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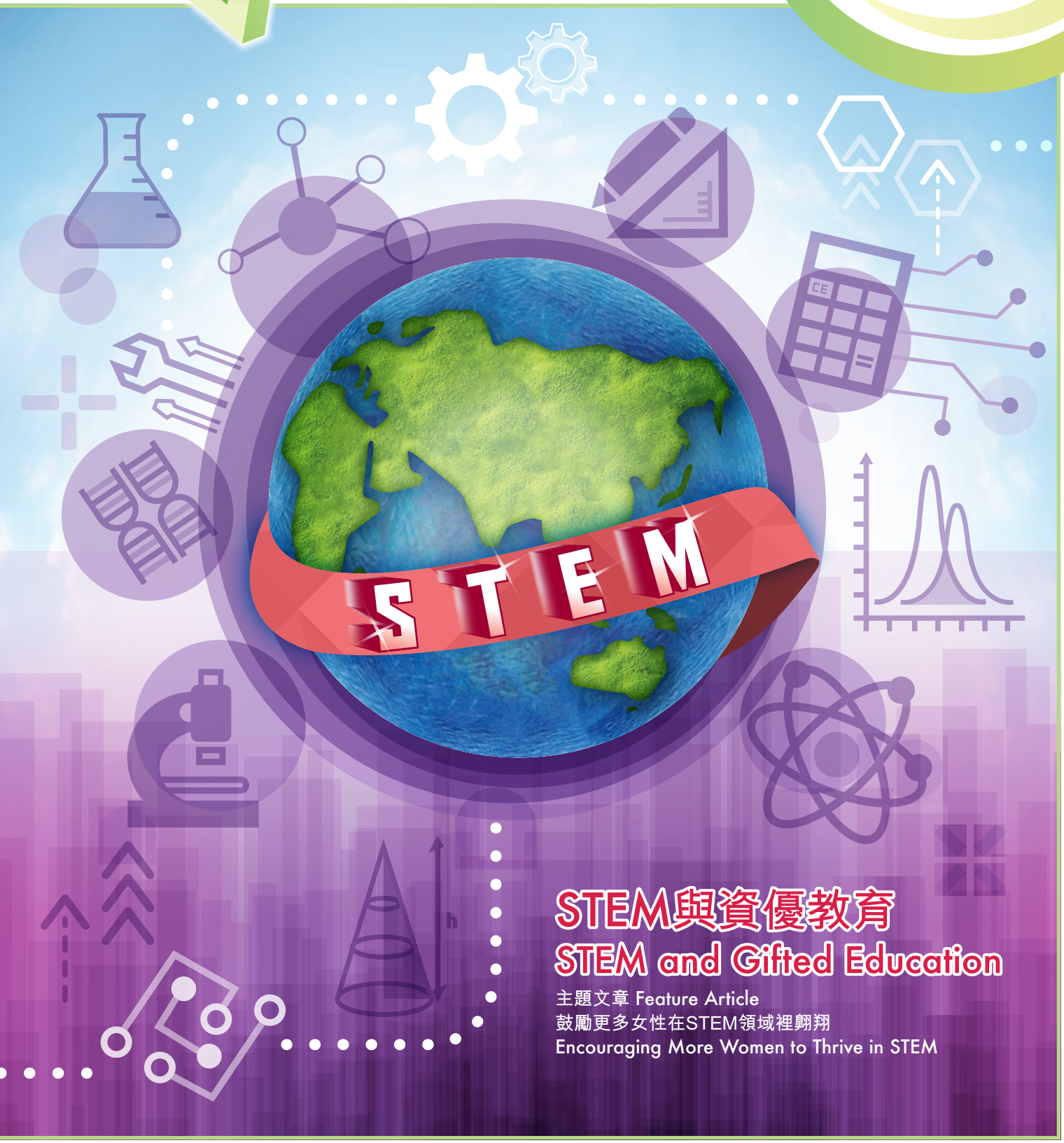
資優薈萃 Gifted Gateway



STEM與資優教育
STEM and Gifted Education

主題文章 Feature Article

鼓勵更多女性在STEM領域裡翱翔

Encouraging More Women to Thrive in STEM

香港資優教育學苑
The Hong Kong Academy for Gifted Education

資優薈萃 Gifted Gateway

STEM與資優教育
STEM and Gifted Education

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STEM 教育的啟示

一連兩天的「香港資優教育峰會及展覽 —— STEM 之政策與實踐」經已順利舉行。我們很高興可以邀請得到世界各地享負盛名的學者及 STEM 教育同仁，分享他們因應當地需要推行 STEM 教育的寶貴經驗。

根據聯合國人口基金會指出，21 世紀最重要的趨勢之一就是人口老化。在亞洲國家之中，日本面對的人口老化問題最為嚴重。故此，他們希望透過 STEM 教育建立可持續發展社會，讓人民可以幸福快樂地生活。目前，日本透過網絡實體系統來發展出人類跟機械和諧共存的社會，讓機械人為長者提供服務。此外，又透過「工業－大學－政府圓桌會議」，從高中開始全方位推動 STEM 人才教育，促進青少年及女性投身科研及 STEM 相關工作。

由於過往的「一孩政策」，中國同樣面對嚴重的人口老化問題。因此，民間組織聯同業界及學界積極推動科學教育，其中 2015 年由科學家及企業家成立的「未來論壇」，就曾舉辦多場介紹現代科學最新趨勢和成果的公開講座，還有「科技創新峰會」及「未來科學大獎」，來提升國民對 STEM 領域的興趣，香港的盧煜明教授更成為首屆「未來科學大獎」的得主之一。另外，由科學家、藝術家於 2016 年正式成立的大理科學藝術中心是一個綜合科學藝術交流平台，有利孕育更多創新主意，回應未來社會人才需要面對的挑戰。

以色列則有超過 4,000 家初創企業，國際知名的企業亦在當地設立超過 300 家研究及開發中心。能有如此佳績，全賴政府及學界推動全國資優及傑出學生計劃，其中包括區域責任計劃、高中學院及全國輔導計劃等。香港同樣面對人口老化問題，目前政府正積極推動 STEM 教育，民間組織和學界亦蓄勢待發，希望透過 STEM 教育讓本港保持競爭力。縱觀以上各點，不同地區有不同需要，需按當地情況推行具地方特色的 STEM 教育，而跨界別合作乃大勢所趨。然而怎樣相互配合以達致最佳果效，仍然有待探索，尋求各方共識。

Revelations on STEM education

The two-day "Hong Kong Gifted Education Summit and Exhibition — STEM Policies and Practices" was already held successfully. We are pleased to have invited world-renowned scholars and STEM education practitioners to share their valuable experience on implementing STEM education in accordance with the local needs.

According to the United Nations Population Fund, one of the most important trends in the 21st century is aging of the population. Among various Asian countries, Japan is facing the most severe problem of aging population. Therefore, the Japanese hope to build a sustainable society via STEM education, enabling people to live a happy and fruitful life. Recently, Japan has developed a society in which human beings and robotics coexist harmoniously through a Cyber-Physical System. Robotics can play the caretaker's role to serve the elderly. On top of that, an all-round STEM talent education is implemented since high school through the "Industry-Universities-Government Round Table" to encourage youngsters and women to engage in scientific research and STEM related work.

Influenced by the "One-child Policy" in the past, China is also facing a severe problem of aging population. Therefore, NGOs, the industry and the academia are proactively implementing Science education. The "Future Forum", founded by a group of scientists and entrepreneurs in 2015, has organised numerous public seminars on the latest scientific trends and achievements, alongside with the "Innovation and Technology Summit" and "Future Science Awards", to raise public interest in STEM. Professor Dennis Lo Yuk Ming from Hong Kong is one of the awardees of the first "Future Science Awards". In addition, the Dali Center for Sciences and Arts, established by a group of scientists and artists in 2016, is an integrated exchange platform for Sciences and Arts that helps to nurture more innovative ideas to cater to the future challenges our talents would face.

There are more than 4,000 start-up enterprises in Israel. World-renowned corporations set up more than 300 research and development centres in the country. Such outstanding achievements are credited to the government and academia that implement the National Programmes for Gifted and Outstanding Students, including the Regional Responsibility Programme, the Academia in High School, and the National Mentoring Programme, etc. As for Hong Kong, we are unavoidably facing the problem of aging population as well. Recently, the government is proactively implementing STEM education, while NGOs and the academia are also ready and in hopes that competence of Hong Kong could be maintained via an implementation of STEM education. To conclude the abovementioned, different regions would have different needs that STEM education with local characteristics would need to be implemented in accordance with local conditions, and an interdisciplinary cooperation would be a trend in achieving the goal. It is left for investigation and exploration with a smooth cooperation of various parties for the consensus and the optimal achievement.

鼓勵更多女性在STEM領域裡翱翔

在為期兩天的「香港資優教育峰會及展覽－ STEM 之政策與實踐」內，我們喜見世界各地的 STEM 教育有著不同發展。但到底怎樣才可培育更多人才，迎接未來社會的挑戰？怎樣鼓勵更多女性加入 STEM 的學習行列？其他國家到底怎樣推行 STEM 教育呢？

中學選科的時候，若兒子說要選擇理科，父母不會有太大的反應；但若是女兒說要選擇理科，父母或許會勸她放棄。這並不難理解，不少人都認為科學是男性的專長，女性縱有能力亦不會名列前茅。對於要求子女成績卓越、確保將來有份安穩工作的香港父母來說，這確是冒險的選擇。不僅父母，部分女生亦因此棄理選文。

科研發展在國際佔領導地位的以色列，教育部長（科學與數學）Gilmor Keshet-Maor 博士表示近年理科科目中，最多女生修讀的要算生物學，約三分二是女生，其次是化學，約佔百分之 60%，但以運算為主的數學、物理學、電腦及工程等學科仍是以男生主導。不過，她並不認為這是女生的運算或數學能力比男生弱之故。

Gilmor Keshet-Maor 博士指出，以色列透過小組學習模式鼓勵更多女生修讀 STEM 科目

根據 2014 以色列當局進行的數學測驗顯示，女生在第 12 班的基礎及中級數學平均成績都比男生好，雖然男生的三等數學成績較女生優勝，但也只是些微之差。英國倫敦 King's College 也曾有相類似的研究，發現 8 歲兒童中表示喜歡科學的，女孩要比男孩多，她們的數學及科學成績與男孩相比不相上下。然而，渴望將來能從事科學工作的，男生（18%）卻遠比女生（12%）為多。

假如男女生數理能力和興趣的差異不是天生的，那麼是什麼原因導致大多數女性對科學領域卻步？美國一份 2010 年進行的研究，邀請男女生進行一個記憶任務，男女生表現相若，但如果告知這項記憶任務是一個數學測驗，或許在心理上造成影響，約 30% 女生會選擇退出，縱然參加，女生成績亦較男生差。看來男女生數學成績的差異，不在於兩性的數學能力，而在於女生的心理習慣，當遇到數學測試時，較易連繫到壓力所致。

根據澳洲墨爾本皇家理工大學聯同美國工程資訊基金會於 2012 至 2013 年針對選擇 STEM 課程大學生進行的研究，發現女性選科很大程度受家庭影響，而男性則受媒體的影響較大。Keshet-Maor 博士就是一例，她坦言高中時很喜歡生物科，但因為家人勸說一個專業學科對她日後的生活較有保障，於是她便選了藥劑學。她笑笑地說，自己在神經科學展開研究，並且取得腦幹細胞博士後獎學金，其後成為科學家，她現時在以色列則負責 K-12 科學及數學教育。


以色列學生於化學實驗室內

事實上，針對男女生學習偏好上的差異，以色列教育部科學教育研究資料顯示，有關當局嘗試請中學理科老師改變教學模式，把科學概念連繫到日常生活的細節上，並採用小組學習模式。在新教學法下，現時高中修讀物理學的女生人數比例已由 2012 年的 30% 上升至 2015 年的 37%。Keshet-Maor 博士認為女生較喜歡交流、協作，還有遇到問題時，往往要深入了解後才會繼續前進，因此小組學習模式較適合女生。而研究指出，男生則較為喜歡獨立進行研究。當然，除了改變教學方法，邀請女工程師到訪中學，以及安排即將選科的 9 年級女生參觀化學工業機構及高科技公司，讓她們與大學的科學家見面也是很好的做法，不過其中最有效的要算是跟高年級學姐交流，透過跟這些榜樣現身說法，提升女生學習科學的自信心及自我效能感，同時亦有助改變男性對女性從事科研的看法，讓他們知道女性在科研領域同樣可有出色表現。


以色列學生喜歡學習科學

Janet Rafner 鼓勵熱愛科學的女生不應怕失敗而放棄，要有冒險精神和自信，相信自己能做得好

於美國維吉尼亞大學取得物理學及工作室藝術學士學位的 Janet Rafner，為是次峰會最年輕的講者，她現時在丹麥的研究院進行研究。Rafner 指出，她也是因為在高中時有機會與大學物理學研究員實地交流，才打消了修讀醫學的念頭，改修物理學。

不過，Rafner 也坦言在男性主導的物理學世界，女性的確會遇到困難。在男性主導的物理世界，她曾遇過隱含的偏見，有男生不經意地說，她之所以能完成作業，一定是從教授那裡直接取得答案。Rafner 為此感到不悅，但她很快就調整心態，嘗試去理解該男生無意貶低女性，以及不了解他的說話隱含性別歧視。Rafner 試著透過閒聊，直接的對話讓對方明白這樣的評語並不恰當，藉坦誠的溝通，再次建立互信，繼續她的學習旅程。

她又指出在學術領域，女性傾向少些冒險。她鼓勵熱愛科學的女生不應怕失敗而放棄，要有冒險精神和自信，不要為自己的思想及事物設限，又要相信女性作為獨立的個體，而且相信自己具備獨立思想能力。現時 Rafner 綜合個人經驗，運用創意，把科學與藝術結合起來，在丹麥奧胡斯大學的 ScienceAtHome 負責發展物理學影像化的項目，將一般人認為難以明白的物理學概念，通過動畫及有趣的科學遊戲展示出來。這個「物理＋設計」的組合，是其中一個網上平台革新科學研究的模式。（網址： scienceathome.org ）

