

All-in-one and One-for-all: A Proposed Model of Lifelong Technology Education

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1. Introduction

Technology education means different things to different educators, from primary education to higher education, from general education to vocational education. For example, in terms of general education, International Technology Education Association (ITEA), a professional association for technology education teachers, defines "technology education" as "problem-based learning utilizing math, science and technology principles." ITEA argues that technological studies involve: (1) designing, developing, and utilizing technological systems; (2) open-ended, problem-based design activities; (3) cognitive, manipulative, and effective learning strategies; (4) applying technological knowledge and processes to real world experiences using up-to-date resources; and (5) working individually as well as in a team to solve problems ¹⁾. For another instance, the Accreditation Board for Engineering and Technology (ABET) is the recognized accreditor for college and university programs in applied science, computing, engineering, and technology, and the Technology Accreditation Commission (TAC) is one of four accreditation commissions within ABET. TAC develops criteria for accrediting 23 specific engineering technology programs, such as bioengineering technology, information engineering technology and manufacturing engineering technology²⁾. That is to say, ITEA's technology education provides students with an opportunity to explore a wide range of technology related areas without a focus on specific employment skills ³⁾, while ABET's technology education provides students with specific job skills leading to employment.

Therefore, technology education is a study of technology, which facilitates students to learn the knowledge and skills needed to function in a technological society ³⁾. As a study, technology education in the span of human life should be holistic and ongoing. In other words, technology education should be considered as a lifelong learning process, which encompasses learning throughout the life cycle, from birth to grave and in different learning environments, formal, non-formal and informal ⁴⁾ (see Figure 1).

	Formal learning	Non-formal learning	Informal learning
Learning Context	Structured	Semi-structured	Unstructured
Learner's Perspective	Intentional	Intentional	Non-intentional

Figure 1. A rough comparison of formal, non-formal and informal learning

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A model is a generalized or hypothetical description, often based on an analogy and used in analyzing or explaining something ⁵⁾. Technology education needs a lifelong learning model to promote the analysis and explanation of technology education. The purpose of this paper is to propose a lifelong model of technology education.

2. A Lifelong Technology Education Model Proposed

The model is proposed as shown in Figure 2, which has five stages of development ⁶⁾. This model assumes that everyone in most countries/regions should have opportunities to learn about technology in every stage. Learning in the first three stages mainly happens in schools, while learning in the last two stages mainly happens after entering workplace. Learning in schools may be taught with activities that are infused in other classes or as a separate course. Learning after entering workplace may lean to non-formal and informal forms. Educators at each of the following five stages of development should focus on their own special outcomes, and reach out for partnerships with educators at other levels of this lifelong learning process. There is room for technology education in some way everywhere in every educational system.

2.1 Stage I–AWARENESS

In primary grades, students should be aware of the existence of technology in various facets of daily life. At this first stage the focus is on discovering the basics of tools, materials, career opportunities related to technology. Motivation to learn about technology and a sense of praxis are the special outcomes at this stage of the lifelong learning model.

2.2 Stage II–LITERACY

The students in junior high and senior high schools will learn to effectively interact with technology at this stage. They gain necessary and basic technological skills, known as technological literacy, at this stage and apply technological literacy in daily life. The outcome is for all students to become technological literates.

2.3 Stage III–SPECIALIZATION

At this stage, students can take time to identify their own career path and gain a greater depth and breadth of knowledge and skills than the previous stages. This stage may take place in vocational high schools/programs, two-year colleges, training centers, and colleges as well as universities. The outcome is for students to learn how to be successful in the job markets related to technology.

2.4 Stage IV–APPLICATIONS

After entering workplace, youngsters will have opportunities to fully apply what he learned about technology in work, family and leisure. They also have time to gain job experience and/or further education regarding technology. Youngsters become a smart consumer, a productive worker and a ongoing learner in a technological society is the special outcome at this stage.

