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31st December 2015

Prof. Kenneth Young
Chairperson
Curriculum Development Council

Dear Prof. Young,

Consultation on Promotion of STEM Education

We are writing in response to the call for submission to Consultation on Promotion of STEM Education - Unleashing Potential in Innovation.

Our Hong Kong Foundation has recently released its research report, led by Prof Lap-chee Tsui, on Innovation and Technology (I&T). The report reviews the strengths and challenges of the I&T ecosystem in Hong Kong, focusing on the aspects of human resources, business and government. (Link to the report: http://ourhkfoundation.hk/innovation_and_technology)

While the report focuses on activities at university and business level, during our research efforts we notice a demand from STEM professionals and educators calling for more comprehensive exposure to all science subjects such as biology, chemistry, physics, pure and applied mathematics at secondary level, to ensure a better transition to university education. As suggested in our report, we believe the Education Bureau should conduct a thorough review of the DSE syllabus to investigate how to improve the quality of Hong Kong's STEM education.

We welcome the Government's desire to promote STEM education among schools in Hong Kong. In particular, we appreciate the Government's plan in



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strengthening partnerships with key partners in the community as supporting strategies. This echoes our research findings that multi-sectorial collaboration between education, business and government would better facilitate innovation and creativity.

Experience from other countries shed lights on how to push forward such strategies. The US Government got federal agencies (for instance NASA) involved in youth engagement in STEM, offering hands-on and authentic learning activities outside school. Meanwhile, the UK actively strengthens partnerships with industry to inspire students to consider a career in STEM.

We believe the CDC should expand its effort on leveraging resources of the business sector and advanced STEM institutions (e.g. State Key Laboratories), as well as government departments and community partners. Therefore, we hope more partners from the business sector and advanced STEM institutions will appear on the list of resources for STEM education. Not only will that strengthen the goal of improving learning and teaching resources, it will inspire appreciation for STEM subjects and careers from a young age.

Please see the appendix a brief of the US's and UK's experience on STEM education through partnerships, and their policy implications to Hong Kong. We hope the successful promotion of STEM from primary and secondary education will lay a sound foundation for the I&T ecosystem in Hong Kong.

Yours Sincerely,

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Appendix

Challenge in Hong Kong: Difficulties in Attracting Students to STEM

In Hong Kong, STEM subjects have not been able to attract students with the best academic results compared with other disciplines such as law and business, partly due to the perceived less rewarding career prospects. This is well reflected by the universities' admission medians of various degree programmes. Indeed, the median monthly wage for “professional, scientific and technical activities” is lower than that of “financing and insurance” and “education and public administration”. The human resource implications of this phenomenon may hinder the development of Hong Kong’s innovation and technology industry.

The US Experience: Authentic Out-of-School STEM Programs

The US has been facing similar human resource challenges to meet the industry’s growing demand for STEM workforce¹. The Department of Commerce estimates that in the coming years STEM occupations will grow 1.7 times faster than non-STEM occupations. Nevertheless, only one in five high school graduates who score in the top quartile in international assessment of mathematics go on to become STEM professional. Fewer than 40 percent of students who enter college intending to major in a STEM field complete a STEM degree. The lack of interest in STEM subjects among US students echoes the situation in Hong Kong.

In order to increase and sustain youth’s interest in STEM, the Committee on STEM Education (CoSTEM) facilitates youth engagement. For instance, in the 21st Century Community Learning Centers Program hosted by the US Department of Education, the National Aeronautics and Space Administration (NASA) provides middle school students the opportunity to solve challenges that NASA scientists and engineers might encounter².

¹ https://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf

² <http://www.hfrp.org/publications-resources/browse-our-publications/federal-collaborations->



Collaboration with CoSTEM agencies are desirable because they enable authentic STEM experience within or without schools.

Implications of the US Experience to Hong Kong

We welcome the HKSAR Government’s initiative to strengthen partnerships with key partners in community as one of its proposed strategies. In the recognition that real-world problem solving activities would inspire students, so to cultivate personal appreciation for the STEM fields. We recommend the Government to fully leverage resources, including but not limited to materials, facilities and experience of STEM professionals from the business sector and advanced STEM institutions to provide hands-on exploration of STEM. Focus could be placed on collaborations that forge pupils’ connections to real-world applications that may not be available during school hours. Moreover, pupils would gain much exposure from collaboration of out-of-school STEM programs, without compromising teachers’ energy.

The UK Experience: Strengthening Partnerships with Industry

The UK has faced a similar issue of shortage in STEM-skilled labour. To promote interest in STEM education, the UK Government has leveraged on industry support and initiated the “Your Life” campaign. Through the campaign, schools can organise unique school trips to innovative businesses³. The objective is to expose students to the “real world”, and encourage them to consider pursuing career in STEM. It is felt that the demand for STEM talent message can be best delivered by the demanders – the business sector.

Implications of the UK Experience to Hong Kong

We recommend that partnerships with the business community should be further encouraged, so as to better “convey [industry’s] enthusiasm and

bringing-authentic-stem-experiences-to-high-need-communities-through-the-nation-s-largest-out-of-school-program

³ <http://yourlife.org.uk/best-school-trip/>

excitement to children at a point when they may be making decisions about their future”⁴.

We believe that first-hand insights gained from such trips will demonstrate the relevance of STEM knowledge to pupils. Furthermore, school trip opportunities and other forms of support also mean that teachers will be given additional and more interactive teaching resources, thus creating a win-win situation for pupils, teachers and the business sector.