中國

2010 年頒佈的《國家中長期教育改革和發展規劃綱要（ 2010-2020 ）》，其中就強調要提高學生勇於探索的創新精神和善於解決問題的實踐能力。高等教育着力培養高素質專門人才和拔尖創新人才，建立以科學與工程技術研究為主導的導師責任制和導師項目資助制，推行產學研聯合培養研究生的雙導師制。

中國不乏激發年青人科學創意的比賽，如被譽為中國當代大學生科技創新奧林匹克盛會的「挑戰杯」及「全國青少年科技創新大賽」等。此外，1993 年上海更開辦了全國首間以科技教育為特色的康寧科技實驗小學；2012 年中國第一所科學高中深圳科學高中成立，旨在培養以科學、技術、工程和數學見長的創新型高中學生。

政府以外，民間團體也聯同業界及學界積極推動科學教育，包括 2015 年成立的「未來論壇」。該機構已舉辦了多場介紹現代科學最新成果和趨勢的公開講座、「科技創新峰會」以及推出「未來科學大獎」。另外，由全球 13 位頂尖華人科學家、藝術家發起的大理科學藝術中心亦於 2016 年正式成立。中心不僅是一個綜合性科學藝術交流平台，更是全球頂尖科學家和藝術家的研究和工作中心。

以色列

以色列只有 800 萬人口，但有多達 4,000 家初創企業。為了應付市場需求，以色列全力推動 STEM 教育。

以色列已在全國推行資優學童計劃培養 STEM 人才。計劃包括鼓勵資優中學生以小組形式利用科學知識及其創意協助所屬小區解決問題；學生還可一邊繼續享受中學生活、與同輩相交，一邊透過虛擬環境修讀 STEM 課程，甚至取得大學學位；又自 2009 年起推行「全國輔導計劃」，導師團隊包括專業研究人員及業界，讓學生可以接觸最先進的科技設備及最新的研究項目。

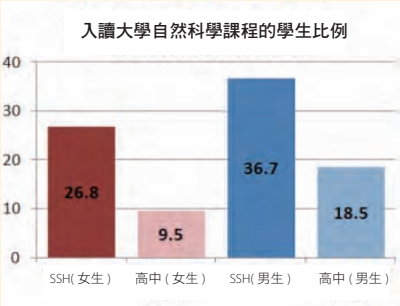
有鑑於選讀高級數學的高中學生人數每年下降（2013 年以前），以色列當局推出多項計劃，甚至邀請總統里夫林（ Reuven Rivlin ）拍攝宣傳廣告來呼籲學生研習科學。此外，若偏遠地區學校修讀高級數學人數不足 5 人，學生可透過網上課程學習數學，又邀請工程師到訪中學甚至擔任老師。為了提升師資，除了開設在職進修課程外，又設立「全國教師中心」作支援及交流的平台。2014 年後，選讀高級數學的學生人數明顯回升，期望 2020 年人數較 2013 年上升 50%。

日本

2016 年 1 月，日本內閣會議正式提出了社會 5.0（Society 5.0）的概念，主要是最大限度應用信息通訊（ICT）技術，通過網絡空間與現實空間的融合和共享，給人們帶來富裕的「超智慧社會」。

為了配合社會 5.0 的發展，孩子需要掌握一些基礎科學知識才能適應新的社會模式。為此，所有高中將提供基礎科學訓練，讓孩子明白科學技術在社會扮演的角色；教學模式方面，日本科學理事會建議綜合物理、化學、生物以及地理科學的課程，除了推行主動學習外，還要應用 ICT 來改革教育；在科學技術培訓方面，政府、業界和學界必須攜手合作，政府要鼓勵女性加入科學領域，要投入更多資源讓年輕研究員在科學領域發展事業，以及為現時業內僱員提供進修機會。

現時全日本已有 200 間超級科學高中（SSH），這些中學不僅以英語教學，和大學有緊密聯繫，同時亦與海外以科學主導的高中進行交流。據統計顯示，SSH 的學生在大學修讀科學相關學科的比率遠比一般的高（見附圖）。2014 年日本科技振興機構（JST）在全國設立「全球科學校園」，為資優高中生提供科學技術課程，也為他們提供國際交流機會。



香港

過去兩年教育局不僅推出報告詳列在中、小學推動 STEM 的最終建議，還舉辦了多項以科學為主題的大型活動。業界、機構考慮到未來或會出現「人才荒」，也相繼加入推動 STEM 教育的行列。

香港賽馬會就於 2016 年宣佈撥款 2.16 億元推行為期 4 年的「賽馬會運算思維教育計劃」，預計會有 16,500 名小四至小六學生及 100 名老師受惠。

雖然推廣活動頻繁，但香港 STEM 教育的發展有一定阻力。據一些中學的經驗所知，要將 STEM 教育納入課堂時間表之中，率先反對或不滿的是學生家長，他們擔心此安排會影響子女其他正規課程的學習時間，以致在公開考試中不能取得佳績。

現階段大家都是放膽嘗試，投石問路，摸索 STEM 教育的模式。有中學就透過參加科學相關的比賽加深學生對 STEM 教育的認識，發揮學生創意，提升他們的演說技巧和英語水平。另外也有小學以「培育未來社會居民」為目標，讓孩子認識科學與生活共融，明白科學加上自己的創意可以提升社區或他人的生活質素。

至於香港 STEM 教育應走的路，有學者建議 STEM 教育應讓所有學生參與，並應看重學生的學習過程，而非成果。

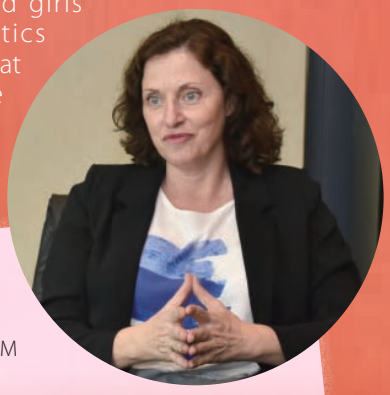
Encouraging more women to thrive in STEM

In the two-day "Hong Kong Gifted Education Summit and Exhibition – STEM Policies and Practices", we are pleased to see STEM education worldwide is having different development approaches. However, how do we nurture more talents to cope with future challenges? How do we encourage more women to engage in STEM? How do other countries implement STEM education?

Let us recall the time when students have to choose their major in their secondary school life. If a son wanted to go for Sciences, his parents would probably be fine with it; but if a daughter wanted to go for Sciences, her parents might ask her to give up. This is totally understandable as many consider that men are especially good at Sciences while women could make no comparison even if they are equally able. For Hong Kong parents who usually look for academic excellence in their children and hope that they would be able to secure a stable job in the future, it would be considered a risky choice for girls to study in Sciences. Not only for parents, some girls would also give up on their pursuit in Sciences and turn to Arts instead because of such reasons.

Israel is a globally leading country in scientific research developments. Dr Gilmor Keshet-Maor, head of the Division for Science and Math at the Ministry of Education, Israel, stated that in recent years, Biology was the most popular Science subject among all Science subjects that were taken by girls, in which around two-third of the students were girls, followed by Chemistry, in which 60% of the students were girls. However, subjects that were based on mathematical operations like Mathematics, Physics, Computer and Engineering were still male dominant. Nevertheless, Dr Keshet-Maor did not consider that it was because girls were weaker than boys in mathematical operations or Mathematics.

According to the results of the Mathematics test conducted by Israel in 2014, the average performance of girls in both basic and Intermediate Grade 12 Mathematics was better than that of boy's. Although boys outperformed girls in Advanced Mathematics, the difference was subtle. A similar research of King's College, London, revealed that more girls than boys among a group of eight-year-old children were fond of Sciences, and girls' performance in Mathematics and Science was similar to that of boys'. Nevertheless, there were more boys (18%) than girls (12%) who claimed that they wanted to pursue their career in Science.



Dr Gilmor Keshet-Maor stated that Israel encouraged more female students to study in STEM subjects via study groups

If the differences between boys and girls in their ability and interest in Mathematics and Sciences are not inborn, what stops most of the women from engaging in Sciences? In a study conducted in the U.S. in 2010, a group of male and female students were asked to carry out a memory task. The performance of two gender groups was similar, but when told that the memory task was a Mathematics test, 30% of the female students opted out of the test as some psychological influence might have taken into effect. Female students performed worse than male students even if they chose to take part in the test. It seemed that the difference in their Mathematics performance between male and female students lay not on the Mathematical ability of the two genders, but on the habit of mind that female students face of Mathematics tests, they tended to connect their feelings with pressure.

According to a study conducted from 2012 to 2013 by the Royal Melbourne Institute of Technology (RMIT University), Australia, and the Engineering Information Foundation of the U.S. on undergraduates who chose STEM programmes, it was found that women were deeply influenced by their families when choosing their major, while men tended to be influenced by the media. Dr Keshet-Maor is a real-life example of this finding. She revealed that she was fond of Biology when she was in high school, but her family convinced her that a major with professional qualifications could better secure her living in the future, so she chose her major in Pharmaceutics. She smiled and commented that she later commenced research in neuroscience and took a postdoctoral fellowship studying brain stem cells. Following her years as a scientist, Dr Keshet-Maor is now responsible for K-12 Science and Mathematics education in Israel.

Tackling the issue of difference in learning preferences of male and female students, as revealed in science education research the Israel Ministry of Education is asking Science teachers in secondary schools to amend their instruction, to explain scientific concepts as they connect to daily lives, and to let students study in groups. Under the new teaching method, the ratio of female students who study in Physics in high school has raised from 30% in 2012 to 37% in 2015.

Israeli students in chemistry lab

Dr Keshet-Maor opined that female students preferred to interact and cooperate with others, and when a problem was encountered, female students would only move on to the next step after a thorough understanding was reached. Therefore, to study in groups would be more suitable for female students. Of course, apart from changing the teaching method, inviting female engineers to visit secondary schools, organising visiting tours to chemical industry and high-tech companies for Grade 9 girls who are about to choose their major, and allowing them to meet with scientists in universities are some other good ways to engage women in Sciences. The most effective way, however, is to let girls communicate with their female seniors, allowing the seniors to share their own experience as role models, in order to boost girls' confidence and self-efficacy in studying in Sciences. Also, it would help to change the traditional male point of view on women engaging in scientific research, letting them understand that female are equally capable of excelling in the scientific research field.

Israeli students enjoy studying science

Janet Rafner encouraged all girls who were passionate in Sciences not to give up for fear of failures and to be adventurous and confident.

Janet Rafner, who graduated from the University of Virginia, U.S. and holds degrees in Physics and Studio Art, is the youngest speaker in the summit. She is conducting her graduate research in Denmark. Rafner stated that it was because she was able to exchange ideas with researchers in Physics when she was in high school that she decided to pursue physics instead of medicine.

Rafner opened up to discuss the ways in which it was difficult to work within the male dominated world of Physics. In the male dominant world of Physics, she has often experienced implicit bias. A male student once offhandedly commented that the only reason she was able to finish her work was because she must have received the answers from the professor. Displeased and unsettled by these comments, Rafner was able to adjust her own mindset and understood that the male student did not intend to be demeaning but rather he was ignorant of the sexism behind his comments. Through casual, yet direct conversations, Rafner made the male student understand that his comments were inappropriate. Mutual trust and understanding were thus rebuilt through honest communications, and her journey of learning continues.

Rafner also commented that academically, women tend to take fewer risks. She encouraged all girls who were passionate in Sciences not to give up for fear of failures, and to be adventurous and confident. She also encouraged girls not to set limits or boundaries for their thinking and to have confidence in their individual and independent thoughts. Currently, Rafner integrates her personal experience with creativity to connect Sciences and Arts by developing projects on Physics visualisations at ScienceAtHome at Aarhus University, Denmark. The projects help people to visualise difficult Physics concepts with animation and fun Science games, and such combination of "Physics + Design" is a model in which online platforms perform scientific research. (Website: scienceathome.org)

China

In the Outline of the National Plan for Medium and Long-Term Education Reform and Development (2010-2020) promulgated in 2010, it is emphasised that students' courage for exploration and innovation with their practical problem-solving ability should be enhanced. Higher education stresses on nurturing able professionals and outstanding innovative talents, developing an accountability system and a project funding system for tutors that are based on scientific and engineering technique research, and implementing a dual tutor system that nurtures postgraduate students with a collaboration of the industry, academia and the research sector.

China is with plenty of competitions that stimulate young people's scientific creativity, for instance, the "Challenge Cup" (known as the "Olympics" in promoting innovation in Social Science, Science and Technology for university students in China) and the "China Adolescents Science and Technology Innovation Contest" etc.. In 1993, Kangning Technology Experimental Primary School, the first primary school that is based on technology education in China, was opened in Shanghai; in 2012, Shenzhen High School of Science, the first high school of Science in China, was established to nurture innovative high school students who are good at Science, Technology, Engineering and Mathematics.

Apart from the government, NGOs are also promoting Science education with the industry and academia, including the establishment of "Future Forum" in 2015. The Future Forum has already held numerous public seminars on the latest achievements and trends of modern Science, organised the "Technology and Innovation Summit", and launched the "Future Science Awards". Besides, the Dali Center for Sciences and Arts (DCSA), founded by 13 top-notch Chinese scientists and artists, was officially established in 2016. Not only does this center work as an integrated exchange platform for sciences and arts, it is also a research and work center for the world's best scientists and artists.

Israel

With only a population of 8 million, there are more than 4,000 start-up enterprises in Israel. To cope with the demands and needs, Israel is putting all-out effort in implementing STEM education.