2.5 Stage V–GROWTH

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At this stage, adults effectively solve technological problems and continuously enhance technological competencies. A variety of education and training programs are widely available to help them to keep growth in technological literacy and competencies. The outcome is for adults to timely update and upgrade their technological literacy and competencies.

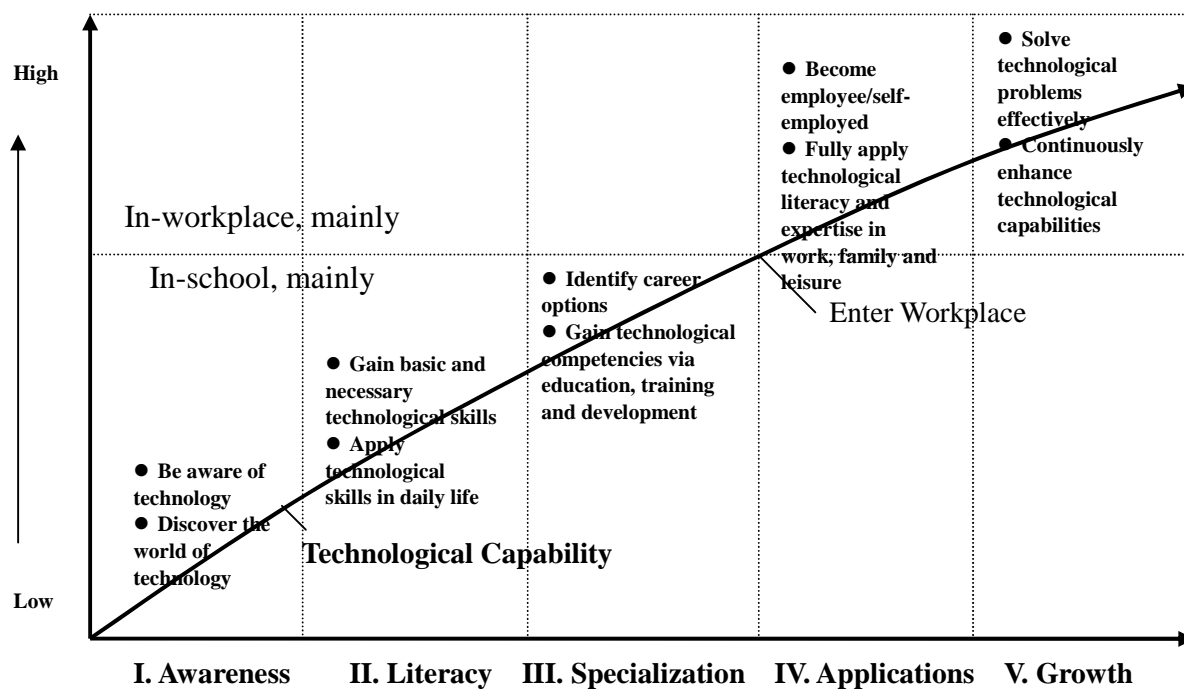


Figure 2. Five stages of lifelong learning about technology

3. Taiwan as an Example to Use the Proposed Model

The world's educational systems considerably differ. According to the International Standard Classification of Education, known as ISCED97 and developed by UNESCO in November 1997, a national education system can be classified and coded as follows:

- 0- Pre-primary education
- 1- Primary education/First stage of basic education
- 2- Lower secondary education/ Second stage of basic education
- 3- (Upper) secondary education
- 4- Post-secondary non tertiary education
- 5- First stage of tertiary education (not leading directly to an advanced research qualification)
- 6- Second stage of tertiary education (leading to an advanced research qualification) ⁷⁾

Normally, the Stage I in the proposed model takes place in Codes 0 and 1, Stage II in Codes 2 and 3, Stage III from Codes 3 to 6, Stages IV and V might link to Codes 4, 5 and 6.

