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ABSTRACT

Technology and education are both rapidly being internationalized. In order to promote exchanges and cooperation in technology education between Asian countries and New Zealand, it is necessary to study the trends in Asian countries. The following trends were found in five Asian countries or economies (Hong Kong, Japan, Singapore, South Korea, and Taiwan): (1) flexibility in technology education in national curricula is increasing; (2) information technology is being increasingly incorporated into technology education; (3) the design process is becoming a new focus of technology education; (4) and the integration of technological content organizers is a new direction in technology education. The implications of these trends for New Zealand are that there should be more dialogue between New Zealand and Asian technology educators, and that computers should be applied as a vital tool in technological learning and teaching. (KC)

Running head: TRENDS IN TECHNOLOGY EDUCATION IN ASIA

Trends in Technology Education in Asia and Their Implications for New Zealand

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Paper presented at
the Second Biennial Telecom Technology Education New Zealand Conference,
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Abstract

There are few areas undergoing internationalization as rapid as that in either technology or education. In order to promote exchanges and cooperation in technology education between Asian countries and New Zealand, this paper introduces the following trends in technology education in five Asian countries/economies (Hong Kong, Japan, Singapore, South Korea and Taiwan): (1) Flexibility in technology education in national curricula is increasing. (2) Information technology is being increasingly incorporated into technology education. (3) The design process is becoming a new focus of technology education. (4) The integration of technological content organizers is a new direction in technology education. Based upon the above trends, the following two implications for New Zealand are found: (1) There should be more dialogue between New Zealand and Asian technology educators. (2) Computers should be applied as a vital tool in technological learning and teaching.

Trends in Technology Education in Asia and Their Implications for New Zealand

Internationalization is one of main common characteristics of both technology and education. For example, the mainland Chinese (i.e., PRC) government has attempted to keep computer users away from the web sites of Western newspapers, human rights organizations and dissident groups, but is for E-mail gives mainland China a censorship headache (May, 1999). As another example, many educational institutes in Western countries as well as in Australia and New Zealand like to recruit students from Asian countries. One of the primary reasons for recruiting these students is that international students pay much higher tuition than domestic students.

Technology education, a confluence of "technology" and "education," is increasingly a worldwide development in curriculum. In order for technology educators in different countries to learn from each other in this global technological society, technology education should be developed at the local level and discussed at the international level.

Introduction and Purpose

Although confronted with an economic slump caused by a currency crisis, the Asia Pacific region, consisting of the countries/economies of East and South East Asia, has emerged as the most dynamic component of the global economy. Some Asian leaders in the past liked to stress "Asian values" during the boom days in Asia. In addition, many Asian people like to say that the 19th century was the European century, the 20th century was the North American century, and the 21st century will be the Asian century.

In order to promote exchanges and cooperation in technology education between Asian countries and New Zealand, this paper introduces the following trends in technology education in the following five Asian countries/economies: Hong Kong, Japan, Singapore, South Korea and Taiwan. Japan and the United States are two economic giants within the Pacific Rim area while Hong Kong, Singapore, South Korea, and Taiwan are known as the Asian Four Little Dragons or the East Asian Newly Industrialized Countries (NICs), and are well-known for their high rates of economical growth. As a result of their people's hard work and willingness to learn, these five countries will remain the world's fastest growing economies in the 21st century.

Procedures and Methods

In G. Z. F. Bereday's four-stage comparative methodology (see Figure 1) (Bereday, 1966), an area study comprises the first two stages, and a comparative study consists of all four stages. Employing the concept of G. Z. F. Bereday's four-stage comparative methodology, country-specific information was collected through literature review, interviews and visitations. It should be noted that in 1996, funded by the National Science Council (NSC), this presenter and his associates completed a study on technology education in Singapore. In 1997, the International Conference on Technology Education in the Asia-Pacific Region (ICTE'97), organized by the presenter and his colleagues, was held in Taipei, Taiwan, from April 23 to 26. International delegates from the following eight countries in the Pacific Rim attended: Australia, Hong Kong, Japan, Korea, New Zealand, Thailand, Taiwan, and the U.S.A. In addition, in 1997, funded by the NSC, this presenter and his colleagues completed a cross-country comparative study on technology education in the following eight countries: Australia, Japan, Korea, Mainland China, Malaysia, New Zealand, the Philippines, and Taiwan. All of the study results and conference presentations provided valuable resources for understanding technology education in Asia.