Israel has already launched several national programmes for gifted students in order to nurture talents in STEM. The programmes encourage gifted secondary students to solve problems in groups for their communities with their scientific knowledge and creativity; students would be able to enjoy their school and social life on one hand, and to take STEM courses or even obtain a degree via a virtual learning platform on the other hand; from 2009 onwards, the "National Mentoring Programme" was launched with tutors from the professional research sector and the field, allowing students to have access to the state-of-the-art scientific equipments and the latest research projects.

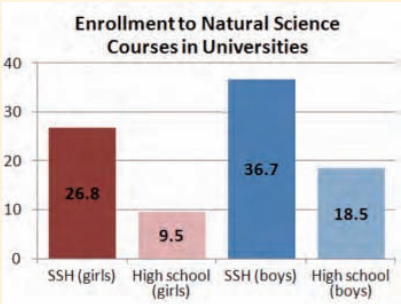
As the number of high school students who studied in the Advanced Mathematics subject was descending (before 2013), Israel implemented several plans and even invited Reuven Rivlin, President of Israel, to shoot a promotional commercial on calling students for studying in Science. On top of that, if there were less than 5 students studying in Advanced Mathematics at schools located in remote areas, students were allowed to learn Mathematics via online courses, and engineers were invited to visit high schools or become their teachers. To enhance the qualification of teachers, on-the-job training courses were offered and "National Teacher Centers" were set up as a supportive and interactive platform. The number of students who studied in Advanced Mathematics had significantly increased after 2014, and it is expected that the number in 2020 will increase by 50% when compared with the number in 2013.

Japan

In January 2016, the Cabinet of Japan brought about the concept of Society 5.0, mainly on maximising the application of information and communications technology (ICT), and creating a well-off "Super Smart Society" with an integration of and a sharing between the cyberspace and the reality.

Catering to the developments of Society 5.0, children would need to master some fundamental scientific knowledge in order to adapt to the new society. Therefore, all high schools would provide trainings on fundamental Science, letting children understand the role that Science and Technology plays in the society; on the teaching pattern, the Science Council of Japan suggested an integrated programme in Physics, Chemistry, Biology and Geographic Sciences, implementing active learning and an educational reform with the application of ICT; on scientific and technological training, the government, the industry and the academia must work hand in hand that the government should encourage women to engage in Science, allocate more resources in helping young researchers to pursue their career in Science, and provide further study opportunities for practitioners in the field.

Nowadays, there are 200 Super Science High Schools (SSH) in Japan. These high schools use English as the teaching medium, maintain a close relationship with universities and have exchanges with Science-led high schools overseas. According to the statistics, students of SSH have a higher enrollment rate to natural Sciences courses in universities than students in general (see the attached picture). In 2014, the Japan Science and Technology Agency (JST) initiated the "Global Science Campus" programme throughout the country, providing gifted high school students with courses on Science and Technology, and giving them opportunities on global exchange.



Hong Kong

In the past two years, not only has the Education Bureau released a report with finalised suggestions on implementing STEM education, it has also organised numerous large-scale events with Science as the theme. Considering that there might be a shortage of talents in the future, the education field and some organisations also participate in implementing STEM education successively.

The Hong Kong Jockey Club announced in 2016 that 216 million dollars will be funded for implementing the four-year programme CoolThink@JC, expecting to benefit 16,500 P4 to P6 students and 100 teachers.

Although promotions are frequent, the development of STEM education in Hong Kong is in face of a certain resistance. As reflected by some secondary schools, when there was an attempt to add STEM education in the regular curriculum, parents of the students were the ones who objected or were not happy with the arrangement. It is because they were worried that this arrangement would affect the learning time of their children with the regular courses, and hinder them from achieving good results in public exams.

At this stage, we are all experiencing trials and errors in exploring a model for STEM education. Some secondary schools participate in Science related competitions to deepen students' understanding in STEM education, to realise their creativity, and to enhance their presentation skills as well as English level. On the other hand, a primary school aims at "nurturing future social citizens", allowing children to learn about a communion of Science and life, and understand that their creativity with Science could enhance the quality of life of others and the entire community.

As for the direction of STEM education in Hong Kong, a scholar suggested that STEM education should engage all students and stress on the learning process but not the results of students.

STEM教育普及化

普及教育資優化

近年備受關注的 STEM 教育，透過推動科學、科技、工程及數學教育，培養學生的學習興趣，提升創意和解難能力，發展學生的創新思維。這正好為學生提供了一個跨學科的學習經歷，培育在資優教育中強調的「高層次思維技巧」、「創造力」和「個人及社交能力」等三大資優教育元素。有見及此，本校希望落實「STEM 教育普及化」、「普及教育資優化」的教育理念，採用「三層架構模式」，以整體而連貫的方式在校內推行。

STEM教育普及化

本校將資優教育的三大元素，滲入日常課堂的 STEM 教學中（第一層）。透過多元化的教學內容和富挑戰性的學習活動，加強課程的學習目標，提升全體學生的學習興趣與能力，並讓資優學生逐漸「浮尖」。

優化數學課堂教學

本校為提高學生學習數學的興趣和表現，老師重視課堂學習內容及學生的能力。自 2014/15 學年開始，校方聘請香港教育大學客席講師擔任課程顧問，舉行「思維教學」及「評估」教師工作坊，與老師一起進行同級備課會議，運用「變易理論」（Variation Theory）及「策劃—推行—評估」模式，討論學習內容，確立課堂重點。

■ STEM 教師工作坊

設計校本課程

本校把機械人及 3D 打印技術編入校本電腦科課程，作為 STEM 教育工具。學生通過測試機械人，認識基本工程原理；藉着編程，提升數理邏輯和解難能力；通過學習任務，整合學科理論知識與實作應用；經歷動手做的過程，培養創新思維和解難能力。

■ 電腦科機械人課程

■ 小學數學精英大賽頒獎禮

多元化學習活動

每年一月，本校均舉行專題研習活動，通過具體情境和真實案例，如「環保電動船」，讓學生綜合科學、科技、工程及數學知識之餘，更能把各個學習領域的元素有意義地聯繫起來，以解決真實問題。

■ 學生參加小學數學英大賽

普及教育資優化

教師從日常教學觀察，挑選具潛質且富學習熱忱的學生，接受有系統的校本資優教育服務（第二層）。本校開設各種類型的校本抽離式課程，讓他們進一步發展專科潛能，如數學解難、科學探究、機械人編程等。每年暑假，本校更舉辦「尖子營」，關顧資優學生在情緒、社交、道德價值觀等方面的需要，讓他們得到全人發展，進一步提升他們的成就。

共建願景專業成長

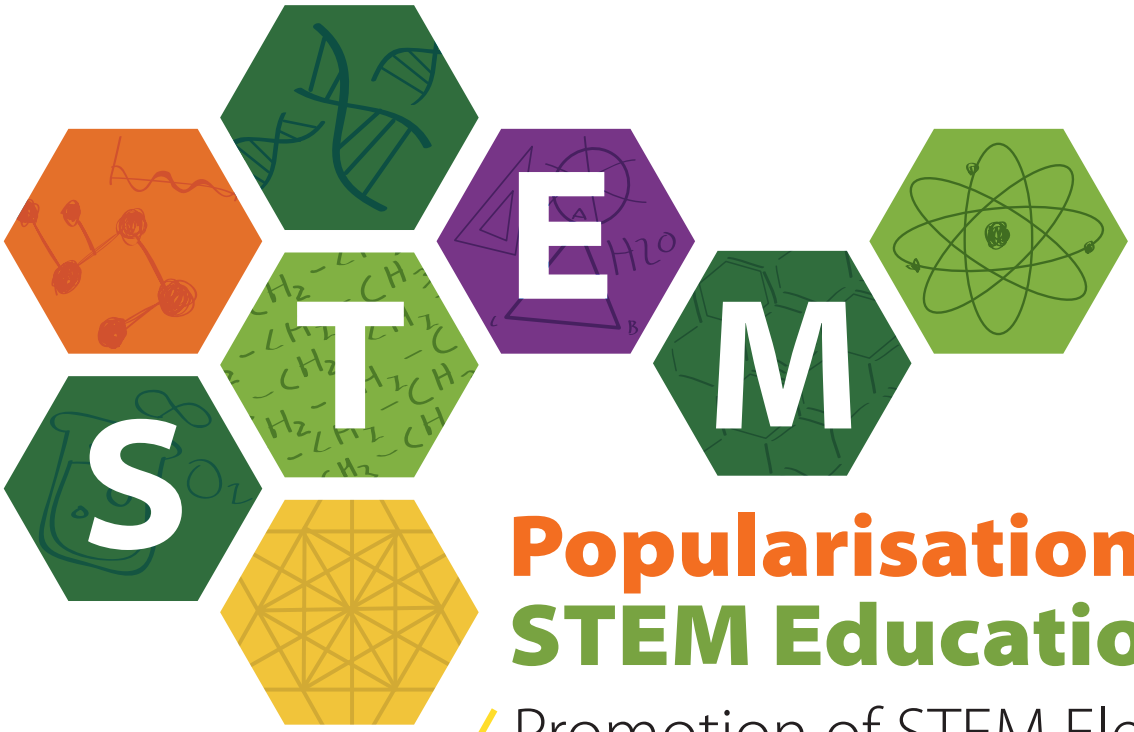
STEM 及資優教育的有效推行及持續發展，有賴學校所有成員實現此「共同願景」。本校鼓勵老師在 STEM 及資優教育上的專業成長，支持老師參與校外機構的講座及課程；亦安排老師訪問其他學校，了解他們的實踐經驗。同時，舉辦校本工作坊，促進同儕的專業學習和交流。

本校近年更與大專院校、中小學及教育機構合辦「小學數學精英大賽」。活動除了培養學生對數學的興趣、提升其分析及解難能力外，亦希望加強學校之間的學習與聯繫，讓老師有機會相互交流。

在發展 STEM 及資優教育的過程中，老師們明白關鍵不再是不斷增加新的學習內容，而是「如何教」比「教些甚麼」更為重要；同時，讓學生「學會學習」，最終使他們能自主地解決各種問題。

通過這幾年努力，本校在現時的課程基礎上持續優化，推行不同種類與 STEM 教育的活動，提升整體學生的能力。同時，亦希望讓學生有機會被發掘，集中資源培育資優學生。盼望在面向二十一世紀，學校教育除了教授傳統學科的知識外，更能培養學生「學會學習」（learning to learn）及創新的能力。

黃智華校長
基督教香港信義會紅磡信義學校



Popularisation of STEM Education and Promotion of STEM Elements in Universal Education

STEM education, which receives quite a lot of attention in recent years, promotes Science, Technology, Engineering and Mathematics education to nurture students' learning interest, enhance their creativity and problem-solving ability, and develop their innovative thinking. It provides students with an interdisciplinary learning experience, and it helps to nurture the "high-order thinking skills", "creativity" and "personal-social competence" in students. These qualities are the three core elements advocated in gifted education. Therefore, our school would like to realise our vision in education by implementing a "popularisation of STEM education" and "promotion of STEM education elements in universal education". A "three-tier operation model" is adopted to implement the above plan thoroughly and coherently in our school.

Popularisation of STEM education

Our school adopts the three core elements advocated in gifted education in our daily STEM curriculum (Level One). Through a diversified syllabus and challenging learning activities, learning objectives of the courses would be emphasised, while learning interest and competence of students at large would be enhanced. Gifted students would gradually become "distinguishable" throughout the process。

Optimisation of Mathematics classess

To enhance students' interest and performance in learning Mathematics, our teachers stress very much on the learning content and students' ability. From the academic year 2014/15 onwards, our school has employed a guest lecturer of the Education University of Hong Kong as our Curriculum Consultant. The Curriculum Consultant holds workshops for teachers on "teaching of thinking" and "assessment", attending the same-grade lesson planning meetings with the teachers, applying Variation Theory and adopting the "planning-implementation-evaluation" model to discuss the learning content with the teachers and pinpoint the highlights to be taught in class.

STEM workshop for teachers

Designing school-based courses

As a means of STEM education, our school has made robotics and 3D printing technology as part of the syllabus of our school-based computer course. Students could learn about the basic principles of engineering via robot testing, enhance their logical thinking and problem-solving ability in Mathematics and Science via programming, integrate theories and practical applications via learning tasks, and develop innovative thinking and problem-solving ability via hands-on participation.

Prize Presentation Ceremony of the Primary Mathematics Elite Competition

Computer course on robotics

Diversified learning activities

Our school would organise project based learning activities in January every year. Through actual scenarios and real cases, like the "eco-friendly electric boat", students would be able to integrate their knowledge in Science, Technology, Engineering and Mathematics, and to connect the elements of various domains meaningfully in order to solve real-life problems.

Students participating in the Primary Mathematics Elite Competition

Promotion of STEM elements in universal education

Our teachers would observe from their daily teaching and select students with potential and enthusiasm in learning to receive our school-based gifted education services (Level Two). Our school offers various school-based pull-out courses to further develop students' potential in a particular domain, for instance, problem-solving ability in Mathematics, scientific investigations, and robotics programming, etc. We would also organise an "Elite Camp" during summer vacation every year, catering to the emotional, social and moral needs of the gifted students, and providing them with a whole-person development that helps to further enhance their achievements.

A shared vision for a professional development

An effective implementation and sustainable development of STEM and gifted education depend on all staff members of our school who realise the "shared vision" of ours. We encourage our teachers to have a professional development in STEM and gifted education, support them to participate in seminars and courses offered by other organisations, and arrange school visits for them to learn from the practices and experience of other schools. In the meantime, there are school-based workshops to facilitate professional learning and exchanges among our teaching staff.

In recent years, our school coorganise the "Primary Mathematics Elite Competition" with tertiary institutions, secondary and primary schools. Apart from developing students' interest in Mathematics and strengthening their analytical as well as problem-solving ability, it is hoped that learning and communications among schools could also be strengthened, and teachers would be able to exchange ideas with one another.

In the process of developing STEM and gifted education, our teachers understand that an endless addition of learning materials is not crucial. What really matters is "how" to teach and "what" to teach. It is equally important to let students "learn to learn", enabling them to solve various kinds of problems on their own.

