Status and Challenges of the Technology Education as an Integral Part of General Education in Taiwan

Lung-Sheng Steven Lee
Graduate Institute of Cultural and Educational Management,
Central Taiwan University of Science and Technology.
666 Buzih Road, Peitun District, Taichung 40601, Taiwan

Paper presented at
The 13th International Conference on Technology Education
in the Asia Pacific Region (2019 ICTE-Korea),
Cheongju, South Korea,
January 16-18, 2019

Abstract

The technology educators in the world should learn and encourage each other to improve the technological literacy education for all students. In Taiwan, Technology is a newly added domain in the upcoming curriculum guidelines for grades 1-12 that will take effect in August 2019. The new (or the 8th) domain includes two courses: Living Technology (LT) and Information Technology (IT). The purpose of this paper was to describe status and challenges of the technology education as an integral part of general education in Taiwan. The literature review was used to gather all the available sources related to purpose. Consequently, the following results are obtained: (1) the technology education in Taiwan is on the move, (2) the newly added Technology domain brings curriculum revival, and (3) there are two challenges can be seen as opportunities as follows—(a) LT and IT could compete against in the Technology domain; and (b) LT and IT could still have a loose body of knowledge.

Keywords: technology education; national curriculum; Taiwan

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1 The Technology Education in Taiwan Is on the Move

In Taiwan, the technology education as an integral part of general education is also called "technology education for all" ("全民科技教育/*quánmín kējì jiàoyù*" in Traditional Chinese) or "technological literacy education" ("科技素養教育/*kējì sùyǎng jiàoyù*" in Traditional Chinese). The technology education for all students in grades 1-12 is mainly implemented through Living Technology (LT) course (or sub-domain), prescribed in the national curriculum. As shown in Fig. 1, LT is included in the "Life" domain (i.e., learning area) in grades 1-2 as well as in the Natural Science and Living Technology (NS&LT) domain in grades 3-9, respectively; and a stand-alone course in grades 10-12.

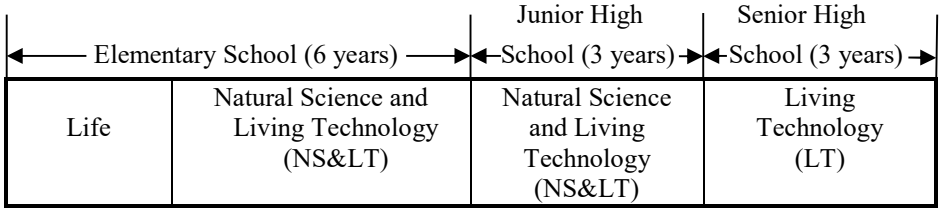

Fig. 1. The course title of technology education prescribed in the current national curriculum of Taiwan.

In grades 1 – 9, the domain of NS&LT is implemented based on competence indicators. Its technology part focuses on the integrative ability of the following aspects: food, material, mechanical application, electricity and its application, information and information communication, residence, transportation, the exploitation and utilization of energy, originality and fabrication, as well as technological civilization. In senior high school (grades 10-12), LT includes a core/required subject "Technology and Life" (2 semester credits) and an advanced option (2-4 semester credits) which consist of the following five subjects: Communication Technology, Construction Technology, Manufacturing Technology, Transportation Technology, as well as Energy and Power. All senior high students have to take 2-6 semester credits among the above five subjects (Lee, 2015).

However, LT has faced the following problems: (1) poor image, (2) inadequate teachers in primary schools, (3) deficient teaching vitality in secondary schools, and (4) diluted technology teacher education programs. The deficiency of teaching vitality found in secondary schools, particularly in junior high schools, results from LT being "swallowed" by NS in the NS&LT domain (Fujita & Lee, 2018). Thus, technology educators want LT to "divorce" from NS.

The National Academy for Educational Research (NAER), which is in charge of the facilitation of national curriculum guidelines was aware of technology educators' voices and the fact that the United Kingdom, Australia, New Zealand, and other countries have established technology domains. Thus, NAER proposed adding Technology as a new domain in the curriculum guidelines for grades 1-12. This proposal experienced a lengthy debate process, including several votes. Fortunately, supported by the majority of committee members, the newly added domain was approved and will take effect on August 1, 2019 (Fujita & Lee, 2018). In recent years, the LT in Taiwan has been separating from NS&LT to make the partnership with Information Technology (IT) in the newly added domain, Technology. Before this curriculum reorganization, IT in grades 1-9 is prescribed as one of the critical issues that should be integrated into every domain, while it is a stand-alone course in grades 10-12.

2 The Newly Added Technology Domain Brings Curriculum Revival

The newly added Technology domain covers two courses, LT and IT, and aims to develop students' technological literacy. It is anticipated that through the use of technological tools, materials and resources in LT and IT, student's knowledge and skills of hands-on implementation as well as designing and creating technological tools and information systems are further developed. It is also anticipated that student's higher-order thinking skills, such as inquiry, creative thinking, logical and computation thinking, critical thinking, problem-solving, are enhanced. In terms of required content organizers, LT and IT comprise the following.