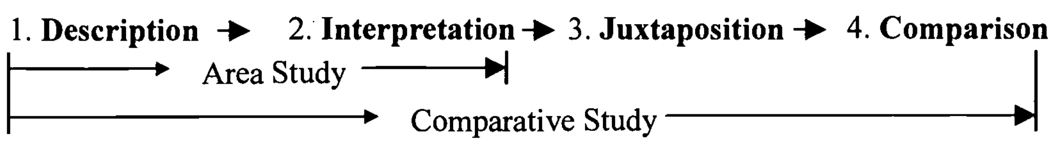

Figure 1. G. Z. F. Bereday's four-stage comparative methodology.

Findings and Conclusions

Country-specific technology education is briefly introduced in the following:

Hong Kong (HK)

Every child in Hong Kong begins six-year primary education (P1-P6) at the age of six. Beyond primary education, secondary schools offer a five-year course (S1-S5) in a broad range of academic subjects leading to the Hong Kong Certificate of Education Examination (HKCEE), which is equivalent to the GCSE in the U.K. Candidates for the HKCEE may enter a two -year sixth form course (S6-S7) leading to the Advanced Level Examination to prepare for admission to higher education institutes (Bray, 1994). The majority of secondary schools are grammar schools. Suggested curriculum time allocation for grammar schools is: languages, 35-40%; mathematics & science, 20-25%; humanities, 15-20%; cultural, practical & technical, 15-20%; and other learning activities, 5% (Wan & Lam, 1997).

The Curriculum Development Institute (CDI) in the Education Department works and advises on curriculum at the preschool, primary, and secondary levels as well as special education. Taking the CDI's advice, most grammar schools offer design and technology (D&T) in junior secondary classes (S1-S3). According to the present "Syllabus for Design & Technology (Form Ⅰ-Ⅲ)", which was published by the committee in1983, the aim of junior-secondary D&T is to develop students' awareness of the challenge of technology and their ability to realize its promise. The aim of the present senior-secondary (S4-S5) D&T curriculum, revised in 1996, is to encourage students to explore and apply modern technological knowledge and skills, including computer-aided design (CAD), in producing artifacts or systems, and to respond to change in an age of rapid technological advancement (Wan & Lam, 1997). Emphasizing personal development and students' experiences through exploration and practical activities, the content areas of the junior- and senior-secondary D&T curricula are those listed in Table 1.

According to Wan and Lam (1997), at the junior secondary level, experiential learning areas, such as the "exploration of material" and "manipulation of tools," are emphasized while at the senior secondary level, more time is spent on "materials processing" and "industrial processes." In addition, the following three D&T trends can be identified: (1) academically-oriented subjects, (2) updating of the curriculum, and (3) incorporation of information technology.

Table 1. Secondary- school D&T Curricula in Hong Kong

Junior secondary (S1-S3; i.e., Grades 7-9)	Senior secondary (S4 -S5; i.e., Grades 10 and 11)
1. Pre-requisite knowledge leading to design, exploration of materials (22 periods), design fundamentals (8 periods)	1. Design (35 periods)
2. Technological studies (22 periods)	2. Materials and materials processing (75 periods)
3. Actual design process	3. Engineering systems (35 periods)
4. Analytical & critical studies (8 periods)	4. Project work: small project (45 periods), exam. projects (50 periods)
5. Communication techniques	

Note: 1. The time allocation prescribed for junior secondary is calculated on a one - year basis while that prescribed for senior secondary is calculated on a two - year basis.

2. Every period is 40 minutes long on average.

Source: Wan & Lam, 1997.

