

STEM EDUCATION IN TAIWAN - LESSONS LEARNED FOR VIETNAM

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ABSTRACT

STEM education is much prompted and widely implemented in many countries around the world. In 2012, STEM education began to appear in a number of private educational institutions in Vietnam. Up to now, STEM education has been mentioned a lot in educational forums and workshop, but has not been implemented in a large scale. By document analysis and practical study of educational management in some schools in Taiwan, the paper presents historical overview of school science education and the current situation of STEM education in Taiwan, thereby propose lessons learned for Vietnam in terms of STEM education field.

Keywords: STEM education, Taiwan, lessons learned, Vietnam.

INTRODUCTION

The acronym STEM stands for the disciplines of science, technology, engineering, and mathematics. “STEM education is an integrated educational method (Science - Technology - Engineering - Mathematics), certainly it is not a subject in which lessons are built based on the STEM topics to integrate the knowledge in Science and Mathematics with problems in Technology and Engineering of the real world ” (Education Communication Center, 2017). STEM education is much prompted and widely implemented in many countries around the world, including Taiwan.

Taiwan education is considered to be one of the high quality education of Asia. Taiwan's government always pays much attention and investment in local education. Taiwan has limited natural resources, so Taiwanese have chosen a wise path to develop the economy through the human resource development. Taiwanese education was ranked 17th in the world and 4th in Asia (after Japan, Korea, China).

In the Taiwanese context, science education is part of the ‘education for all’ mission, which covers the range of all citizens. It emphasizes the development of science literacy, individual creativity and innovative ability. In the first National Science Education Conference in 2002, the goals of science education in Taiwan were stated as enabling every citizen take delight in learning science and understand the application of science, be curious about the profoundness of science and appreciate the beauty of science (Education, 2003).

These goals could be interpreted from three aspects: first, these goals require that science education should be rooted in everyday life and culture; second, science education should enable the citizen to use scientific methods and knowledge to solve the problems encountered within daily life and to criticize social problems rationally and then to make proper decisions; third, science education is required to improve citizens’ science literacy, in order to make a contribution to the world economic growth and sustainable development. From the proposed goals of science education, it can be seen that the focus of science education in Taiwan has transformed from the cultivation of scientists in 1990s to ‘science for all’ and the ultimate

purposes of science education are to pursue the welfare of all human beings rather than merely facilitating economic or technological development. The concerns about humanity have been put in a prior place in Taiwan's science education (Gao, 2012).

In recent years, STEM education has been introduced into Vietnam through many different forms, one of the ways to bring STEM education into Vietnam is through the private education companies such as STEM Academy, Creative Academy S3. STEM education has made a hit in Vietnam by many community activities such as STEM Day with the participation of many STEM educational institutions and many high schools such as Ta Quang Buu, Trung Vuong, Olympia ... The draft of a the new school education program demonstrated the STEM educational ideology: "Orienting the innovation of educational methods mentioned in the general education program is suitable with STEM education at the level of active interdisciplinary teaching, applying interdisciplinary knowledge to solve the real problems" (Thanh, October 26, 2017).

However, some teachers, educational managers or parents have not known about what the STEM is yet. Although there are many efforts in the initial stage of the pilot project, in general, many teachers and parents still have a limited awareness of STEM education. In order to deploy effectively implement STEM education-oriented teaching activities stated in the draft of the new general education program, the ministries and branches, educational administrators need to study and learn from many advanced countries in the world such as Taiwan.

Through the document analysis and practical study about the educational management in some schools in Taiwan, Taizhong, the researchers present the current situation of STEM education in Taiwan from different aspects such as educational policy, teaching practice and informal education field, thereby Vietnam can learn the lessons in terms of STEM education field.

