# LCQ17: Promotion of STEM education

Following is a question by the Hon Jimmy Ng and a written reply by the Secretary for Education, Mr Kevin Yeung, in the Legislative Council today (October 21):

Question:

A Research Brief published in June this year by the Legislative Council Secretariat points out that although the Government has heavily invested resources in the promotion of education on subjects related to Science, Technology, Engineering and Mathematics (STEM education), STEM development of Hong Kong is still falling behind other places and STEM education in Hong Kong has many problems (such as insufficient lesson time, insufficient support for teachers and a lack of clear teaching guidelines). In this connection, will the Government inform this Council:

(1) whether the Education Bureau (EDB) reviewed, in the past two years, the effectiveness of the efforts to promote STEM education; if so, of the outcome; of the new measures to be put in place in the coming two years to resolve the aforesaid problems and enhance STEM education;

(2) of the details and the effectiveness of EDB's collaborative work with commercial organisations and employers in the past two years on strengthening STEM education; whether the Government will set up an intermediary organisation to assist graduates from STEM related university programmes in getting appointments for technology as well as research and development positions; if so, of the details; if not, the reasons for that;

(3) given that the Government has, under the "IT Innovation Lab in Secondary Schools" initiative, provided funding support for publicly funded secondary schools to upgrade their information technology equipment and facilities as well as to organise related extra-curricular activities (ECAs), of the implementation progress of this initiative (including the number and percentage of participating secondary schools, the types of equipment and facilities procured, as well as the details of such ECAs); and

(4) given that some of the items (e.g. cassette tape players and computers with floppy disk drives) on the current Furniture and Equipment List for New Schools recommended to be procured are outdated, while some more advanced items (e.g. 3D printers and laser cutters) are not on the List, whether EDB will expeditiously update the List to dovetail with the promotion of STEM education by schools; if so, of the details; if not, the reasons for that?

Reply:

President,

The Education Bureau (EDB) has been making substantial effort to promote

STEM education and issued the Report on "Promotion of STEM Education – Unleashing Potential in Innovation" in late 2016 (www.edb.gov.hk/attachment/en/curriculum-development/renewal/STEM%20Education%20Report_Eng.pdf) to propose various strategies, including curriculum renewal of STEM-related Key Learning Areas (KLAs)/subjects, enrichment of student learning activities, enhancement of teacher training, development of learning and teaching resources, and collaboration with community partners in organising large-scale STEM learning activities. In the past few years, the EDB has progressively implemented the relevant recommendations. The overall support measures on STEM education have been well received by schools.

In the local primary and secondary school curricula in Hong Kong, STEM education is not an independent subject. Instead, it is implemented under the existing Science, Technology and Mathematics Education KLAs through the learning and teaching across KLAs/subjects. It puts emphases on enhancing students' ability to integrate and apply knowledge and skills and to solve problems through deliberations and practices, thereby unleashing their potential in science and technology and enhancing creativity. STEM education should be incorporated into the hands-on and minds-on activities both inside and outside the classroom of relevant subjects to nurture students' creativity and problem-solving skills. Therefore, in the arrangement of teaching time, there is no need for schools to allocate additional lesson time for STEM classes. Regarding the implementation of STEM education, the EDB updated the curriculum guides for the STEM-related KLAs/subjects in 2017 for teachers' reference, with emphases on the adoption of student-centred pedagogies, such as project learning, investigation and design-and-make activities, to enhance students' ability to integrate and apply knowledge and skills and nurture their creativity.

We will base on the present foundation built by schools to provide further enhanced support measures, so as to continue enhancing students' interest and learning effectiveness in STEM disciplines.

Our reply to the Hon Jimmy Ng's question is as follows:

(1) The EDB has been working through various channels, including regular contacts with schools, school visits and inspections, questionnaire survey, feedback from teachers participating in training courses, schools' experience sharing, to keep abreast of the actual situation of the planning of STEM education, the arrangement of relevant teaching activities in schools, as well as the effectiveness of STEM education.