With our efforts in the past few years, fundamentals of our courses have been optimising continuously. Various activities relating to STEM education are offered to enhance students' competence at large. In the meantime, it is hoped that gifted students could be distinguished and nurtured with concentrated resources. In face of the 21st century, it is hoped that education in schools could develop students' ability of "learning to learn" and innovative competence on top of imparting traditional academic knowledge.

Mr Daniel Wong
Principal, E.L.C.H.K. Hung Hom Lutheran Primary School

積極推行 STEM 教育

有效照顧學習差異

課程發展議會於 2015 年發表《推動 STEM 教育——發揮創意潛能》諮詢文件，提出推動 STEM 教育可在科學和科技範疇培養不同層面、具備不同能力的多元人才，以加強香港的國際競爭力，並促進社會和經濟發展。惟香港推行 STEM 教育仍處於起步階段，學界仍在探索具體有效的施行方法。

其實，STEM 教育與生活息息相關，學校可因時制宜，於任何時間及地點推行 STEM 教學。清華大學高雲峰教授就曾提出「科學、科技、工程、數學之間，存在著互相支持及互相補充的關係，並且不能分割成獨立的小塊，而創客教育（ Maker ）正是整合它們的契機。」本校相信，只要於合適的時間、空間，設定及整合適當的 STEM 教學材料，撤離科組之間的獨立框架，就能有效地推行 STEM 教育。

學生憑作品「微重力狀態下製作多用途的聚合物有孔薄膜」於香港中學生太空搭載實驗方案設計比賽獲冠軍，並由中國航天員在「天宮二號」太空實驗室進行實驗示範

積極推行 STEM 教育

一直以來，本校積極發展科學、科技及動畫創客教育，並參考「香港資優教育推行模式」，以三層形式推行「科普」及「資優培訓」：

第一層次

以推行普及的教學活動為重點，重點引發學生對科學與科技的興趣及培養科學素養，包括：

1. 解釋科學現象
2. 評價和設計科學探究
3. 解釋數據和證據

第二層次

以抽離方式推行，在一般課堂以外進行專科特定範疇的延伸課程，讓資質及天賦優異的學生參與全港、全國甚至國際科學賽事，透過校外比賽，提高學生的識見及建立他們的自信心。

第三層次

為特別資優的學生提供富挑戰性的校外增潤課程及有關 STEM 的延伸學習機會。

與一般較注重前人累積知識的語文科有所不同，STEM 教育著重的是學生的創意思維，較少受一些前設優勢所規限。在這三層模式的教育下，資優學生能夠超越自己，在科創上取得突破，能力稍遜的學生也能成為科創愛好者。這種模式有效達致「科普」與「資優培訓」的並重，讓不同能力的學生也有所得益。透過參加與 STEM 教育有關的活動及比賽，我們觀察到學生對學習愈見信心，各方面亦得以成長，提升了解難、分析、創意思維等能力。

學生獲教育局吳克儉局長頒發澳洲青年電影節獎狀

紀思輝校長
順德聯誼總會翁祐中學

令人鼓舞的個案

談及學生的成長，我想到一位於本校修讀理科的中四學生，他的成績一向平平，部分科目更能力稍遜，被列入「保底」名單。但自從參加「香港中學生太空搭載實驗方案設計比賽」取得理想成績後，在科研比賽中勝出的成功經歷帶動下，他開始樂於學習，成績有顯著的進步。他於獲獎後向傳媒透露，參加比賽前未能找到學習方向，但勝出比賽後便自信大增，能克服早期未能應付的學習困難，並一一擊破，最近更成為班中化學科的第一名。

這數年間，本校學生在科創方面的成就也逐漸獲得外界的肯定。學生參加全港、全國甚至國際科學賽事的表現愈見出色。學生曾代表香港到澳洲、英國、美國、北京、上海、台灣及韓國等 28 個國家及城市作賽及交流，本年度更於「香港中學生太空搭載實驗方案設計比賽」中獲得全港冠軍，得獎作品更由中國航天員在「天宮二號」太空實驗室進行實驗示範。

此外，本校亦致力於社區推動 STEM 教育，向區內小學生提供免費電腦立體動畫課程，課程由本校學生一手包辦，包括制訂教學策略、製作教材、及設計課堂活動等，學生更扮演小導師角色。活動除了提高小學生對動畫的認知外，本校學生亦能從課程準備及課堂教授中得益，學習到團隊合作精神及溝通技巧，亦令學業成績稍遜的學生尋回自信，在教導別人的同時亦更掌握學習的方法，提升學習動機。

學生代表香港到美國候斯頓參加 I-SWEEP 國際大賽

學校舉辦小學生電腦立體動畫課程

IMPLEMENTING STEM EDUCATION PROACTIVELY

To Tackle Learning Differences

The Curriculum Development Council published a consultation paper titled "Promotion of STEM Education – Unleashing Potential in Innovation" in 2015, pointed out that promoting STEM education could assist in the nurturing of diversified talents with a range of capabilities at different levels in Science and Technology fields with an aim to enhance the international competitiveness of Hong Kong and contribute to social and economic development. Nevertheless, the promotion of STEM education in Hong Kong remains at the initial stage. The education field is still exploring for practical and effective implementations of STEM education.

In fact, STEM education is closely related to our daily lives. Schools may implement STEM education anytime and anywhere appropriate. Professor Gao Yunfeng of Tsinghua University opined that "there is a mutual supportive and supplementary relationship among Science, Technology, Engineering and Mathematics that they cannot be divided into independent parts. Maker education is the key to integrate all of the above domains." Our school believes that by designing and integrating appropriate STEM teaching materials at the appropriate time and space, and removing the individual frames of the various domains, STEM education could be implemented effectively.

Promoting STEM education proactively

Our school has been proactively implementing Maker education in Science, Technology and animation, and referring to the "Operation Mode of Gifted Education in Hong Kong" to adopt a three-tier model in implementing "popular Science" and "gifted training":

Level One: with implementing popular teaching activities as the key, it is aimed at inspiring students' interest in Science and Technology, and developing their scientific competence that includes:

1. explaining scientific phenomana
2. evaluating and designing scientific research
3. explaining data and evidence

Level Two: to conduct pull-out, extended programmes in specific areas after regular school hours, in order to allow gifted and talented students to participate in local, national and international Science competitions. Participation in off-campus competitions helps to broaden students' horizons and develop their confidence.

Level Three: to provide challenging off-campus enrichment and extension learning opportunities for exceptionally gifted students.

Unlike language subjects that stress on knowledge accumulated by predecessors, STEM education focuses on creative thinking and is seldom limited by prerequisite advantages. Under this three-tier education model, gifted students would be able to surpass themselves and achieve breakthroughs in Science and innovations, and students who are less able could also become advocates of Science and innovations. This model helps to achieve a balanced emphasis of "popular Science" and "gifted training", benefiting students with different abilities. We observed that by participating in activities and competitions relating to STEM education, students are getting more and more confident in learning. They are able to experience personal growth in various aspects, and their problem-solving, analytical, innovative thinking ability are enhanced.

Students were awarded the Champion of the "Space Science Experiment Design Competition for Hong Kong Secondary School Students" with their winning design, "A Multi-purpose Porous Polymer Membrane under Microgravity", which was carried onboard "Tiangong-2" for demonstration by astronauts

Students were awarded a trophy and a certificate by Mr Eddie Ng Hak-kim, Secretary for Education, for the Auburn International Film Festival for Children and Young Adults of Sydney, Australia

An inspiring example

It reminds me of a F.4 Science student in our school when talked about personal growth of students. He is just doing okay at school, and his performance of some subjects is a bit below satisfactory that he is on the "floor list" for supervision. Ever since he participated in the "Space Science Experiment Design Competition for Hong Kong Secondary School Students" and achieved good results, however, he began to enjoy learning with the success and encouragement he gained in the competition, and his academic performance has improved remarkably as well. He told the media upon being awarded that he failed to see his direction of learning before participating in the competition, but his confidence was growing stronger as he won the competition that he was able to overcome the learning difficulties he failed to tackle earlier and eventually solve them one by one. He even came first in class in Chemistry recently.

Over the past few years, the scientific and innovative achievements of our students are getting recognised. Performance of our students is becoming outstanding in local, national and international Science competitions. Students have represented Hong Kong to participate in competitions and exchange activities in 28 countries and cities, namely Australia, the United Kingdom, the United States of America, Beijing, Shanghai, Taiwan and Korea, etc. This year, our students is awarded the Champion of the "Space Science Experiment Design Competition for Hong Kong Secondary School Students", and their winning design was carried onboard "Tiangong-2" for demonstration by astronauts.

Our school organised 3D computer animation courses for primary students

Students representing Hong Kong to participate in the I-SWEEP at Houston, the United States of America

Dr Alex Kai
Principal, Shun Tak Fraternal Association Yung Yau College

On the other hand, our school has been striving for promoting STEM education in the community, providing free 3D computer animation courses for primary students in the district. The courses are solely prepared by our students, and the preparation work includes formulating a teaching strategy, producing teaching materials, and designing activities in class, etc. Students would also work as the little teachers of the courses. Apart from deepening primary students' understanding in animation, the courses are also beneficial to our students via the course preparation and teaching process. Our students are able to experience team spirit and learn about communication skills, and students with less satisfactory academic performance are able to regain their confidence. In the course of teaching, students are able to better master the method to learn and have their learning motives enhanced as well.

STEM 教育背後的意義

林曉鋒博士工程師
科技集團主席及城大電子工程客席教授

於科學園內舉行的STEM 科技教學試行計劃工作坊
Pilot Scheme Teacher Workshop@Science Park

教育局在 2015 年開始推廣 STEM 教育，但到底背後的意義為何，大家都可能摸不著頭腦。追本溯源，STEM 教育源自美國，提出在科學、科技、工程和數學方面加強培訓，並應用到跨學科層面上，希望從中小學開始推行，及後奧巴馬總統提出培育創新（Educate to Innovate），目的是培育 21 世紀創新人才，提升國家競爭力。

現時世界的經濟發展趨勢，都是由科技帶動的「知識型經濟」，能否有效地利用 STEM 科技教育培訓人才，成了「知識型經濟」發展的關鍵。目前，全球最大的經濟體系，包括中國和美國都是以科技為主導。因此，筆者樂意見到教育局銳意推行 STEM 教育，讓香港日後能有足夠人才發展「知識型經濟」。

面對挑戰

事實上，早年美國開始推行 STEM 教育時，亦面對過不少挑戰。據當時美國教育部的統計，28% 畢業生對 STEM 相關的職業感興趣，然而其中 57% 畢業生表示不會從事 STEM 相關的職業。換句話說，縱使投放了大量資源於培訓之上，亦不保證可獲相應的人才。箇中原因眾說紛紜，大體都是推行得過於急速，未能掌握學生程度，較難編撰合適的課程，令部分學生產生恐懼等。其後，在 2009 年，奧巴馬總統提出培育創新，令學生對學習產生興趣，勇於創新，這樣美國的 STEM 教育才邁向正確方向，日趨成熟，支持美國創意產業高速發展。

目前 STEM 已在香港登陸，但部分老師不太明白 STEM 為何物。部分老師沒有信心推行，部分不太適應這個轉變；然而說來倒也奇怪，部分老師卻認為他們一直都有推行 STEM 教育，只是過往的名稱不同而已。

林曉鋒博士工程師於科學園內為STEM 科技教育論壇演講
Ir Dr Alan Lam's talk in the STEM FORUM@Science Park

環顧香港的傳統學科，其實已包含 STEM 的元素：

S 的部分：	包括常識、科學、自然、物理、生物、化學、地理等；
T 的部分：	包括科技、資訊科技、電腦和視藝等；
E 的部分：	包括設計與科技和家政等；
M 的部分：	包括數學、統計、附加數學和純粹數學等；

其他元素，還有：

R（Reading）的部分：	包括中文、英文、歷史和文學等；
A（Art）的部分：	包括美勞、美術和音樂等；
S（Sports）的部分：	包括體育等；
+（其他）：	包括經濟、商業、會計等。

因此筆者認為香港傳統的教育，可以轉化成為 STEM 的擴充版，並撮寫成「STREAMS+」。

在推行 STEM 教育時毋須過度焦慮，我們可以運用過往經驗，再加入跨學科元素、運用科技提升趣味及互動性、透過活動來讓學生「動手做」等，促成具本土特色的 STEM 教育。此外，我們可以加入「i」理念，即「innovation」創新和「inspiration」啟發，為傳統教育創造附加價值，豐富香港的教育模式，讓 STEM 教育可以務實地實踐出來。

但到底如何運用創意來增潤香港的科技教育呢？美國谷歌公司成功開發的手機運作系統安卓（Android），便是一個很好的例子。這個平台不但能讓資源共享，更鼓勵不同地方的開發者共同參與研發，分享研究成果。我們可以向美國借鏡，製作免費網上 STEM 教育平台，讓不同的學校、不同的老師，可以在平台上分享教材及心得，讓免費的資源持續地積累，為學界提供高水平、高效益、高趣味及低成本的教材，減低老師的工作量。另外，又可透過培訓教師，鼓勵老師分享個人製作的教案及相關教學工具，並定期舉辦分享會讓業界交流，讓香港的 STEM 教育得以持續發展。

參與者於科學園內舉行的 STEM 科技教育論壇合照
Group Photo of the STEM FORUM@Science Park

The Meaning Behind STEM Education

i-education
的教師工作坊
Teacher Workshop
@i-education

The Education Bureau started to promote STEM education in 2015, but what is the meaning behind this practice? We might have no idea. Getting to the root of the matter, STEM education was initiated from the United States of America that it emphasises training on Science, Technology, Engineering and Mathematics with an application on interdisciplinary levels. It is hoped that STEM education could first be implemented in primary and secondary schools. Subsequently, the Obama administration administered the "Educate to Innovate" campaign that aims at nurturing innovative talents in the 21st Century to enhance the competitiveness of the country.