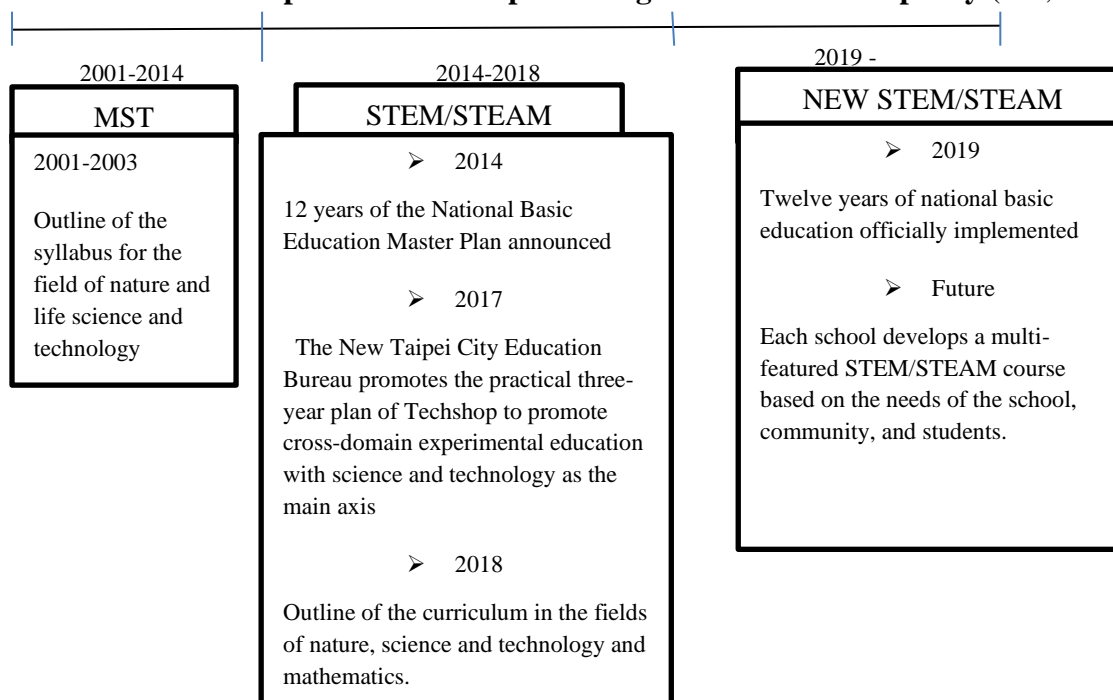
LITERATURE REVIEW

In Taiwan, students' STEM capacity is built via a comprehensive and diversified school system. There are six years of primary school education followed by three years of junior secondary education. Compulsory education ends following a student's 9th grade year and Taiwan allows transitions between many of their vocational and academic tracks in the following stages (Gao, 2012).

Taiwan's policy background and historical evolution in promoting STEM education can be traced back as early as the tentative nine-year curriculum outline published in 2001, when nature and life science and technology were merged into the field of nature and life science and technology, thereby promoting cross-disciplinary integration of mathematics, science and technology. Joint courses. In recent years, Taiwan has been committed to promoting the twelve-year reform of basic national education. In 2014, it has published the general outline of the twelve-year curriculum of basic national education. In 2018, it has published the outline of the curriculum in the fields of nature, science, technology and mathematics. It is expected that the outline will start in 2019 (108 academic years) in stages and year by year. Implementation (Ministry of Education, 2013). In the published syllabus and curriculum outlines in various fields, STEM education-related policies have not been clearly defined, and the core literacy and learning focus in the syllabus have not been systematically planned and implemented STEM education. Taking the curriculum outline in the field of science and technology just published in September 2018 as an example, although the related connotations of integration of STEM or STEM are mentioned in the content of the curriculum outline, its planning concept,

core literacy and learning focus are all in the field of science and technology rather than STEM. Core planning. Therefore, there is no systematic and complete plan for STEM education in the 12-year National Basic Education Curriculum Program planned by the Ministry of Education. the STEM course with science as the main axis includes teaching activities such as mushroom experiment and incubator design; the STEM course with science and technology as the main axis includes teaching activities such as squirrel cart, truss bridge, anti-seismic structure tower; and the STEM course with engineering as the main axis includes teaching activities such as robots and four-axis aircraft. The STEM course with mathematics as its main axis includes teaching activities such as IQ lights (Lin, 2019).

Figure 1: Taiwan's development chart for promoting STEM education policy (Lin, 2019)



Taiwan's primary and secondary science education aims at improving every student's research ability, creativity and critical thinking, and cultivating students' curiosity and scientific ethics and attitude. Science education is much more than just knowledge about S&T and their application. It involves educational programs where learners become engaged in critical thinking as they design and develop products, systems, and environments to solve practical problems. In order to fulfill the aims of science education at primary and secondary level, Taiwan's Ministry of Education has reformed the curriculum for several times to expand students' participation in STEM and to improve students' science literacy (Gao, 2012).

METHODOLOGY

The paper collected the research materials from the following sources: Vietnam National Agency for Science and Technology Information, Thu Dau Mot University library, Ministry of Education Republic of China (Taiwan) Information; the searching tools on the internet such as: Google, Baidu, CNKI, Research gate ... From the secondary data materials collected, we proceed to read, analyze and summarize the content which related to STEM education; By case study in Taiwan, the paper propose lessons learned for Vietnam in terms of STEM education field.