Japan (JP)

Every child in Japan is required to receive nine years of compulsory education: six years of elementary education plus three years of lower secondary education (see Appendix 1). Monbusho (i.e., the Ministry of Education, Science, Sports and Culture) lays down national curriculum standards, called the "Course of Study," for all schools levels, from kindergarten to upper secondary. The present course of study has been put into effect in stages: in 1990 for kindergartens, in 1992 for all grades in elementary schools and in 1993 for all grades in secondary schools. Technology education, called "industrial arts," is mainly offered at the lower secondary level. Along with homemaking, industrial arts is one of eight required subjects. Every student is required to take 70, 70, 70-105 hours of industrials arts and homemaking in the 7^{th}, 8^{th}, and 9^{th} grades, respectively (see Appendix 1). The newly revised lower secondary course of study was completed in 1998 and will go into effect in 2002. The present teaching hours for 9^{th} graders--70-105--will be decreased to 35 hours. This subject currently consists of 11 categories, including timber processing, electricity, family life, food and the like. It will be reorganized so as to include two categories of industrial arts and homemaking. Industrial arts will emphasize content related to manufacturing and basic skills for computer processing.

Singapore (SN)

Every child in Singapore is required to receive six years of primary education and at least four years of secondary education (see Appendix 2). Primary education is divided into two stages: foundation and orientation. The foundation stage (Grades 1-4) emphasizes basic literacy and numeracy. Pupils in the orientation stage (Grades 5 and 6) are streamed into the following three language streams: EM1 (English and mother tongue as first languages), EM2 (English as first and mother tongue as second language), or EM3 (English as first language and mother tongue for oral proficiency). At the end of Grade 6, pupils take a national placement examination called the Primary School Leaving Examination (PSLE). According to their performance on the PSLE, pupils are admitted to the special, express, normal (academic), or normal (technical) course. The special course is designed for the top 10% of the students who are academically excellent and competent in language learning. About 50% of secondary-school students go into the express course. Normal (academic) course students (about 20-25%) and normal (technical) course students (about 10-15%) are allowed an addition fifth year before they qualify to take the General Certificate of Education (GCE) O-level examination because they are less academically able than express course students. The former (academic) students enroll in academic courses while the latter (technical) students, who are the lowest academically, enroll in technical courses. Students completing four years of study in the normal course (academic or technical) take the qualifying GCE N-level examination. Those who succeed in this examination are allowed to proceed to the fifth year in the normal course. At the end of either five years of normal or four years of special or express course study, the students take the GCE O-level examination (Yeoh, 1994).

The Curriculum Planning and Development Division (CPDD) of the Ministry of Education (MOE) is responsible for ongoing review and systematic revision of the national curriculum as well as the subject-specific multimedia package used in schools. According to the approved subject syllabuses, the present secondary technology education curricular titles are those shown in Table 2.

Table 2. Secondary-school Technology Education Curricula Singapore

Level	Normal (technical)	Special, Express and Normal (academic)
Lower secondary (Grades 7 and 8)	Technical Studies (TS) (Compulsory examination subject; two periods/week)	Design & Technology (D&T) (Compulsory examination subject; two periods/week)
Upper secondary (Grades 9 and 10)	TS or D&T*(Elective examination subject)	D&T (Elective examination subject)

*Those who have design potential are allowed to take D&T.

As shown in Table 2, D&T prepare pupils for living and working in a technological world. They help pupils to recognize the need for new or modified systems and then give pupils the capacity and confidence the need to design, make and evaluate these products and systems for themselves. In D&T, pupils are taught the design process and have an opportunity to work with a variety of materials, particularly, wood, metal and plastics, to enable them to acquire knowledge of a range of materials and to develop manipulative technical skills needed to obtain solutions to design problems. Designed for normal (technical) course students, TS has been specially tailored to equip pupils with a level of functional proficiency needed to pursue post-secondary industrial and engineering-biased courses at Institutes of Technical Education. Compared to D&T, TS emphasizes on practical work, the development of psychomotor skills and the acquisition of work attitudes (Tang, 1995). Obviously, streamed curricula may be the main characteristic of technology education in Singapore.