The development trend of the world's economy is moving towards a "knowledge-based economy" that driven by technology. Whether or not STEM education could be implemented effectively to nurture talents is the key to the developments of a "knowledge-based economy". The world's largest economies nowadays, including China and the U.S., are technology-led. Therefore, I am pleased to see that the Education Bureau is determined to implement STEM education, equipping Hong Kong with sufficient talents to develop a "knowledge-based economy".

FACING CHALLENGES

In fact, the U.S. had encountered numerous challenges when implementing STEM education at the early stage. According to the statistics of the U.S. Department of Education at that time, 28% of the graduates declared an interest in a STEM related field, yet 57% of them stated that they would not pursue their career in a STEM related field. In other words, having allocated enormous resources on training does not guarantee an equivalent number of talents nurtured. There are many reasons for this, but in general, it is believed that it might be due to a rapid implementation of STEM that it failed to be in line with students' progress, and it was hard to design an appropriate curriculum that some students were intimidated by the courses. Subsequently, in 2009, the Obama administration brought about the "Educate to Innovate" campaign to booster students' interest in learning and to encourage innovation. As a result, STEM education in the U.S. started to be on the right track and become sophisticated that it is sufficient to support the rapid developments of the creative industries in the U.S.

STEM education has landed in Hong Kong recently, but some teachers are not quite sure what STEM is. Some teachers are not confident in practising STEM, and some are not adaptive to the changes. Nevertheless, some teachers consider that they have always been implementing STEM education. The only difference is that the subjects they have been teaching were named differently in the past.

Reviewing the traditional subjects in Hong Kong, STEM elements are actually embedded:

S	: including General Studies, Science, Nature, Physics, Biology, Chemistry, Geography, etc;
T	: including Technology, Information Technology, Computer and Visual Arts, etc;
E	: including Design & Technology and Home Economics, etc;
M	: including Mathematics, Statistics, Additional Mathematics and Pure Mathematics, etc;

Other elements include:

R (Reading)	: including Chinese, English, History and Literature, etc;
A (Art)	: including Art & Craft, Art and Music, etc;
S (Sports)	: including Physical Education and others;
+ (Others)	: including Economics, Business and Accounting, etc.

Therefore, I think traditional education in Hong Kong could be transformed into an extended version of STEM and be called "STREAMS+".

There is no need to be anxious when implementing STEM education. Based on our previous experience with an addition of interdisciplinary elements, making use of technology to enhance the fun and interactivity, and allowing students to have hands-on experience via activities would all help to bring about our very own STEM education with localised features. On the other hand, "innovation" and "inspiration" could be added to add values for traditional education, to enrich the education model in Hong Kong, and let STEM education be implemented in a practical way.

How do we enrich technology education in Hong Kong with creativity? Android, a mobile operating system developed by Google Inc., U.S., is a good example to illustrate this point. Not only does this platform allow resource sharing, it also encourages developers from different regions to participate in research and development, and to share their research results. We could learn from this U.S. example by creating a free online platform on STEM education, which allows teachers from different schools and with different backgrounds to share their teaching materials and tips, so that free resources could be sustainably accumulated, and provide the field with fun, quality teaching materials that are of high level of efficiency and in low cost. Workload of teachers could hopefully be reduced as well. Moreover, a sustainable development of STEM education in Hong Kong could be realised through training teachers and encouraging them to share their self-made teaching plans and tools, and holding regular sharing sessions that allow idea exchanges among practitioners of the field.

Ir Dr Alan Lam
CEO of a technology group and Visiting Professor of the City University of Hong Kong in Electronic Engineering

演講嘉賓與資優學苑院長吳大琪教授合照

學生向參觀者介紹他們的創意發明

教育界矚目盛典 展現STEM教育成效

由香港資優教育學苑主辦，教育局及香港科技園公司首度合辦的「香港資優教育峰會及展覽—— STEM 之政策與實踐」，已於去年 12 月 9 至 10 日於香港科學園順利舉行。

一連兩天的活動，內容豐富，反應熱烈。來自世界各地包括以色列、英國、美國、日本、南韓、中國內地、台灣及本港學者、STEM 教育同仁等，出席峰會，分享 STEM 教育最新趨勢及推行的實戰經驗。講座與會者眾，每場出席人數接近 300 之多。大會並於部分環節設有小組討論時段，讓與會者發問，與台上演講嘉賓交流。此外，會場亦設有不同論壇，讓大學教育同工及中小學生分享 STEM 教育心得。

六所本地大學首次就 STEM 教育雲集一堂，透過精彩展覽介紹 STEM 的卓越成就，其中展示的創新構思有：利用太陽能驅動汽車和淨化用水、應用於日常生活及醫療範疇的創意應用程式、最新研發的機械人，還有其他教人嘖嘖稱奇的科研成果。教育局局長吳克儉先生 , SBS, JP 於活動首天出任主禮嘉賓，吳局長對活動表示欣賞，並謂是次活動提供了一個極佳平台討論 STEM 教育政策及如何將之實踐。在二十一世紀，培育和物色人力資源是港府的重要任務。資優學苑院長吳大琪教授感謝各界鼎力支持，他希望透過是次活動，讓不同國家及地區的學者進行交流，探討如何透過 STEM 教育促進資優教育發展，並祝願教育界同工能獲得啟發，為香港的教育工作一起努力！

小女孩對 STEM 教育活動甚感興趣

為期兩天的活動，內容豐富，會場內設有學生分享講壇

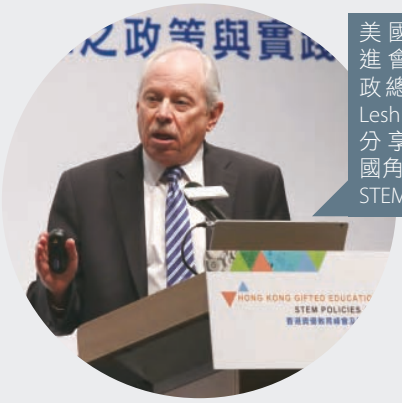
講座後設小組討論環節，供與會者提問

教育局局長吳克儉先生 , SBS, JP 參觀 STEM 教育展覽

每場講座也有近 300 人參加，反應相當熱烈

資優學苑董事局主席林潤富先生頒發紀念品予香港科技園公司董事會成員兼 STEM 教育行動創辦人梁穎宇女士，JP

STEM 教育展覽展示各大學的科研成就



美國科學促進會榮休行政總裁 Alan I. Leshner 博士分享「從美國角度看優質 STEM 教育」

STEM 教育先驅 David Pines 博士（中）欣賞資優學苑學員的兒時作品集

中國科學院物理研究所丁洪教授分享「中國的科學教育參與度」

以色列教育部長 Gilmor Keshet-Maor 博士出席 STEM 教育峰會晚宴與海外專家交流

日本科技振興機構科技顧問中村道治博士的講題是從 STEM 及資優教育達致未來可持續發展的社會

Speakers photographed with Professor Ng Tai Kai, Executive Director of the HKAGE

Students introduced their innovative inventions to the visitors

A greatly anticipated event in the education field with a showcase of STEM education effectiveness

Hosted by the Hong Kong Academy for Gifted Education (HKAGE) and co-organised for the first time by the Education Bureau and the Hong Kong Science and Technology Parks Corporation, the "Hong Kong Gifted Education Summit and Exhibition – STEM Policies and Practices" was successfully held at the Hong Kong Science Park from 9 to 10 December last year.

The two-day event was fruitful and greatly welcomed. Scholars and STEM education practitioners worldwide, from Israel, the United Kingdom, the United States of America, Japan, South Korea, Mainland China, Taiwan and Hong Kong, participated in the summit, shared the latest trends and their practical experience in implementing STEM education. There was a large number of participants in the seminars that each received nearly 300 participants. Panel discussions were arranged in some sessions, which allowed the floor to raise questions and exchange ideas with the speakers. Moreover, there were various types of forum in the venue that allowed education practitioners from the universities, secondary and primary students to share their insights on STEM education.

Panel discussions were arranged after the seminars for participants to raise questions

Six local universities gathered for STEM education for the first time to showcase their remarkable achievements on STEM. Some of their innovative ideas include: solar powered cars and solar water purification, apps that could be used in daily life and for medical purposes, newly invented robots, and many other fascinating scientific research achievements. Mr Ng Hak Kim, Eddie, SBS, JP, Secretary for Education, was the officiating guest at the first day of the event. Mr Ng was impressed by the event that he found it an excellent platform for a discussion on STEM education policies and its implementation. Nurturing and identifying human resources is a crucial mission for the Hong Kong government in the 21st century. Professor Ng Tai Kai, Executive Director of the Hong Kong Academy for Gifted Education, thanked all stakeholders who gave their all-out support to the event. Through this event, he hoped that scholars from different countries and regions would be able to exchange ideas, and to investigate how STEM education would help to facilitate the development of gifted education. Professor Ng wished that all fellow education practitioners would be inspired by the occasion and would strive for the best for education in Hong Kong.

Mr Ng Hak Kim, Eddie, SBS, JP, Secretary for Education, visited the STEM education exhibition

The seminars were greatly welcomed that each received nearly 300 participants

The STEM education exhibition showcased the scientific and research achievements of the universities

This little girl was quite interested in the STEM education activities

The two-day event was fruitful and student sharing forums were available in the venue

Dr David Pines (person in the middle), a STEM education pioneer, was enjoying the childhood works of student members of the HKAGE

Dr Gilmor Keshet-Maor, Ministry of Education – Sciences and Math, Israel, attended the dinner for the STEM education summit and exchanged ideas with overseas professionals

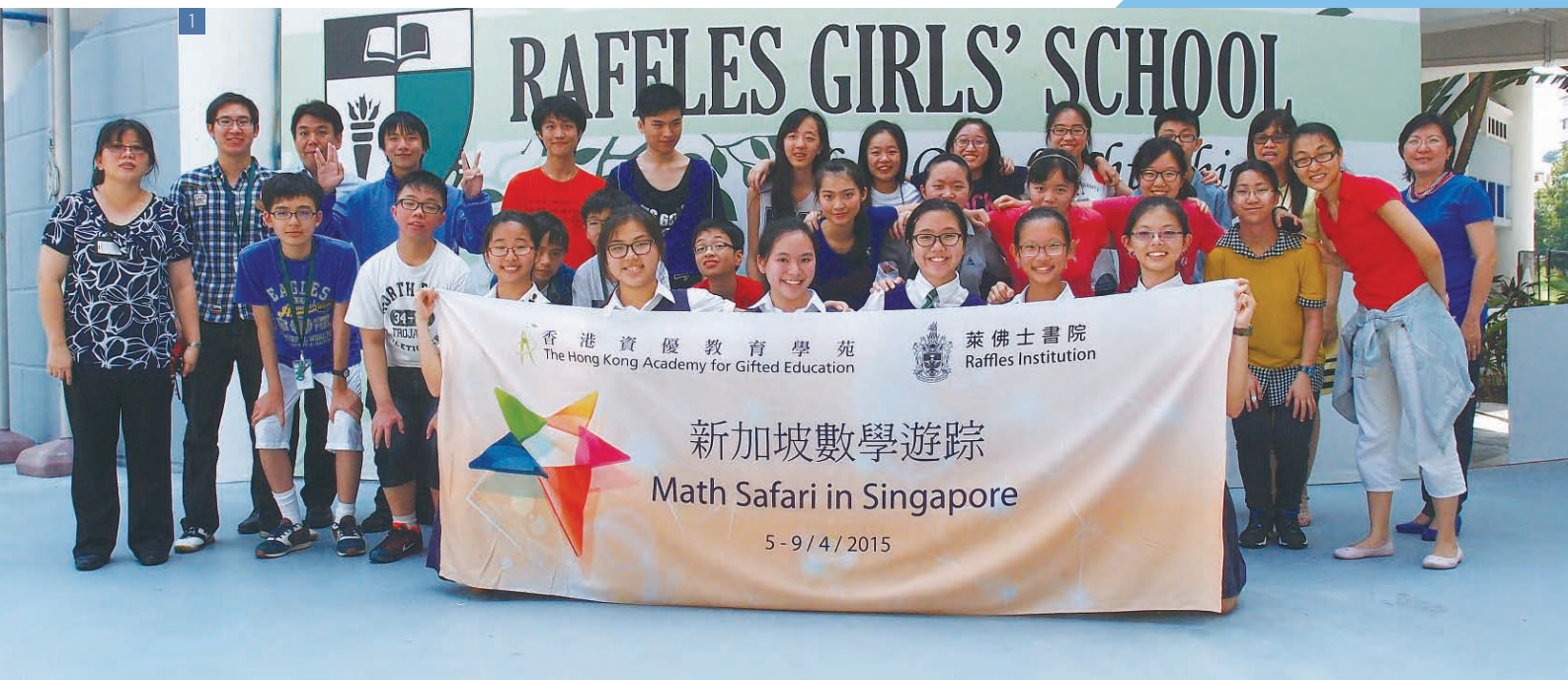
Mr Lam Yun Fu, Frederick, Chairman of the Board of Directors of the HKAGE, presented souvenirs to Ms Nisa Leung Wing Yu, JP, Member of the Board of Directors of the Hong Kong Science and Technology Parks Corporation and founder of STEM Initiative Hong Kong

Dr Alan I. Leshner, Chief Executive Officer Emeritus, American Association for the Advancement of Science, shared his presentation on "An American View of High Quality STEM Education"

Professor Hong Ding, Institute of Physics, Chinese Academy of Sciences, shared his presentation on "Science Education Engagement in China"

The presentation topic of Dr Michiharu Nakamura, Advisor for Science and Technology, Japan Science and Technology, was on STEM and Gifted Education towards a Future Sustainable Society

