learning activities (TLA's) and related workshops have been developed and held to assist school teachers in developing their school-based curricula. For example, funded by the MOE and the Education Department of the Taiwan Provincial Government, a project team, which was directed by the author and composed of a co-project director, two project assistants, 21 school teachers, and 16 consulting teacher educators, was organized to develop a set of exemplary TLA's. Based upon the principle of "for the teacher and by the teacher," 24 junior-high and nine senior-high exemplary TLA's were completed in this project (Lee, 1997). As another instance, some technology teacher educators, including the author, are working on developing LT portfolios, which emphasize students' hands-on and mind-on learning through a design/problem-solving process. In addition, funded by the National Science Council (NSC), many research and development projects, such as a development of a technological literacy testing battery, and an international comparative study of technology education in the Asia-Pacific Region, have been conducted. Hopefully, coupled with other routine support, such as teacher training and textbook compilation, these efforts will meet school teachers' needs and promote the field.

Harder Work Needed in the Year of the Ox

According to the 12 terrestrial branches (地支， pronounced *ti-chih* in Chinese), the symbolic animal for 1997 is the ox[8]. Farmers in Taiwan traditionally used water buffalo to help them plow the rice paddy. Thus, to the Taiwanese/Chinese, the ox embodies diligence and perseverance. The secondary-school LT curriculum standards in Taiwan will take effect in the school year of 1997-- the Year of the Ox. This is a time when technology educators in this country must begin to work harder.

Since technology education in Taiwan is transiting from IA to LT, more and more technology educators in Taiwan realize that their primary mission at this time is to pragmatically implement the new LT curricula by enriching professional competency, developing a school-based curriculum, modifying IA laboratories, selecting instructional materials, etc. We hope that the new LT, built on the traditional IA, will better serve all students who need to be technologically literate in today's technological society as well as in the future.

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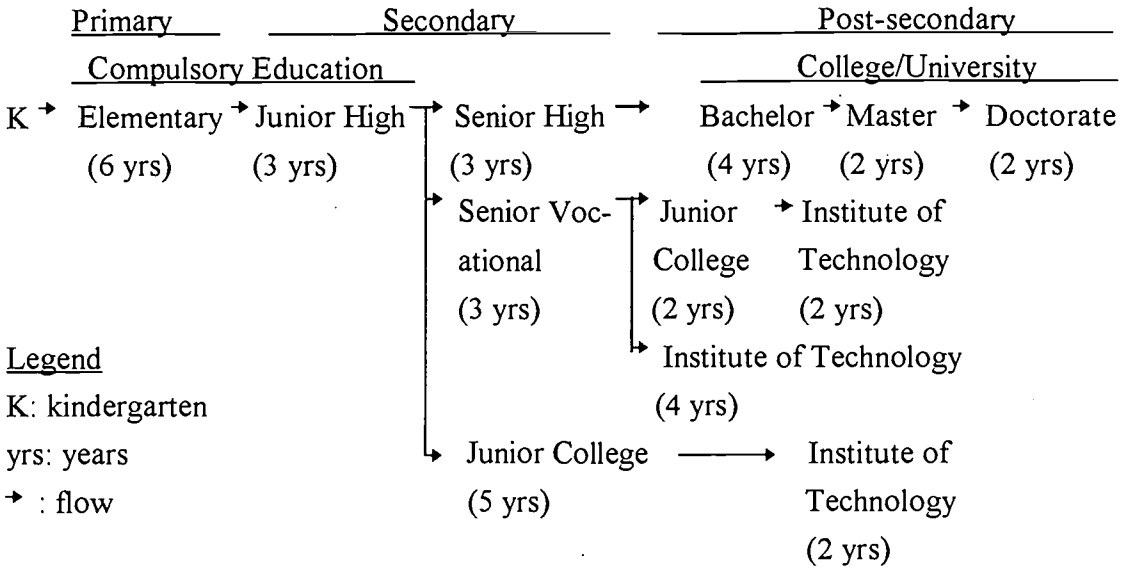
Footnotes

[1]The school system of Taiwan may be illustrated as follows:



[2]Each school year in Taiwan lasts from August 1 to July 31 of the next calendar year. For example, the school year of 1997 lasted from August 1, 1997 to July 31, 1998.

[3]The other two domains are Appreciation and Observation, and Inquiry and Discussion.

[4]The other two domains are Performance and Estheticism.

[5]In addition to the required subject, three elective courses pertaining to industrial arts--drafting, metalworking, and electronics--are prescribed in the present junior-high-school curriculum standard.

[6]Some elective courses classified as industrial arts--drafting, metalworking, woodworking, electricity, ceramics, etc.--are prescribed in the present senior-high-school curriculum standard.

[7]Additionally, drafting, energy and power, and industrial materials are prescribed as elective courses in the new senior-high-school curriculum standard.

[8]The Chinese yearly calendar has been expressed using two characters for a long time. The upper character is one of the 10 celestial stems (天干， pronounced *tien-kan* in Chinese), and the lower character is one of 12 terrestrial branches. The combination of the stems and the branches form a 60-year cycle. The 12 terrestrial branches are represented by 12 animals of the Chinese zodiac in the following order: rat, ox, tiger, rabbit, dragon, snake, horse, goat, monkey, rooster, dog, and pig.

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