The educational system in Taiwan is shown as Figure 3. It can serve as an example to use the model proposed above. The present education structure in Taiwan supports 22 years of formal study. Completion times are flexible, depending upon the needs of the students. Normally, the entire process

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requires 2 years of preschool education, 6 years of elementary school, 3 years of junior high, 3 years of senior high school, 4-7 years of college or university, 1-4 years of a master's degree program, and 2-7 years of a doctoral degree program. The nine-year compulsory education in Taiwan is comprised of elementary and junior high schooling⁸⁾.

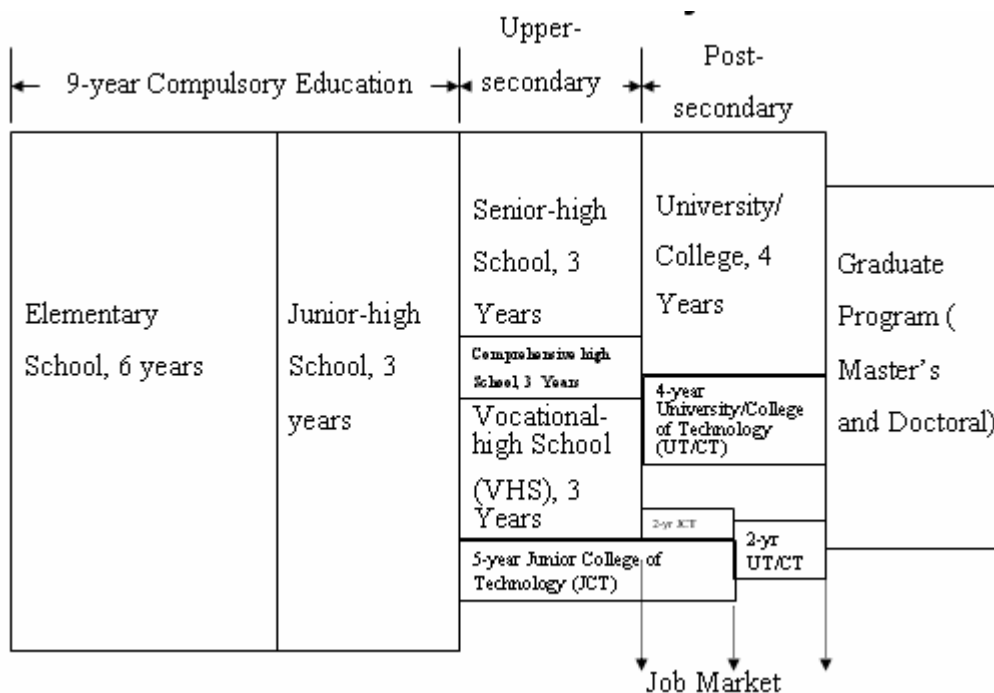


Figure 3. The educational system in Taiwan

Taiwanese people may learn about technology in the five stages in the lifelong learning process (see Figure 2) as follows:

3.1 Stage I—AWARENESS

According to national curriculum promulgated by Ministry of Education (MOE), technology education in elementary schools is integrated with science education. The key learning area (KLA) embracing science and technology education is called “natural science and living technology (NS<).” The purpose of this KLA is mainly to provide students with scientific and technological awareness education.

3.2 Stage II—LITERACY

In Taiwan, all students in junior high and senior high schools are required to take technology education courses for becoming technological literates. At the junior high level, technology education is mainly offered by the KLA “NS<,” while at the senior high level, living technology (LT) is a independent course.

3.3 Stage III—SPECIALIZATION

Career-oriented students in vocational high schools/programs, junior colleges of technology, colleges and universities can learn technological competencies for further employment and studies.

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Specific programs widely include agriculture, industry, business, maritime, engineering, medicine, nursing, home economics, etc.

3.4 Stage IV–APPLICATIONS

Once graduating from vocational high schools/programs, training centers, junior colleges of technology, colleges or universities, students may choose to enter workplace. After entering workplace, they can fully apply what he learned about technology in work, family and leisure. They also have time to gain job experience and/or further education with respect to technology.