海外活動
新加坡數學遊踪



1 參觀萊佛士女子中學
2 參觀萊佛士書院的圖書館
3 摺紙的數學
4 在萊佛士書院的校園附近遠足

由香港資優教育學苑（資優學苑）及萊佛士書院合辦，兩年一度專為資優學苑學員而設的海外活動「新加坡數學遊踪」，已於 2015 年 4 月 5 至 9 號圓滿舉行。萊佛士書院於 1823 年創立，是新加坡最歷史悠久的學校及預科學習中心。資優學苑學員參與各種學術活動如數學講座、觀課及參觀萊佛士女子中學，都有助他們增進對數學的認識。學員還參與了涵蓋代數、組合數學、幾何和數論的數學增潤課程。除了各種學術活動之外，學員亦參觀了一些旅遊景點，例如夜間野生動物園及克拉碼頭，同學們都樂在其中。在萊佛士書院的寄宿學校裡，學員和新加坡的資優生在學術和社交上都有十分緊密的交流，學員們在香港以外的資優圈子裡亦漸漸建立起友誼了。

學員分享

學員一
「讀萬卷書不如行萬里路」，這說話可真是正確的呢！不走一回，便不知自己的渺小；不走一回，便不會發現自己是井底之蛙。無論是知識上，或是價值觀上，這趟旅程都令我大開眼界，嘆為觀止！

學員二
我們的首席導師 Thomas Teo 先生將數學教授得生動有趣，我們都很喜歡他的教學風格，我想藉此機會多謝他以及萊佛士書院國際數學奧林匹克比賽的受訓學員。

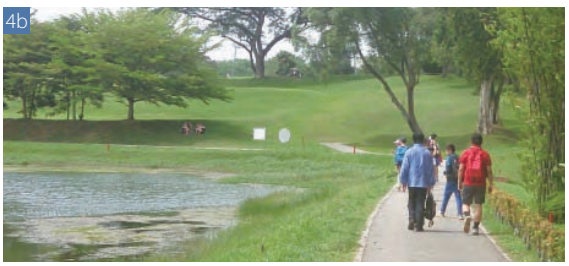
學員三
我很高興和榮幸可以跟國際數學奧林匹克比賽的金牌得獎者會面，亦很高興來到新加坡。這地方真的很棒，我很享受這趟旅程。

學員四
我最難忘的經歷是參加摺紙工作坊，從前我都不知道原來摺紙跟數學息息相關的。我們可以用紙張輕易摺出不同長度的線條，而透過這個工作坊，我們學會將這些特質應用到日常生活上，例如應用在衛星上。這個工作坊實在令我印象深刻。

學員五
縱使我尚未掌握某些技巧也好，但透過參加這次旅程，提升了化解奧數問題的興趣。我學到很多數學以外的知識，亦盡我所能去理解所學到的東西。我還在不同活動裡與萊佛士書院的學生互動，例如進行文化交流和認識新朋友等。總括而言，今次旅程擴闊了我的眼界，還賦予我繼續學習新知識的力量。

Overseas Programme
Math Safari in Singapore

A tailor-made Biennial Overseas Programme Math Safari in Singapore, co-organised by the Hong Kong Academy for Gifted education (HKAGE) and Raffles Institution (RI) for the HKAGE student members, was successfully held from 5 to 9 April 2015. RI, founded in 1823, is the oldest school and centre for pre-tertiary learning in Singapore. Our students have enhanced their understanding in Mathematics by taking part in various academic activities such as Mathematics talk, lesson observations and a visit to Raffles Girls' School. They also had Mathematics enrichment courses that cover Algebra, Combinatorics, Geometry and Number Theory. Other than a variety of academic activities, our student members also went to tourist attractions such as Night Safari and Clarke Quay, and they enjoyed these fun-filled programmes. Our students interacted with gifted students in Singapore intensively during academic and social activities and their stay at the RI boarding school. They started building friendships with gifted community outside Hong Kong.



1 A school visit to Raffles Girls' School
2 Visit the Raffles Institution's library
3 Mathematics in origami
4 Hiking tour near Raffles Institution's campus

SHARING BY STUDENTS

Student 1

"Travelling brings about far greater benefit than mere book learning." I can't agree more with this saying! It's only by travelling I'm able to see how petite I am as a human being; and it's only by travelling I'm able to learn how ignorant I am. This trip has definitely broadened my horizon in terms of knowledge and values. I am deeply impressed!

Student 2

Our chief tutor Mr Thomas Teo had done a great job teaching Math as an interesting and enjoyable subject. All of us enjoyed his teaching style and I would like to thank him and the International Mathematical Olympiad (IMO) trainees in RI.

Student 3

I am very glad to have met IMO gold medal awardees. It was an honour to meet them. Also, I was really glad to be in Singapore. It is such a great place. I really enjoyed my time there.

Student 4

The most unforgettable experience for me was participating in an origami workshop. I never noticed that origami is closely related to Math. We can just fold the paper and easily get lines of different lengths. Through this workshop, we learnt to apply this feature in daily life, such as using it in satellites. I was deeply impressed by that workshop.

Student 5

Through this trip, my interest in solving Math Olympiad problems had been increased, even though I have not learnt these skills before. I learned a lot of extra-mathematical knowledge and have tried my best to understand as much as I can. Moreover, I interacted with the RI students through different activities, such as cultural exchange and meeting new friends. In sum, this trip broadened my horizons and gave me strength to continue learning extra knowledge.

JA 學生營商體驗計劃
融匯所學，實踐商業智慧

參與學員於展銷會中公開展示並售賣他們的產品
Participants of this programme showcased and sold their products at the trade fair held in December 2016

進階學習體驗部旨在為特別資優學生提供個別化及富挑戰性的學習機會，好裝備他們迎接未來社會的挑戰。在 2016 年 7 月，我們為一群對創業營商有興趣的學員，籌組了 Junior Achievement (JA) 學生營商體驗計劃。學員藉著計劃得到一個創業機會，學習如何經營自己的公司。在為期八個月的計劃中，大約二十名學員與兩位義務商界顧問（Volunteer Business Advisors）一同經歷公司組成、籌集資金、業務發展規劃、生產及營銷以至清盤的商業週期，並於 2016 年 12 月的展銷會公開展示並售賣他們的產品。

多年來香港學生在數理和科學範疇中表現優異，但大多偏重於學科學習，未能讓學生有機會實踐所學。此計劃讓學員透過營商過程面對實際處境，設計及擬定具體及具創意的解決方案，從而提升他們在綜合和應用跨學科知識與技能的能力；特別是透過產品設計、生產等過程，提升他們的創造力和促成創新意念，讓潛能得以發揮在 STEM 的範疇內。

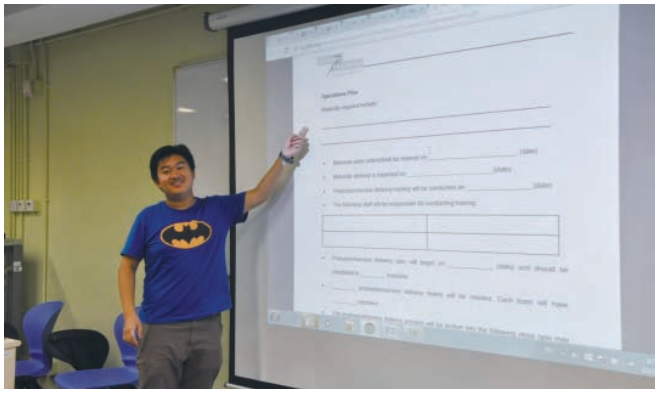
參與學員兼學生公司行政總裁梁兆俊就參與此計劃分享他的期望：「我對創業十分有興趣，因為營運一間公司很有意義，亦可以從中學習商業營運的知識以及溝通技巧。我也想知道自己有否打理和營運一間可持續發展公司的能力。」此計劃為學員提供課堂以外的學習經歷，不單提升他們於 STEM 相關範疇的學習興趣，學員從中亦能發展領導才能、溝通技巧、解決問題能力、團隊精神及社交技巧，為他們日後在 STEM 和其他需要相關知識、技能和態度的範疇升學和就業打好基礎，應對現今世界因急速的經濟、科學及科技發展所帶來的轉變和挑戰。

Junior Achievement (JA) Company Programme

Applying Knowledge with Business Intelligence

The Advanced Learning Experiences Division aims at providing gifted students with individualised and challenging learning opportunities, and preparing them for future challenges. In July 2016, we organised the Junior Achievement (JA) Company Programme for student members who are interested in starting up their own business. Student members were given a business start-up opportunity to learn and run a company of their own. In this eight-month programme, around twenty student members and two Volunteer Business Advisors experienced together the entire business cycle of company formation, fundraising, business development, manufacturing, sales and liquidation. Participants of this programme would showcase and sell their products at the trade fair held in December 2016.

For years, students of Hong Kong excel in Mathematics and Science, but what they have learnt is mostly academic and they seldom have any opportunities to apply their knowledge. This programme allows student members to face actual situations via business running, to design and propose practical and innovative solutions, and to enhance their competence in integrating and applying interdisciplinary knowledge and skills. It would also strengthen their creativity, nurture their innovative ideas and help them to live up to their potential in STEM especially when the practices of product design and manufacturing are done.



參與學員兼學生公司行政總裁梁兆俊
Anson Leung, participating student member and CEO of the student company

Anson Leung, participating student member and CEO of the student company, shared his expectations on joining this programme, "I am strongly interested in starting up a business. It is because running a company is meaningful, and I would be able to learn the knowledge in running a business and its related communication skills. I am also eager to know if I am competent to run and operate a sustainable company." This programme provides student members with learning experience outside classrooms. Not only would their interest in STEM and its related fields be enhanced, student members would also be able to develop their leadership skills, communication skills, problem-solving skills, team spirit and social skills, giving them a sound foundation for further studies and career development in the fields that require STEM and other related knowledge, skills and attitude, and helping them to cater to the changes and challenges that brought by rapid economic, scientific and technological developments around the world nowadays.

兩位義務商界顧問定期與學員進行會議並分享他們在營商的實戰經驗
Two Volunteer Business Advisors had regular meetings with the student members and shared with them their practical experience in the business field

「汽車與環境工作坊」於實際場景運用科學知識

"Workshop on Cars and the Environment" Application of scientific knowledge in real-life scenarios

陳文豪博士
香港教育大學科學與環境學系助理教授

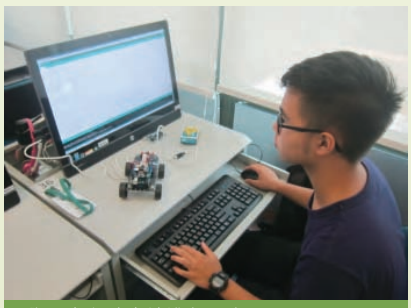
適逢國際汽車電動方程式錦標賽於2016年10月在香港舉行，香港教育大學與香港資優教育學苑合辦歷時三星期的「汽車科技基礎課程：認識電動方程式（TECS1351）」課程。其中一個環節是「汽車與環境工作坊」。

「汽車與環境工作坊」的上課情況
In the class of the "Workshop on Cars and the Environment"

「汽車與環境工作坊」目的在於探討汽車設計與環境保護之間的關係。學生需要透過實驗和理論了解汽車設計的同時，亦需要顧及對環境的影響，以及認識當今科技如何改善汽車設計以達致更佳的環保效果。

此工作坊主要分為兩個部分。第一部分探討太陽能應用在汽車上的可能性。學生需要將太陽能板接駁至電壓計，用以量度不同光度與產出電壓之間的關係，學生也需要探索最佳照射角度和當中的限制。由於這個工作坊具有STEM教育的元素，故此我們設下了一些情境讓學生思考在該情境下如何產生最佳效果。其中一個情境是我們假設太陽能汽車在一特定的時間內行走，學生需要利用科學、科技、工程和數學等技巧，計算出太陽的位置和照射角度，並運用之前探索得出的結果判斷出太陽能板的最佳安裝角度。

工作坊的第二部分主要探討汽車如何減少能源損耗。第一個讓學生探究的主題是「動力回收系統」（Kinetic Energy Recovery System）。老師簡單介紹完這個系統的基本概念後，學生需要自行設計系統，以回收汽車剎車時的動能。在學生自行探索和嘗試十多分鐘後，陸續有組別成功設計出系統，可見學生無需老師特別協助下，亦有足夠能力自行探索和發掘知識。第二個讓學生探究的主題是「怎樣減少摩擦力」。眾所周知，汽車車輪需要有一定的摩擦力才能驅動和轉彎，學生因此需要尋找最適當的摩擦力度。雖然課堂沒有真實的汽車和車輪來進行試驗，但我們用了一些物料例如膠片和砂紙等模擬車輪的摩擦力，讓學生利用「力感應器」（force sensor）測度摩擦力大小，而大部分學生都能夠順利完成所有探究活動，找出摩擦力的最適值。



學員專心致志地進行研究
A student member being focused on his work

總括而言，從觀察所見，大部分學生都樂於參與各項活動，而且增進了不少相關知識，也增強了學習科學的信心。我相信這批學生將來必能學以致用，潛能得以發揮。

Dr Man Ho Chan
Assistant Professor, Department of Science and Environmental Studies, The Education University of Hong Kong

In view of the FIA Formula-E Championship being held in Hong Kong in October 2016, a three-week "Introductory Course in Car Technology: Understanding Formula E (TECS1351)" was coorganised by The Education University of Hong Kong and The Hong Kong Academy for Gifted Education. "Workshop on Cars and the Environment" was one of the sessions in the course.

The "Workshop on Cars and the Environment" aims at investigating the relationship between car design and environmental protection. Not only are students required to understand car design by experiments and theory learning, they are also required to take into account the impact on the environment, and to learn how technology nowadays helps to improve car design for a better effect on environmental protection.

This workshop is mainly divided into two parts. Part one investigates the feasibility of solar energy application on cars. Students were required to connect solar panels with a voltmeter in order to assess the relationship between different intensity of light and the voltage generated. Students were also required to explore the best radiation angle and its restrictions. As this workshop contains elements of STEM education, we designed a few scenarios for students to decide how to achieve the optimal effect under specific situations. One of the scenarios was that we presumed a solar car to drive in a specific period of time. Students had to apply skills of Science, Technology, Engineering and Mathematics to calculate the location of the sun and its radiation angle, and to decide in which angle should the solar panels be installed for the optimal effect based on the results of their investigation.