South Korea (KS)

In South Korea, both elementary and secondary education last for six years. Secondary education is composed of three years in middle school and three years in high school. High schools are mainly divided into general (academic) high schools and vocational high schools. Almost all of the specific details of the school curricula are determined by the Ministry of Education (MOE). Based on the secondary-school curricula revised in 1992, the secondary-school technology education curricula are those shown in Table 3.

Table 3.
Secondary-school Technology Education Curricula in South Korea.

Level	Subject Title	Time allocation
Middle (Grades 7-9)	Technology & Industry	Grade 7: one hour /week Grades 8 and 9: two hours/ week
High (Grades 10-12)	1. Technology (8), 2. Home Economics (8), 3. Agriculture (6), 4. Industry (6), 5. Commerce (6), 6. Housekeeping (6), 7. Information Industry (6), 8. Career & Vocation (6)	Each high school selects two (or one) subjects among the nine subjects shown to the left.

Source: Kim, 1997.

Both the middle- and high-school curricula are currently undergoing revision. Middle schools will use the new curriculum in 2001while high schools will do so in 2002. In the new curricula: (1) students in middle schools will study the integrated subjects of technology and home economics (two hours/week for 7th graders and three hours/week for 8th and 9th graders); (2) 10th graders in high schools will study the integrated subjects of technology and home economics (three hours/week) as in middle schools while 11th and 12th graders will choose from among the following six subjects: information society and computers (4 units), agricultural science (6 units), industrial technology (6 units), business administration (6 units), ocean science (6 units), and home economics (6 units) (Kim, 1997).

Taiwan (TW)

The present school system in Taiwan is based upon the 6-3-3 system: six years in elementary school, three years in junior high school (JHS), three years in senior high school (SHS) or senior vocational school (SVS). 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. Secondary - school technology education is prescribed in the curriculum standards; however, the newly revised junior-high-school and senior-high-school curriculum standards went or will go into effect in the 1997 and 1999 school years, respectively. Based on the present and new curriculum standards, the main subjects of technology education can be summarized as shown in Table 4. In addition, some elective courses related to technology education are recommended in both the junior-high and senior-high curriculum standards. Compared to IA, LT is more systematic and design-oriented with an emphasis on gender equity.

Table 4.
Secondary-school Technology Education Curricula in Taiwan. .

Level	Present Title and Synopsis	New Title and Synopsis
Junior high (Grades 7-9)	Industrial Arts -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 -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)	Industrial Arts -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 five domains.	Living Technology -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 four domains, which are the same as those in junior-high-school LT.

Source: Lee, 1997.

In response to calls for curricular reform, the present elementary and junior-high school curriculum standards are currently being revised. The newly revised curriculum, anticipated to be put into effect in 2001, emphasizes curricular coherence and integration. Technology education will interweave with science education.

Based on the above introduction, the following four conclusions cat least an be drawn:

1. The flexibility of technology education in national curricula is increasing.
All five countries/entities have national technology education curricula. All of them require lower-secondary-school students to receive technology education and offer upper-secondary-school students elective technology curricula.

Additionally, both South Korea and Taiwan require students to receive technology education in the earlier grades at the upper-secondary level. However, schools have increasing power to shape their own curricula.

2. Information technology is being increasingly incorporated into technology education.

   The computer is the most significant technological invention of the 20th century. It is found that serious effort has been made to incorporate the components of information technology into the technology education curricula in these five countries/entities.

3. The design process has become a new focus of technology education.

   Higher-order thinking, or the intellectual process, is being increasingly emphasized in the technology education curricula in these five countries/entities. That is, design/problem-solving is being increasingly incorporated into the contents of technology education.

4. The integration of technological content organizers is a new direction in technology education.

   It seems that number of teaching hours for school subjects, including technology education, is shrinking. Thus, the various content organizers in technology education are being combined.