RESULTS

CASE STUDY IN TAIWAN

Puli Junior High School

Puli Junior High School is located in Nantou County, Taichung City. In addition to STEM, Puli Junior High School also applies STEAM to the school curriculum. Unlike STEM (Science - Technology - Engineering - Mathematics), STEAM is added to element A - Art (art). Art elements are integrated in the curriculum through interesting programs such as carpentry and pottery making. The school also invests heavily in KIT Robot kits for students to practice. At Puli school students, students have made semi-automatic machines such as garbage collector models, balanced robot models. Through the relatively early STEAM education, Puli School has caught up with the international trend of science and technology education. Puli junior high school students won the senior group championship in the STEAM Star National competition (Science, Technology, Engineering, Arts, Mathematics). STEAM education trains students to use school theory to solve problems in real-life situations. The Youth Science and Technology Innovation Contest is the best platform for displaying student learning outcomes. Thanks to the importance of scientific and technical education, Taiwan has and will become a major force in the world in this field.

The way Puli Junior High School works based on the notion: education is the love, education is the humanity, education is the honest, education is respecting other cultures.

The brief experience at Puli Junior High School made the researchers ask questions about some values at schools in Vietnam. We have talked a lot about work ethics, friendliness and openness in the domestic educational environment, but perhaps the out-of-dated doctrine and old educational values have hindered the culture of school development. For schools in Taiwan, the openness is very obvious when setting foot in school, open but also very disciplined.

Fugui Primary School

Fugui Primary School is located in a rural area in Nantou District, Taichung City. If Vietnam has a "new countryside" standard, then in Taiwan it is probably a "modern countryside". It is fair to say that the facilities of Fugui "village" school are enough to defeat many the urban schools in Vietnam. Although it was just an elementary school, there was a runway with a piste. A quite different point is while the primary schools in Vietnam tends to be decorated with the variety of colours, Fuguischool is just covered with a gray color of block stone in contrast to the red of the next track.

The special thing at Fugui Primary School is the STEM education model that explores nature, helping to stimulate children's curiosity, observation and intelligence for everything in the world around them. Students can explore nature with STEM educational methods at the school's pet, bug and insect garden. At the corner near those garden, the school has the art activity for students, that is creating Mosaic of all kinds of bugs and animals. The school also keep the bat on the campus. Although there are many pets, it is still clean.

In addition, the school cleverly applies QR codes in the placement of learning information at the school, students easily scan these codes on the phone to access information resources on the network. This simple application helps the school to transfer information and knowledge more quickly, save space and increase fine art and visualization for the school.

Huiwen High School

Huiwen High School is located in the center of Taichung City. With the concept: "international education", Huiwen High School has established an international action center in order to

provide the information and advice to teachers and students, both domestically and internationally, as well as courses and TOEFL certificate. Besides that, it also offers the elective courses in German, Japanese, French and Spanish.

In addition to modern facilities and STEM practice rooms. The special thing at Huiwen High School is that the school built an observatory for students and visitors in order to observe the astronomical phenomena. The school also has an STEM classroom system on the Observatory to disseminate knowledge and practice STEM lessons related to space technology. With this approach, students are provided with an understanding of astronomy, explaining some astronomical phenomena such as the delimitation of seasons in the year, the changing position of celestial bodies in the sky, familiar phenomena such as eclipses, eclipses ... In addition, Huiwen High School is also impressed by a unique STEM practice room such as a pottery room and calligraphy room.

DISCUSSION

From the experience of STEM education in Taiwan, Vietnam needs to plan Educational Policy to implement the STEM Education Program effectively providing that it is suitable with the reality of the country. The following is lessons learned for Vietnam:

Fostering to raise awareness about STEM education, innovating teaching activities

Implementing education reform must start from innovating the way of thinking and teaching at each teacher and innovating thinking, innovating the way of managing teaching activities at each managerial staff. Therefore, fostering to transform and raise awareness about STEM education program, innovation of teaching activities is an important content in the training content at the unit. This content must derive from mastering the objectives of the STEM education program, mastering the techniques of integrated and interdisciplinary teaching, on active teaching methods, and skills of innovating test methods , assessing in the process of teaching.

In the professional team activities, the school management staff directs the professional teams to focus on clarifying new points in the STEM education program, studying the integrated approach of STEM education in the curriculum. new high school education, study the contents and skills of integrated interdisciplinary teaching to exploit and practice.