According to the information collected from the various channels, schools generally support STEM education and are implementing STEM education progressively. In respect of the planning in schools, most schools have set up a task group to co-ordinate the work related to STEM education and set directions of development. Most schools understood the emphases of STEM education, which involved the adoption of appropriate teaching strategies so as to enable students to integrate and apply knowledge and skills across STEM-related KLAs/subjects and to nurture their problem-solving skills and creative thinking. As observed, many schools have already mapped out clear

directions for implementing STEM education and the cross-disciplinary collaboration in schools has been gradually enhanced. It is also encouraging to note from the above survey that quite a number of schools indicated that they had successful experience in implementing STEM education. A substantial number of schools have, based on their school contexts, development focuses and the learning needs of students, developed distinctive STEM projects in various STEM disciplines. For example, some schools have successfully adopted biotechnology, scientific research and investigation, computational thinking or Maker as themes and planned their STEM teaching activities inside and outside the classroom, thus introducing novel technology to their students and engaging them in lively and interesting learning activities.

As for teaching, we notice that more and more hands-on and minds-on learning activities adopting a student-centred approach are being provided in classes related to Science, Technology and Mathematics, giving students more opportunities to integrate and apply STEM-related knowledge and skills in conducting investigations and project learning. In addition, to extend learning in STEM-related classes and to enrich students' learning experience, diversified life-wide learning activities, such as competitions and visits outside school, are also arranged outside the classroom so as to further enhance their learning interest. With regard to students' learning, most teachers remarked that the learning motivation and interest of students have been improved, and their ability in integration and application of knowledge and skills as well as their collaboration, problem-solving skills, creativity and innovativeness have been enhanced. A considerable number of students have achieved excellent results in STEM competitions inside and outside school.

With the implementation of various support measures for schools by the EDB in the past few years, including the renewal of curricula of relevant KLAs/subjects, development of relevant teaching resources and enhancement of professional development of school leaders and teachers, we have made intermediate achievements in taking forward STEM education. Earlier on, the EDB has also produced a number of videos on STEM education, covering its fundamental concepts and the implementation strategies in schools, as well as the sessions of Intensive Training Programme (ITP) on STEM education and the experience sharing of the participating teachers, so as to give the school sector and the public a better understanding of the aims of STEM education and the relevant training for teachers. The videos are available on the EDB's website on STEM education (stem.edb.hkedcity.net/en/edb-etv-on-stem-education-chinese-version-only).

At present, some primary and secondary schools with outstanding performance in implementing STEM education have been invited to be the co-ordinating schools of the Quality Education Fund Thematic Networks. These schools have made use of the additional resources provided by this programme to organise networking activities to share their experiences with other schools in the implementation of various themes relating to STEM education. About 50, 60 and 70 schools have participated in the above networking activities in the 2018/19, 2019/20 and 2020/21 school years respectively.

Looking ahead, the EDB will continue to strengthen the support measures

to facilitate schools to further promote STEM education. Following the completion of the ITP on STEM education for school principals and middle managers in the previous stage, we will launch a new round of ITP targeting STEM co-ordinators and frontline teachers in primary and secondary schools, focusing on strengthening teachers' capabilities in planning teaching activities and applying teaching strategies relating to STEM education. To tie in with the latest development in digital technology, we will enrich the information technology (IT)-related elements in the professional development of teachers (such as in the aspects of coding education and artificial intelligence (AI)) to equip teachers with the capability in strengthening students' ability in IT application and enhancing their information literacy.

As for the ongoing renewal of curriculum, we finished updating the "Computational Thinking – Coding Education: Supplement to the Primary Curriculum" to support teachers in implementing coding education and the Senior Secondary Information and Communication Technology Curriculum in 2020. We will continue to review STEM-related curricula, and will further provide schools with diversified teaching resources, including teaching materials and examples of teaching practice that are in line with the ongoing curriculum renewal, for teachers' reference, with a view to helping teachers master relevant teaching strategies effectively, so that they can enable students to develop the ability to integrate and apply knowledge and skills and to nurture creative thinking.