Implications

In New Zealand, technology is a very new school subject. Although having visited New Zealand and reviewed some literature, such as "Technology in the New Zealand Curriculum" (Ministry of Education, 1995), this presenter's knowledge of technology education in New Zealand is limited and superficial. Nevertheless, the following implications for New Zealand are suggested:

1. There should be more dialogue between technology educators from New Zealand and Asian countries.

   As mentioned earlier, more and more Asian students are studying in New Zealand. In order to help technology educators in New Zealand better understand these students and to obtain benefits from international exchange of information, there should be more communication between technology educators in New Zealand and those in Asian countries.

2. Computers should be applied as a vital tool in technological learning and teaching.

   In order to make technological design and production process efficient and to enhance students' computer literacy, technology educators in New Zealand should note the increasing use of computers in technology education in the five Asian countries. Technology education in New Zealand will benefit if computer use is applied in every content organizer.

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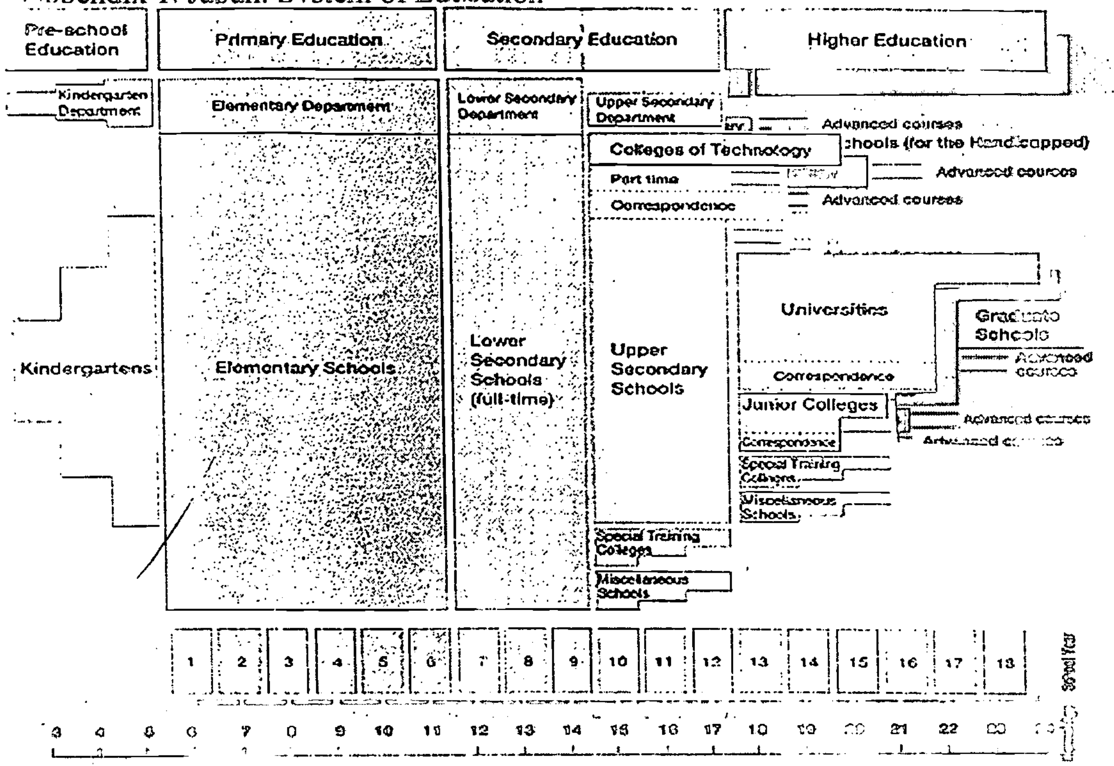
Appendix 1. Japan: System of Education



	Subject	175	140	140
Required subjects	Japanese Language	140	140	70-105
	Social Studies	105	140	140
	Mathematics	105	105	105-140
	Science	70	35-70	35
	Music	70	35-70	35
	Fine Arts	105	105	105-140
	Health and Physical Education	70	70	70-105
	Industrial Arts and Homemaking	35	35	35
Moral Education		35-70	35-70	35-70
Special Activities		105-140	105-210	140-280
Elective Subjects, etc		1,050	1,050	1,050
Total				

Source: Monbusho, 1997. Available on http://www.monbu.go.jp/aramashi/1997eng/.