Part two of the workshop mainly investigates how cars could reduce energy consumption. The first theme for students' investigation is the "Kinetic Energy Recovery System". Upon a brief introduction on the basic concepts of this system, students were required to design a system that could recover the kinetic energy when a car brakes. After minutes of exploration and attempts, several groups of student were able to design their own systems. It is proven that students were capable of exploring and discovering new knowledge on their own without assistance from the teacher. The second theme for students' investigation is "how to reduce friction". It is a known fact that car tyres need certain degree of friction to drive and turn. Therefore, students had to figure out the appropriate degree of friction for that particular purpose. Although there was no real car or tyre for the testing, we made use of materials like plastic sheets and sandpaper to simulate the friction of tyres, and allowed students to measure the degree of friction with a force sensor. Most of the students were able to complete all investigative activities and figure out the appropriate degree of friction needed.

To conclude, it is observed that most of the students enjoyed participating in various activities and had their knowledge on the relating field enhanced. Their confidence in learning Science was also strengthened. I believe that these students will be able to apply what they have learnt and live up to their potential in the future.

從 CSI 到 STEM 教育
整合跨學科知識，培養探索精神
From CSI to STEM Education
Integrating Interdisciplinary Knowledge and Developing Exploratory Spirit

從事科學教育多年，我一直致力於探討教導年青人學習科學的有效方法。目前科技發展一日千里，以往分科教學的模式，已不能完全切合現今社會的需要。近年在美國盛行的 STEM 教育，結合各理、工科的優點，能加快科技創新及配合工種的變化，正正回應了新一代人材培訓的需要。STEM 教育涵蓋科學、數學、科技和工程範疇，以數學和科學作為基礎，以科技作為工具，並以工程用作解難。STEM 教育結集以上各範疇的優點於一身，其中包含科學的探索精神及技巧、數學的邏輯推理思維、研發科技的大膽創新和工程的解難能力。

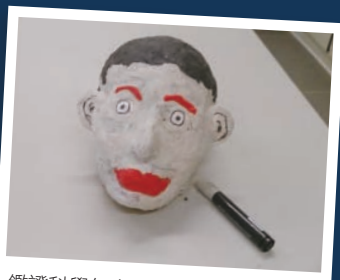
犯罪現場學（ Crime Scene Investigation, CSI ）就是其中一個教導 STEM 的方法。犯罪現場學和 STEM 確有不少類近之處，因為鑑證科學包含多種不同學科和知識：身份鑑定（指紋、DNA、牙齒、足印、面容重組）、驗屍（死因、死亡時間、兇器）、毒物分析、血濺分析、纖維分析、子彈鑑證等多種專門學問。因此，CSI 既專且博，查案時就要應用各種專門的科學和技術。學習 CSI 要從搜證開始，然後分析證物，再將各種證據結合，從而推理、重組案情，並加以求證推論。

搜證要有科學探究的細心觀察和探索精神，也需要引用最新科技。警隊在 2008 年引入新的電腦系統，並在 2014 年引入指紋及掌紋活體掃描系統，都有助套取活體指紋及對比指紋，除了對比指紋的速度大幅提升，準確度亦由以往約 80% 提升至約 90%。分析證物則必需如數學家般運用邏輯思維和冷靜思考。要將證據結合、重組案情，就要如工程師般結合各種數據，解決疑難，這亦需要科研時的大膽假設及實驗精神。最後就要為所立論據求證，求證過程當中需要按客觀事實分析證據，這亦如科學家建立理論時的求證過程。

查案本來就是一種求真精神，也就是科學精神。透過教導 CSI 來進入 STEM 的大門，是一種不錯的途徑。

謝志庭先生
科學世界有限公司學術總監

從 CSI 到 STEM 教育，整合跨學科知識，培養探索精神
Integrating interdisciplinary knowledge and developing exploratory spirit from CSI to STEM education



鑑證科學包含不同學科和知識，例如身份鑑定之中的面容重組
Forensic Science covers numerous disciplines and knowledge, for instance, facial reconstruction in identity authentication

Being dedicated to Science education for years, I have been striving for an effective way to engage young people in learning Science. As the developments of Science and Technology are rapid and ever-changing, the traditional subject curriculum is no longer fully catering to the needs of the society nowadays. STEM education, which is popular in the U.S. in recent years, has answered the latest needs of manpower development by integrating the advantages of Science and Engineering domains, accelerating technological innovation and catering to the changes of different trades. STEM education covers the domains of Science, Mathematics, Technology and Engineering, using Mathematics and Science as the foundation, Technology as a tool, and Engineering as a problem-solving means. STEM education is comprised of all advantages of the above domains that it includes the exploratory spirit and skills of Science, the logical thinking of Mathematics, the boldness and innovation of technological research and developments, and the problem-solving competence of Engineering.

Crime Scene Investigation (CSI) is one of the means to practice STEM education. CSI and STEM share quite a lot of similarities that Forensic Science covers numerous disciplines and knowledge: identity authentication (fingerprints, DNA, teeth, footprints, facial reconstruction), autopsy (cause of death, time of death, weapons), analytical toxicology, bloodstain pattern analysis, fibre analysis and bullet identification. Therefore, CSI is a specialised and broad domain that various scientific knowledge and skills must be adopted during an investigation. CSI must be learnt from evidence gathering, then moving on to evidence analysis, combining all gathered evidence to reason and reenact the crime details, and verifying your inference.

Evidence gathering requires careful observation and the exploratory spirit that it takes in scientific exploration, and state-of-the-art technology is also necessary. A brand new computer system was introduced by the Hong Kong Police Force in 2008, followed by a new Fingerprint and Palmprint Livescan System introduced in 2014. Both systems help to take fingerprint live scan and compare fingerprints that the speed of comparing fingerprints has greatly enhanced, and the accuracy is increased from around 80% to around 90%. Analysing evidence requires logical and calm thinking that resembles a Mathematician, while combining evidence and reenacting the crime details needs to master all types of data and solve the problems like what an Engineer does. The boldness in making hypotheses with the spirit for trial and error in doing scientific research is also required at this stage. Last but not least, you need to verify your inference by analysing the gathered evidence based on facts. This verification process also resembles what a Scientist does when developing a theory.

After all, crime investigation is all about truth seeking, and truth seeking is the core value of Science. Walking into the door of STEM with CSI teaching would be a good path to go.

Mr Felix Tse
Academic Director, Science World Limited

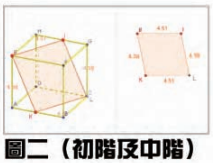
促進STEM教育的GeoGebra課程

柯志明
香港 GeoGebra 學院

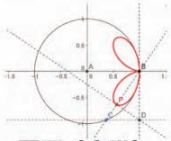
行政長官於 2015 年的施政報告提出推動科學、科技、工程和數學（STEM）教育。免費動態數學軟件 GeoGebra（Geometry + Algebra）揉合了數學、科技和編碼（coding）等元素，支援構作、建模（modelling）和探究，是促進 STEM 教育的理想工具。

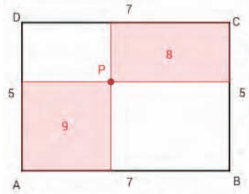
香港 GeoGebra 學院於 2014 年開始和香港資優教育學苑合作舉辦暑期 GeoGebra 課程，更於 2016 年為學苑的小學及中學學員提供初階、中階及進階程度的常規課程，透過使用 GeoGebra 軟件進行一系列幾何和代數的構作、設計、探究及解難等實作活動（圖一至圖六），豐富學員對數學的理解，讓他們發揮創意，提升解難能力，培養他們的科學和數學素養，促進 STEM 以致 STEAM（A: 藝術）教育。


圖一（初階）

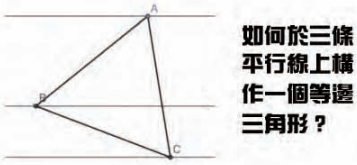

圖二（初階及中階）


圖三（中階）


圖四（高階）

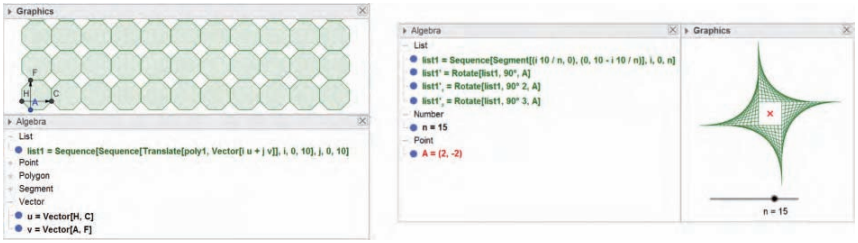


圖五：初階探究問題

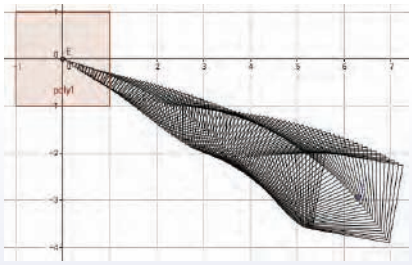


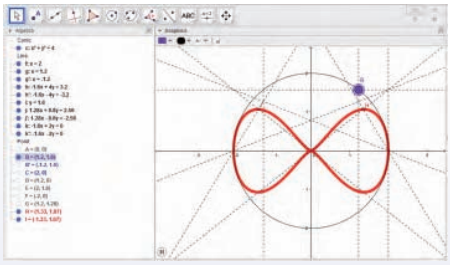
圖六：高階探究問題

為裝備學生編寫程式的能力，我們在各階課程中安排了使用 GeoGebra 代數指令進行密鋪和繡曲線（圖七）等活動，讓學生透過構思、編碼和測試，培養邏輯分析及代數思維等程式編寫的相關能力。


圖七：編碼活動（密鋪和繡曲線）

GeoGebra 課程的學員反應熱烈，積極投入課堂活動，部分更運用所學，創作新的圖形（圖八）和研究新的軌跡（圖九）。經過數年的實踐，我們認為 GeoGebra 能夠有效啟發學生思維和創意，提升他們的探究和解難能力。我們希望，GeoGebra 的構作和探究活動能夠普及到小學和中學的課堂中，促進 STEM 教育的發展。


圖八：學生 Jeff Chau 作品


圖九：學生 黎晉睿 作品

學員分享

梁浚禧

大家好，我是香港資優教育學苑學員梁浚禧。我十分榮幸可以在這裏與大家分享我在學苑的學習經歷。

在 2016 年 1 月 至 4 月， 我參加了學苑和香港 GeoGebra 學院合辦的兩個 GeoGebra 課程。當時我決定參加，是因為我覺得 GeoGebra 的功能強大，而且很新奇。另外，剛巧我在 2015 年參加另一課程時，亦使用過 GeoGebra，故此我想繼續鑽研下去。

使用 GeoGebra 能令一些複雜死板的數學難題和理論變得生動有趣。一般的數學課程多數牽涉到眾多複雜難記的數學公式，但在 GeoGebra 世界裏，任何難題均能以生動的動畫和圖像顯示出來。以「立體的截面」為例，像我這些空間感欠佳的人， 往往都很難想像一個立體的截面形狀是怎樣的。但使用 GeoGebra 後，可利用內置的 plane view 功能，輕鬆解決問題。

GeoGebra 最吸引之處在於它強大的內置功能，可以覆蓋不同層面，包括平面圖形，立體圖形及反射及對稱等，令人愛不釋手， 百做不厭。

GeoGebra Courses for STEM

OR Chi Ming, Anthony
GeoGebra Institute of Hong Kong

In his 2015 Policy Address the Chief Executive put forward the recommendation to promote Science, Technology, Engineering and Mathematics (STEM) education. The free dynamic mathematics software GeoGebra (Geometry + Algebra) integrates mathematics, technology and coding in one package that supports construction, modelling and investigation. It is an ideal tool for STEM education.

Since 2014, the GeoGebra Institute of Hong Kong and the Hong Kong Academy for Gifted Education (HKAGE) have co-organised summer GeoGebra courses for secondary student members of the HKAGE. In 2016 we offer regular GeoGebra courses of elementary, intermediate and advanced levels for primary and secondary student members of the HKAGE. In the courses, students make use of the software GeoGebra to conduct various hands-on activities on geometric and algebraic constructions, designs, inquiries and problem-solving (Figures 1 to 6) that enrich their understanding in mathematics, foster their creativity and problem-solving skills, and nurture their science and mathematics literacy so as to facilitate STEM as well as STEAM (A: Art) education.

Figure 1 : (elementary)

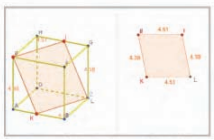


Figure 2 : (elementary and intermediate)

Figure 3 : (intermediate)

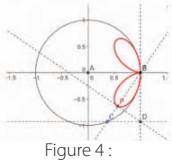
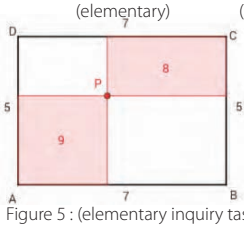
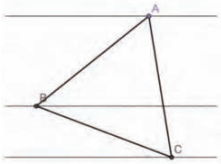


Figure 4 : (advanced)



What are the positions of P at which the two rectangles have equal areas?

Figure 5 : (elementary inquiry task)



How to construct an equilateral triangle on three parallel lines?

Figure 6 : (advanced inquiry task)

To equip students with the programming skills, we have included tasks of tessellation and curve stitching using algebraic commands (Figure 7) at the courses, in which programming-related capabilities such as algebraic and logical thinking could be cultivated through the process of analysis, coding and testing in the tasks.

