STEM Education and development of engineering identity

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Since the inception of Hong Kong in the 1840s, over the past 180 years, local engineers have tirelessly demonstrating their diligence and enthusiasm in contributing their expertise to bring about safe, convenient and comfortable living for our citizens.[1] Our engineers have also been rated not only as one of the best in Asia but also being highly recognised world-wide. However, following the transition of high-profile engineering positions to the management positions, and the inclusion of engineering into “science and technology” at an international level, the status and visibility of engineering have declined in the past few decades, leading to an inaccurate development of engineering identity among youngsters[2] and difficulties in recruiting youngsters to join the industry.

Research have shown that students around the world have an inaccurate understanding of the job natures of engineers. One local study also reported that students would not like to become engineers because they cannot clearly distinguish between construction workers and engineers.[3] STEM (**S**cience, **T**echnology, **E**ngineering and **M**athematics) Education, a topic that has gained traction and popularity among education sectors and associated industries in recent years, is actually not something new but has been taking effect and promulgated in the US for over 20 years. Though there are lots of different interpretation to the goals and outcomes of STEM Education, STEM is a combination of skills that strive towards an ultimate goal of contributing to the health and vitality of the economy.[4] Although STEM education does not serve only for the purpose to train engineers, scientists or technologists, it can also allow students to understand more about engineering, the duties and job natures of engineers and the vision of the industry. Youngsters will be facilitated to develop an engineering identity more accurately, though whether or not they are going to join the industry is another story.

Engineering education has long been regarded as a professional subject which is only offered in university. However, following the increasing demand of engineers for the continuous growth of their country, countries worldwide have realised that engineering education should be included in K-12 education because it takes a long time for students to develop their engineering identity.[5] STEM education thus serves as a tool to infuse engineering education into the existing K-12 education system. In response to the call for practicality instead of theory-oriented, problem-based learning is widely adopted where children have to integrate knowledge learnt in science, technology and mathematics to reach an engineering solution.

In Hong Kong, numerous STEM related activities have been organised every year, with competitions focusing on coding and robotics being the majority. With the funding from the Education Bureau of the HKSAR Government and donations from the commercial sectors, many secondary schools have procured advanced equipment such as 3D printers and laser cutters to assist students for better results in the competitions. However, despite the resources put into STEM related activities, engineering education has barely been introduced among secondary school. Engineering and production related subjects are available to HKDSE candidates but the number of candidates sitting for the subjects are usually less than 1% of the total population in recent years. It is observed that students were not taught about engineering related knowledge, nor the contributions engineers made to the society.

Lacking the chance to develop their engineering identity and receiving career guidance from practitioners in the engineering industry, students are thus unwilling to proceed their careers as engineers. What makes the situation worse, the word “engineering” in Chinese (工程) shares similar meaning to “construction work”, which further discourages students to understand the profession. To attract more youngsters to join the engineering industry so that there can be sufficient talents for the continuous growth of our city, STEM is recommended to be integrated into the curriculum instead of maintaining at the level of extracurricular activities (ECA). Identities and contributions of engineers should also be delivered in lessons so that students can have more information by the time they have to make decision on their careers.

Although Japan shares a different culture with Hong Kong, some of their views on nature, contributions and identities of engineers[6] can serve as a good reference for us to educate our future engineers and the public:

- Being an engineer is a life-long identity. From the moment one obtains the professional qualification, one bears the responsibility to utilise his profession to contribute to a better world;
- The careers of an engineer do not start at the moment of employment, it starts at the moment when one decides to be an engineer;
- The growth of engineers will result in the growth of an enterprise, and ultimately the growth of society and country;
- We are not sure how technology is going to advance in the future, but we can be sure that engineers are at the back to support every advancement in technology; and
- Engineers across the century share the same value by inventing new technologies for the betterment of society.

The engineering identity of a student cannot be developed in a short period of time. It is wished that STEM education can be soon infused into our education system and not just as an ECA so that our youngsters can have more opportunities to develop their engineering identity and contribute their efforts for a better society.

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