Additionally, some national science or engineering student competitions in the UK have set up alumni clubs, allowing frequent access to industry leaders and information. While similar competitions are also held in Hong Kong, we recommend the Government to facilitate more meaningful prize of access to industry for young people.

⁴ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/36747/49-08-S_b.pdf

Education Bureau and Our Hong Kong Foundation Matching on STEM		
	<p>Education Bureau</p> <p>“Report on Promotion of STEM Education - Unleashing Potential in Innovation” December 2016</p>	<p>Our Hong Kong Foundation “Consultation on Promotion of STEM Education” December 2015</p>
<p><u>STEM Curriculum</u></p>	<p>EDB would update the curricula of the Science, Technology and Mathematics Education Key Learning Areas (KLA), including KLA Curriculum Guides and relevant subject guides, to align with the ongoing renewal of school curriculum with the focus on nurturing students’ creativity, collaboration, problem solving skills and innovativeness through student-centred pedagogies, and pave the way for nurturing students’ entrepreneurial spirit in senior secondary subjects such as Applied Learning courses.</p> <p>The updated KLA Curriculum Guides of Science, Technology and Mathematics Education will be available in the 2016/17 school year. It is also planned that the curriculum is recommended for territory-wide implementation in schools in the 2018/19 school year.</p> <p>To ensure provision of quality STEM-related learning opportunities in Applied Learning, EDB will continue to review and strengthen</p>	<p>As suggested in our report, we believe the Education Bureau should conduct a thorough review of the DSE syllabus to investigate how to improve the quality of Hong Kong’s STEM education.</p>

	<p>the existing Applied Learning courses of both the areas of studies on “Applied Science” and “Engineering and Production”, as well as providing tasters and extension programmes as appropriate.</p>	
<p><u>Collaboration and Partnership</u></p>	<p>To foster synergy within the community for the promotion of STEM education, EDB will strengthen the collaboration with various institutions, including government organisations and STEM-related bodies for different initiatives to ensure the projects are leveraging on the strengths and are complementary to each other. These include the “Computational Thinking and Coding Education” of Hong Kong Jockey Club Charities Trust and the “Enriched IT Programme in Secondary Schools by OGCI of the Innovation and Technology Bureau.</p> <p>We will strengthen the collaboration with various STEM bodies, e.g. The Academy of Sciences of Hong Kong, Hong Kong Science and Technology Parks Corporation, in providing STEM-related activities for enriching students’ learning experiences. This could facilitate the provision of various STEM learning opportunities for students.</p> <p>EDB will also strengthen the partnerships with tertiary institutions and professional bodies (e.g. British Council Hong Kong, Hong</p>	<p>We believe the Curriculum Development Council should expand its effort on leveraging resources of the business sector and advanced STEM institutions (e.g. State Key Laboratories), as well as government departments and community partners.</p> <p>Therefore, we hope more partners from the business sector and advanced STEM institutions will appear on the list of resources for STEM education. Not only will that strengthen the goal of improving learning and teaching resources, it will inspire appreciation for STEM</p>

	<p>Kong Federation of Youth Groups and Hong Kong Association for Science and Mathematics Education) in various strategies.</p> <p>EDB will also tap information about the future career opportunities (e.g. direction of STEM, job vacancies in different sectors) through liaison with related bodies/organisations/business firms/employers for reference in planning different strategies.</p>	<p>subjects and careers from a young age.</p>
<p><u>Real-life applications</u></p>	<p>Schools are advised to adopt whole-school curriculum planning, with flexible use of curriculum time, to incorporate elements of STEM education into the school curriculum for broadening students’ learning experiences through time-tabled lessons and other life-wide learning activities beyond the classroom, including arranging for students to participate in various local, national, and/or international STEM-related competitions/events/study tours.</p>	<p>We recommend the Government to fully leverage resources, including but not limited to materials, facilities and experience of STEM professionals from the business sector and advanced STEM institutions to provide hands-on exploration of STEM. Focus could be placed on collaborations that forge pupils’ connections to real-world applications that may not be available during school hours.</p>

<p><u>STEM trips and competitions</u></p>	<p>Based on the positive feedback on the Student Education Fair on Science, Mathematics and Technology 2016 organised in collaboration with the Hong Kong Science and Technology Parks Corporation, and that on the student events of The InnoTech Expo 2016 organised by <u>Our Hong Kong Foundation with EDB as a supporting organisation</u>, EDB will continue to partner with relevant bodies in organising some large-scale STEM-related events for students. These would provide quality learning experiences for students to enhance their interests, creativity, and innovation and to strengthen their ability in integrating and applying both knowledge and skills in solving authentic problems.</p> <p>In collaboration with other relevant organisations, EDB has launched the Inter-school Cross-curricular Project Competition on Climate Change between October 2016 and mid 2017 on the mitigation, adaptation and/or resilience strategies to cope with climate change. This Competition provided an effective learning platform for nurturing global citizenship and caring attitude towards the well-being of mankind by using knowledge and skills of STEM.</p>	<p>We believe that first-hand insights gained from such trips will demonstrate the relevance of STEM knowledge to pupils. Furthermore, school trip opportunities and other forms of support also mean that teachers will be given additional and more interactive teaching resources, thus creating a win-win situation for pupils, teachers and the business sector.</p> <p>Additionally, some national science or engineering student competitions in the UK have set up alumni clubs, allowing frequent access to industry leaders and information. While similar competitions are also held in Hong Kong, we recommend the Government to facilitate more meaningful prize of access to industry for young people.</p>
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