Building STEM teachers

Managing people is a difficult task, managing people in education, and each of their products is the development of a personality even more difficult. The quality of comprehensive education of the school is the result of the management and direction. That quality depends on many factors, but teachers, are important factors. Therefore, building and fostering STEM teachers needs to be carried out regularly, by many measures, is an immediate and long-term task, but it is also a strategic issue because it decides in innovation of educational methods.

Organize training sessions on STEM to change the awareness for all teachers of the schools about STEM education methods, provide professional teachers with basic skills in teaching STEM orientation or good STEM integration such as: How to build STEM lesson plans, project teaching methods, integrated in STEM teaching or technical design process in STEM teaching ...

Applying science and technology into management in a smart and effective way

Use QR codes in school education. QR code is a very simple application, no cost to transmit a certain content. When everyone including young children can use smart phones, on-hand applications are essential.

Schools sometimes focus on very costly projects such as word boards and smart boards. Systems that integrate modern teaching methods. The investment costs a lot of money while there are many sources that are cheaper and more convenient. The educational manager should think about the way that apply free but more effective applications.

Associated with the community

In Vietnam, schools or universities are still considered "ivory towers", isolated themselves to the outside community. Maybe we have lots of reasons as different societies but those schools should increase interaction with the community more.

Schools in Taiwan allow the community to use a part of the school's facilities. We were quite impressed with the operation of Huiwen High School's library with the participation of students' parents or the surrounding community. Although participants in activities that benefit from government welfare, it is can not deny that the interaction of school and community have created the benefits for both parties.

The first is that educational institutions become more transparent in the eyes of the public, people supervise educational institutions and become a reliable source of information about educational institutions with the people. The community also monitors educational institutions, getting direct or indirect benefits from educational activities.

Secondly, people are allowed to approach to a constantly changing educational activities, both directly and indirectly. People are "learning" longer. The elderly or retired people also can still contribute to the society.

Building, directing and implementing the educational goals of the school in each stage

The school needs to orient the objectives clearly, develop the detailed and realistic action plans. In the plan, the board of directors indicate the key tasks, supporting tasks, assigning tasks to the members, then checking, evaluating and drawing experiences in a timely manner.

The school year plan is built and implemented reasonably, focusing all efforts and efforts of all members on implementing the goals and tasks of the school year. Develop plans from each staff, teachers who directly implement. This plan is discussed by professional teams, finding solutions and through a meeting of officials at the beginning of the school year and becoming a resolution to implement.

In order for all activities, all organizations in the school to work together towards the common goal, the school's management board in addition to the awareness of constantly improving moral qualities and professional capacity, management capacity must also be the mirror in every aspect, especially in the spirit of self-learning, self-training, and self-renewing by self-learning, drawing experience, creativity, daring to think, to dare to take responsibility. A place for teachers to trust, open, and confide. It is a center that unites all members in the collective, creating the unity, consensus and consensus. Being a good colleague in the profession, always respect the collective opinion, trust to deliver the work; know how to create a happy and comfortable atmosphere when going to school to have an effective motivation to work.

Solidarity in leadership, creating an effective working team, considering personal achievement as a collective achievement, thereby setting an example for teachers in the school to see people work as a common responsibility, the achievement of the collective is the achievement of all members to build a strong collective.

CONCLUSIONS

In order to successfully manage teaching oriented STEM education activities at high school in the period of international integration, Vietnam needs to consult and learn from the experiences of many countries around the world and the region on STEM education. First of all, it is necessary to foster to raise awareness about STEM education, innovating teaching activities, innovate teaching activities. Since then, build a strong STEM teachers. There is a breakthrough in the managerial thinking of the principal, applying science and technology into management in a smart and effective way. Building, directing and implementing the educational goals of the school in each stage. In addition, it is necessary to associate with the community to create new quality and efficiency of education, to meet the interest and trust of the people and society.

REFERENCES

- Education Communication Center, M. o. (2017). *STEM education in high school: Not just theory*. Hanoi.
- Education, M. o. (2003). *White Paper on Science Education (p7)*. Taipei: National Science Council.
- Gao, Y. (2012). *Report of Taiwan: STEM (Science, Technology, Engineering and Mathematics)*. Melbourne: Centre for the Study of Higher Education (CSHE), University of Melbourne.
- Lin, K. Y. (2019, 3 19). *Reasearchgate*. Reasearchgate: <https://www.researchgate.net/publication/332094495>
- Thanh, H. (October 26, 2017). STEM education model: The fashion or trend . *Capital Labor Newspaper*.