3.5 Stage V–GROWTH

In order to keep their own technological literacy and competencies updated and upgraded, adults in/out of workplace can keep learning about technology in formal, non-formal or informal learning environments.

In addition, the technology educators in Taiwan like to categorize the technology education in formal education institutions into the following two types: (1) technological literacy education, and (2) technological specialty education (see Figure 4). In Figure 4, when a student goes up to advanced educational institutions, he/she receives deeper technological literacy education and more technological specialty education. Upper secondary education institution is a confluence of technological literacy and specialty education. For example, senior high schools mainly offer technological literacy education while vocational high schools technological specialty education.

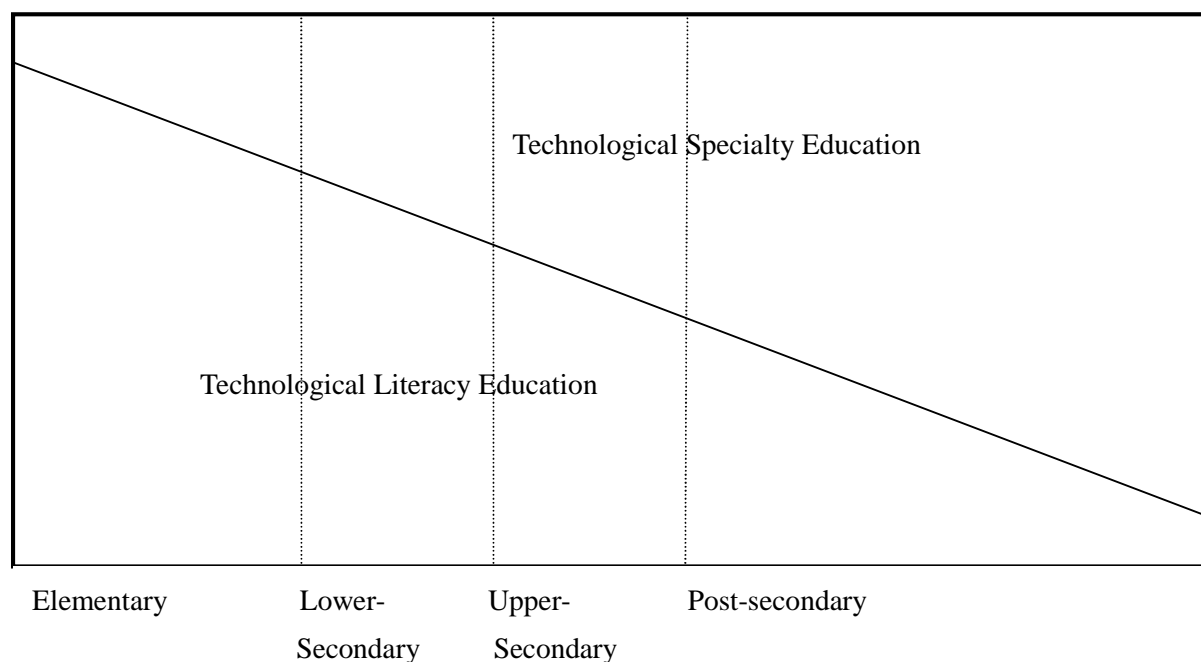


Figure 4. Two types of technology education in Taiwanese formal education institutions

4. Two Main Features of the Proposed Model

In conclusion, the lifelong technology education model as shown in Figure 2 is universal. It at least has the following two features:

4.1 All-in-one

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All possible technology education opportunities for school pupils, college students, and adult learners are embraced in the model. In addition, both general and specialized technology education programs are included in the model. That is, the model is all-in-one.

4.2 One-for-All

The model is proposed to serve as a conceptual or re-conceptualized tool/framework to analyze and explain all technology education in most countries or regions. That is, it is one-for-all.

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