We will also continue to strengthen our collaboration with different community stakeholders, including innovation and technology (I&T) institutions/sector, STEM-related organisations, tertiary institutions and other government departments, to jointly organise quality student learning activities, so as to increase the effectiveness of STEM education. For instance, the EDB initially planned to co-organise the "STEM Education Fair" with various stakeholders in the previous school year (2019/20 school year) to provide students with quality learning opportunities and consolidate their learning achievements. However, the event has been postponed due to the COVID-19 pandemic.

The EDB will continue to encourage schools to make good use of the Life-wide Learning Grant allocated to the public sector primary and secondary schools starting from the 2019/20 school year, to support the development of STEM education in schools. It is believed that with the easing of the epidemic, schools will arrange more out-of-classroom diversified experiential learning activities to provide more opportunities for students to apply what they have learned so as to enhance learning effectiveness.

The Task Force on Review of School Curriculum submitted its final report to the EDB in September 2020. The Report put forth recommendations on the enhancement of STEM education in primary and secondary schools. The EDB is carefully considering the various recommendations of the Task Force and will listen attentively to the feedback from the school sector and other stakeholders to understand the needs of schools, so as to follow up on the recommendations for further promoting STEM education.

(2) The EDB attaches great importance to collaborating with different stakeholders, including the I&T sector, in the promotion of STEM education. For example, in the past two years, we collaborated with Da-Jiang Innovations Science and Technology Co. Ltd. in co-organising a series of teacher professional development programmes on the operation of drone, Python coding and AI application. We also invited the representatives of SenseTime to share their experience in AI application and supporting schools in the Mainland in our seminars and workshops, with a view to increasing teachers' understanding of the latest development and application of such technologies. The participating teachers provided positive feedback on these programmes and reflected that the workshops facilitated them in organising related learning activities for students to develop their coding and computational thinking skills. The EDB has also collaborated with relevant enterprises in the Mainland to organise field trips, such as visits to technology institutions in the Guangdong-Hong Kong-Macao Greater Bay Area, to enable teachers to have a better understanding of the latest development of I&T and related sector in the Mainland. This can help widen teachers' horizons and enable them to further reflect on the planning and implementation of STEM education in their schools.

To nurture more technology talents, the Research Talent Hub under the Innovation and Technology Fund (ITF) administered by the Innovation and Technology Commission provides funding support for organisations and companies undertaking ITF-funded R&D projects and other technology companies conducting R&D activities in Hong Kong to engage research talents, including STEM graduates from local universities, to carry out R&D work. In addition, the pilot STEM Internship Scheme launched this year supports undergraduates and postgraduates taking STEM programmes in local universities to participate in short-term internships so as to encourage them to pursue a career in the innovation and technology field after graduation. On the other hand, the universities have been providing career planning and support to their students direct. The EDB has no plan in setting up an intermediary organisation to assist university graduates in securing employment in specific industries.

(3) The "IT Innovation Lab in Secondary Schools" Programme managed by the Office of the Government Chief Information Officer will be open for application from December 1, 2020. The EDB issued a circular memorandum on October 9, 2020 to invite all public sector and Direct Subsidy Scheme secondary schools to submit applications for the Programme.

(4) The EDB issues the "Reference Lists" for public sector primary and secondary schools as a general guidance on the procurement of furniture and equipment for new school premises upon completion to ensure the prudent use of public money. The "Reference Lists" set out the reference costs for individual items of school furniture and equipment, providing reference for schools in compiling their procurement lists for application of relevant subsidies. Schools may also include items of furniture and equipment not on the "Reference Lists" in their procurement lists taking into account their school-based teaching and learning needs. The EDB annually adjusts the funding level for furniture and equipment of primary and secondary schools

with reference to the year-on-year change of the Composite Consumer Price Index for durable goods. To meet the latest teaching and learning needs, we are currently conducting a comprehensive review on the contents of the "Reference Lists", and will consult the school sector in due course. On the other hand, schools can make use of different subsidies including the Composite Information Technology Grant and the Expanded Operating Expenses Block Grant flexibly to meet their operational needs for IT education as appropriate.