LT: nature of technology; design and making; applications of technology; technology and society.

IT: algorithms; programming; system platform; data representation, processing, and analysis; IT applications; IT and human society (MOE, 2018).

As shown in Table 1, the students in elementary schools can learn technological literacy from the school-developed Alternative Curriculum in which integrated theme-, project- and issue-based inquiry courses are expected. The teaching hours of Technology for junior high school students are two hours per week. The schools are suggested to offer students LT and IT course every other semester. For the senior general high school students on the academic track, the required LT and IT are suggested to be offered in one semester, respectively. In addition, the 8-semester-credit electives for deepening and widening learning are planned as follows: Robots Project (2 credits), Technological Applications Project (2 credits), Advanced Programming (2 credits), and Engineering Design Project (2 credits).

Table 1. Teaching hour/credit allocation and course/subject combination

Level	Elementary School	Junior High School			Senior High School				
Grade	1-6	7	8	9			10	11	12
LT	Alternative Curriculum	2*	2*	2*	Required	LT	2**		
						IT	2**		
IT					Elective (for deepening and widening learning)		8**		

Notes: * hours per week; ** semester credits

Source: MOE, 2018.

Becoming a new (or the 8th) domain of the upcoming national curriculum guidelines for grades 1-12 is truly a good prospect for Technology curriculum revival. The promotions for the new Technology curriculum have been spread. For example, The MOE has offered the following three aspects of supporting measures (Fujita & Lee, 2018; MOE, 2017):

1. Teachers inventory and empowerment planning

The MOE has already surveyed the number of teachers who are licensed Technology teachers and need to receive further empowerment training that has been offered since the winter break of 2017. The in-service school teachers who are not Technology teachers but are willing to become one can attend the "second specialty" training program to make up for the shortage of Technology teachers in schools. The MOE has also modified the list of specialty/technical subjects and credits required for Technology teachers to guide the pre- and in-service Technology teacher training.

2. Curriculum planning and instruction preparation

Since August 2016, in order to lay the foundation for the implementation of the new Technology curriculum guidelines, the MOE has subsidized every county (i.e., prefecture) and city to set up a Maker education demonstration center. The centers are expected to integrate relevant resources, to develop curricula and teaching modules, and to cultivate elementary school and junior high school students' mind-on and hands-on skills.

Regarding senior high schools, creative Maker labs have been set up under the 5-year "Creative Maker Program" to empower teachers, to develop related curriculum and teaching materials, as well as to provide teachers and students with design and making space and opportunities. The Coding course in IT has already been incorporated into the Summer Enjoy Learning Pilot Scheme (SELPS) as of August 2015 for elementary school and junior high school students.

In addition, to test the new Technology curriculum guideline that concerns accumulating successful experiences, the MOE has been overseeing a pilot school program since August 2015 to explore implementation problems and propose solutions. A three-level TE counseling system has been set up for elementary and junior high schools. The three levels include: (1) the central counseling group, (2) local counseling groups, and (3) Maker education demonstration centers and pilot schools.

The counseling group members at the first two levels are expected to combine the outputs and experiences of Maker education demonstration centers and pilot schools, transform curriculum guidelines, and develop examples for teaching and assessment,

as well as provide field teachers with professional assistance and support. The Maker education demonstration centers at the third level are expected to serve as the best field of curriculum development and testing.

3. Equipment and budget preparation

To cope with the implementation of the newly added Technology curriculum guidelines, the MOE has drafted the basic standards of elementary and junior high school facilities. According to the drafted standards, every 36 classes in elementary schools and every 24 classes in junior high schools should have a LT and an IT lab. Therefore, an additional 1,385 LT labs and 279 IT labs will be needed. From 2018 to 2020, NTD 1,608.2 million (about USD 53.6 million) will be subsidized to set up elementary and junior high schools' new LT and IT labs. In addition, from 2018 to 2021, NTD 498.48 million (about USD 16.6 million) will be subsidized to update senior high schools' LT and IT equipment.

3 Two Challenges Can be Seen as Opportunities

There are at least two challenges to proceed the upcoming Technology curriculum as follows:

1. LT and IT could compete against in the Technology domain

As mentioned earlier, LT and IT in schools have long been ignored, and many LT and IT teachers are unsatisfied. Specifically, as many junior high school LT teachers have experienced NS&LT teaching hours being dominated by NS, they are afraid the Technology domain will be dominated by IT in the future. In addition, some IT teachers are afraid that the Technology domain will be dominated by LT because many LT teachers have the capabilities to teach both LT and IT. The opportunity is through collaboration (or cooperation). More dialogues and interactions should be encouraged and arranged to promote collaboration instead of competition.

2. LT and IT could still have a loose body of knowledge

Due to not being included in the domains/subjects for student's further studies, LT and IT teachers have much freedom to teach. This leads to the negative image that LT and IT have a loose body of knowledge. Core competencies serve as the backbone of curriculum development in the curriculum guidelines for grades 1-12. Thus, the opportunity is both LT and IT educators should follow the core competencies to develop their curriculum, instruction and assessment and have them aligned.

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