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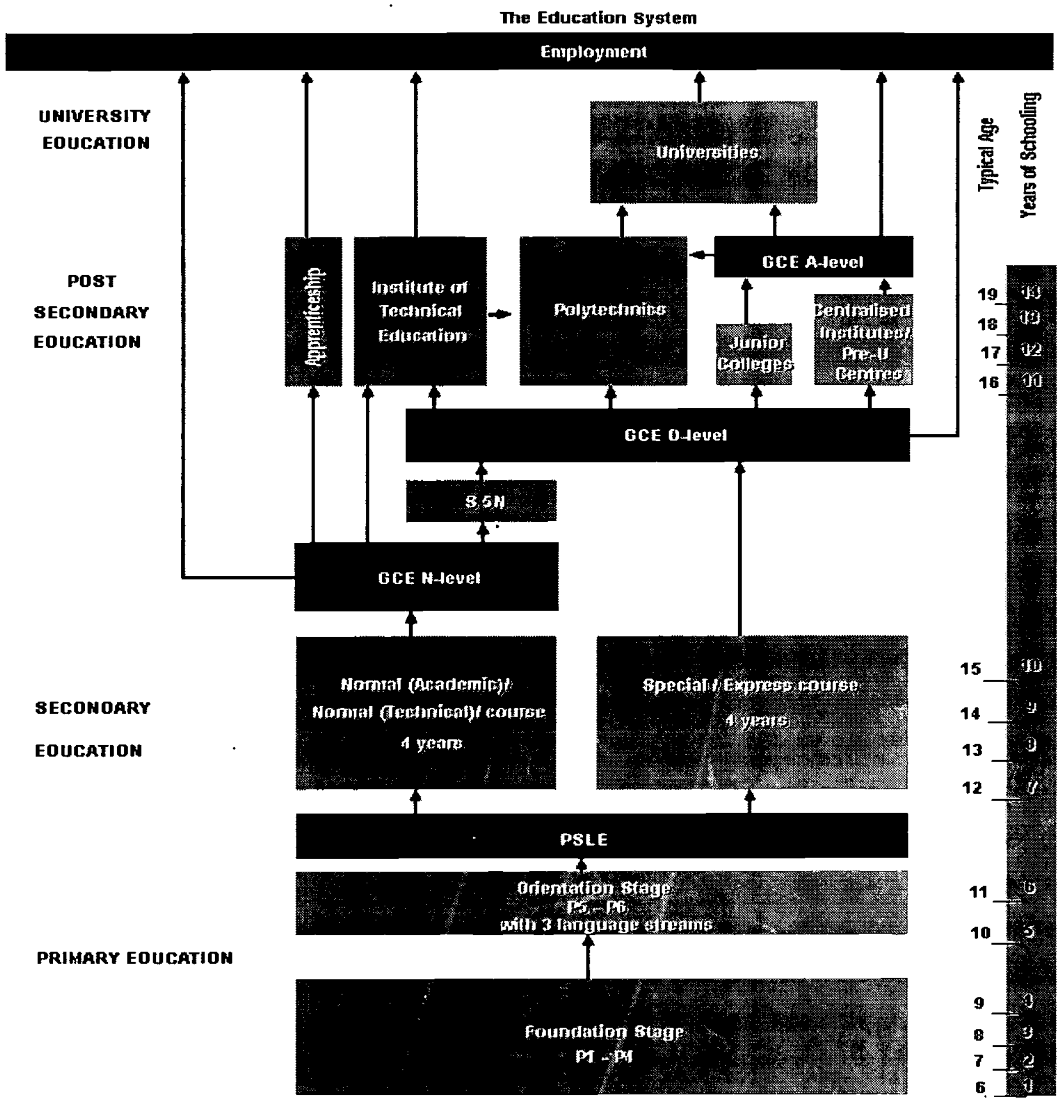
Appendix 2. Singapore: System of Education



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