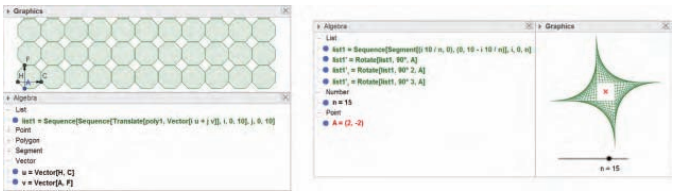


Figure 7 : Coding Tasks (tessellation and curve stitching)

The GeoGebra courses are very well-received by student members. They participated actively in the courses, and some of them applied what they learnt to create new figures (Figure 8) and to investigate new loci (Figure 9). After these years of practices, we consider that GeoGebra can effectively inspire students' thinking and creativity, and to enhance their abilities of inquiry and problem solving. We hope that the construction and inquiry activities with GeoGebra could be more popular in the primary and secondary classes to facilitate the STEM education.

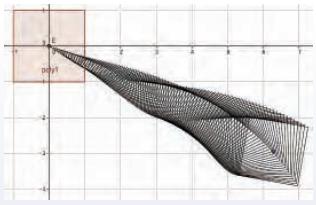


Figure 8 : The work of student member Jeff Chau

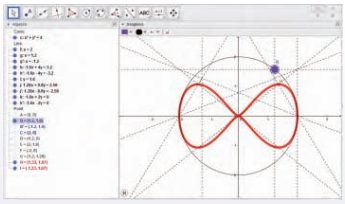


Figure 9 : The work of student member Lai Chun Yui

Sharing of a student member

LEUNG Tsun Hei

Hello, I am LEUNG Tsun Hei, a student member of the Hong Kong Academy for Gifted Education (HKAGE). I am very honoured to share with you all my learning experience here.

From January to April 2016, I participated in two GeoGebra courses co-organised by the HKAGE and the GeoGebra Institute of Hong Kong. I decided to join these courses because I found that GeoGebra is very powerful and novel. I had tried GeoGebra before when I participated in another course in 2015, and so I would like to learn more about it.

The application of GeoGebra makes complicated and tedious Mathematics problems vibrant and interesting. Mathematics courses often involve complicated Mathematical formulas that are hard to memorise. In the world of GeoGebra, however, difficult problems can be visualised with dynamic figures. Use "Sections of 3D Shapes" as an example, people with poor spatial sense like me find it difficult to visualise the shapes of the sections of a 3D figure. With the "plane view" function of GeoGebra, I can visualise the section easily and solve the problem.

The most fascinating thing about GeoGebra is its powerful built-in functions that cover different dimensions, such as plane shapes, 3D shapes, reflectional symmetry etc. It is truly intriguing and one would never get tired of it.

香港資優教育學苑校友於 2012-14 年度香港中學文憑試 STEM 相關科目 / 模組的表現

背景

香港近年推行新高中學制及課程，自 2009 年起，所有學生除了接受九年基礎教育之外，還有機會接受額外三年的高中教育。學生必須修讀四個核心科目（中國語文、英國語文、數學及通識教育），另外選讀兩至三科選修科目。這些選修科目可從不同學習領域的高中科目、應用學習科目及 / 或其他語言科目之中選修。香港考試及評核局每年會舉辦一次公開考試，稱為香港中學文憑試。

在各個非核心科目 / 模組當中，物理、數學延伸部分：單元二[1]、化學及生物是較受歡迎兼與 STEM 的宗旨最有關係的科目。我們將在下面分析香港資優教育學苑（資優學苑）校友於香港中學文憑試 STEM 相關科目 / 模組的表現，從而評估他們在這些範疇的能力，並與香港整體學生的表現作比較。

STEM 相關科目 / 模組的香港中學文憑試成績

我們將 2012 至 2014 年畢業的資優學苑校友的個人身份識別資料，送交到香港考試及評核局以獲取他們的香港中學文憑試成績數據。收到的紀錄約有 3,000 多份，所有個人身份識別資料已從紀錄抹去。同時隨機抽樣了 3,000 多份跟這些資優學苑學員來自同一學校及有相同性別的非資優學苑學員的香港中學文憑試成績作為對照組進行比較。

由於版面所限及科目性質，我們只會簡報資優學苑校友在以下兩組科目的表現，而不會逐科匯報。這兩組科目分別為：第一組－「化學及生物」，以及第二組－「物理及數學單元二」。讀者須注意香港中學文憑試將考生每個科目 / 模組的成績分為八級，分別為：第 5** 級、第 5* 級、第 5 級、第 4 級、第 3 級、第 2 級、第 1 級，以及第 U / X 級（即不予評級或缺席）。資優學苑校友、對照組及香港日校學生在這兩個科目組別的各個成績級別百分比（根據學生人次而定）表列如下（表一及表二）。從表一及表二獲得 5** 級的百分比可見，資優學苑校友於 STEM 相關科目 / 模組的表現遠較香港日校學生及對照組學生優勝。另一方面，對照組學生的表現則只較香港日校學生稍為優勝。這顯示有提名資優學苑學員就讀的學校並非全部集中在頂尖學校的組別。

表一：
資優學苑校友、對照組及香港日校學生於 2012-14 年度香港中學文憑試「化學及生物」科組的各個成績級別百分比

組別	第 5** 級	第 5* 級	第 5 級	第 4 級	第 3 級	第 2 級	第 1 級	第 U / X 級
資優學苑	15.4%	24.7%	25.3%	22.5%	8.8%	2.3%	0.6%	0.4%
對照組	2.9%	8.5%	17.8%	32.5%	22.6%	9.3%	4.3%	2.0%
香港日校	2.0%	5.9%	11.6%	25.2%	26.6%	15.4%	7.9%	5.5%

表二：
資優學苑校友、對照組及香港日校學生於 2012-14 年度香港中學文憑試「物理及數學單元二」科組的各個成績級別百分比

組別	第 5** 級	第 5* 級	第 5 級	第 4 級	第 3 級	第 2 級	第 1 級	第 U / X 級
資優學苑	17.5%	26.5%	25.9%	18.7%	7.8%	2.3%	0.6%	0.6%
對照組	3.1%	10.9%	23.0%	27.8%	20.0%	10.5%	2.6%	2.2%
香港日校	2.7%	8.3%	16.5%	23.7%	22.9%	14.6%	6.8%	4.5%

此外，當我們就參加過最少一個資優學苑課程、工作坊或比賽的資優學苑學員（活躍學員的成績），與從未參加過這些活動的學員（非活躍學員的成績）作比較，發現活躍學員於香港中學文憑試 STEM 相關科目的成績大致上較非活躍學員為佳，雖然兩者的差異幅度較小（表三及表四）。

表三：
活躍學員及非活躍學員於 2012-14 年度香港中學文憑試「化學及生物」科組的各個成績級別百分比

組別	第 5** 級	第 5* 級	第 5 級	第 4 級	第 3 級	第 2 級	第 1 級	第 U / X 級
活躍學員	15.5%	25.4%	25.7%	22.2%	8.2%	2.2%	0.5%	0.3%
非活躍學員	15.2%	23.5%	24.8%	23.0%	9.9%	2.6%	0.6%	0.5%

表四：
活躍學員及非活躍學員於 2012-14 年度香港中學文憑試「物理及數學單元二」科組的各個成績級別百分比

組別	第 5** 級	第 5* 級	第 5 級	第 4 級	第 3 級	第 2 級	第 1 級	第 U / X 級
活躍學員	18.9%	26.6%	26.2%	17.6%	7.0%	2.5%	0.6%	0.6%
非活躍學員	14.9%	26.3%	25.4%	20.8%	9.2%	2.0%	0.8%	0.6%

再者，我們根據校友在資優學苑的參與紀錄為每位校友的表現作評分，並以統計線性模型分析校友於資優學苑的表現評分（自變量）與其香港中學文憑試 STEM 相關科目成績（因變量）的關係。控制了學校高低組別[2]、學員於入學時能力差異[3]及性別的影響之後，發現校友於資優學苑的表現評分對其香港中學文憑試 STEM 相關科目的成績於統計上有顯著的正面影響。

摘要及總結

總括而言，資優學苑校友於香港中學文憑試 STEM 相關科目的表現遠較對照組（即相同學校及性別）的非資優學苑學員及日校學生優勝。此外，活躍學員的表現大致上亦較非活躍資優學苑學員為佳。再者，從統計線性模型的分析，我們有證據相信學員積極參與資優學苑的活動，能對其香港中學文憑試 STEM 相關科目的表現帶來正面影響。

[1] 單元二（代數與微積分）是為了那些日後選修或從事與數學有關的領域，並希望在高中階段更多研習數學的學生而設。
[2] 根據該校學生在香港中學文憑試的成績表現，把學校分為不同組別。
[3] 學員於入學時需接受甄選測試，而學員能力是根據這個測試的結果作出評估。

HKAGE's Alumni Performance in STEM Related Subjects / Modules in the Hong Kong Diploma of Secondary Education (HKDSE) Examination 2012-14

Background

Hong Kong has recently implemented the New Senior Secondary (NSS) academic structure and curriculum. Starting from 2009, ALL students will be given the opportunity to receive three years of senior secondary education on top of the nine-year basic education. Apart from taking the four core subjects (Chinese Language, English Language, Mathematics and Liberal Studies), students can choose 2 to 3 elective subjects as well. These elective subjects can be chosen from Senior Secondary elective subjects of different Key Learning Areas, Applied Learning courses and/ or other language courses. There will be one public examination leading to the Hong Kong Diploma of Secondary Education (HKDSE), which is held yearly by Hong Kong Examinations and Assessment Authority (HKEAA).

Amongst various non-core subjects/ modules, Physics, Mathematics-Extended Part: Module 2(M2) , Chemistry and Biology are popular subjects which are closely related to the aims of STEM. In the following, we would study the Hong Kong Academy of Gifted Education (HKAGE) alumni performance in STEM related subjects/ modules in HKDSE Examination so as to gauge their abilities in these areas, and compare them with that of Hong Kong general population of students.

HKDSE Examination Results in STEM Related Subjects/ Modules

A list of personal identifications of the HKAGE alumni, who graduated in the period from 2012- 2014, was sent to HKEAA for retrieving their HKDSE Examination performance data. Some 3,000 records were returned with all personal identification information being erased. For comparison purpose, the HKDSE Exam performance of a random sample of some 3,000 of non-HKAGE students from same schools with the same genders was also retrieved as a control group.

Due to limited space and the nature of those subjects, the study only presented HKAGE alumni performance in the following two groups of subjects, namely: group 1 – "Chemistry and Biology", and group 2 – "Physics and M2"; instead of presenting one by one. It should be noted that HKDSE Examination classifies the performance of students in a subject/ module into eight levels, namely: Level 5**, Level 5*, Level 5, Level 4, Level 3, Level 2, Level 1, and Level U / X (i.e., unclassified or absent). Percentages (in terms of student frequencies) of various performance levels for HKAGE alumni, the control group and Hong Kong day-school students respectively for these two groups of subjects are tabulated below (Table 1 and 2). From Table 1 and Table 2, it could be observed that HKAGE alumni performed prominently better than Hong Kong day-school students and control group students in these STEM related subjects/ modules in terms of percentages of Level 5**. On the other hand, the performance of control group students was just slightly better than that of Hong Kong day-school students. This illustrates that schools with nominated student members in the HKAGE were not all clustered at the top layer of school banding.

Table 1:
Percentages of various levels of "Chemistry and Biology" for HKAGE alumni, control group and Hong Kong day-school students in HKDSE Examination 2012-14

Group	Level 5**	Level 5*	Level 5	Level 4	Level 3	Level 2	Level 1	Level U/X
HKAGE	15.4%	24.7%	25.3%	22.5%	8.8%	2.3%	0.6%	0.4%
Control Group	2.9%	8.5%	17.8%	32.5%	22.6%	9.3%	4.3%	2.0%
HK Day-School	2.0%	5.9%	11.6%	25.2%	26.6%	15.4%	7.9%	5.5%

Table 2:
Percentages of various levels of "Physics and M2" for HKAGE alumni, control group and Hong Kong day-school students in HKDSE Examination 2012-14

Group	Level 5**	Level 5*	Level 5	Level 4	Level 3	Level 2	Level 1	Level U/X
HKAGE	17.5%	26.5%	25.9%	18.7%	7.8%	2.3%	0.6%	0.6%
Control Group	3.1%	10.9%	23.0%	27.8%	20.0%	10.5%	2.6%	2.2%
HK Day-School	2.7%	8.3%	16.5%	23.7%	22.9%	14.6%	6.8%	4.5%

Furthermore, when we compared the performance of HKAGE alumni who participated in at least one HKAGE programme, workshop or competition (active members), with that of those who never participated in these activities (inactive members), it is found that the active members, in general, performed better than the inactive members in STEM related subjects of HKDSE Examination, although the magnitudes of differences were not so prominent (Table 3 and 4).

Table 3:
Percentages of various levels of "Chemistry and Biology" for active members and inactive members in HKDSE Examination 2012-2014

Group	Level 5**	Level 5*	Level 5	Level 4	Level 3	Level 2	Level 1	Level U / X
Active Members	15.5%	25.4%	25.7%	22.2%	8.2%	2.2%	0.5%	0.3%
Inactive Members	15.2%	23.5%	24.8%	23.0%	9.9%	2.6%	0.6%	0.5%

Table 4:
Percentages of various levels of "Physics and M2" for active members and inactive members in HKDSE Examination 2012-2014

Group	Level 5**	Level 5*	Level 5	Level 4	Level 3	Level 2	Level 1	Level U / X
Active Members	18.9%	26.6%	26.2%	17.6%	7.0%	2.5%	0.6%	0.6%
Inactive Members	14.9%	26.3%	25.4%	20.8%	9.2%	2.0%	0.8%	0.6%

Moreover, we assigned to each alumnus a performance score based on his/ her participation records in the HKAGE. A statistical linear model was then deployed to capture the relationship between alumni performance scores in the HKAGE (independent variable) and their HKDSE Examination results in STEM related subjects (dependent variable). After controlling effects of school, student ability level (at the time of admission) and gender, positive impact of HKAGE performance score of an alumnus on his/ her HKDSE Examination results in STEM related subjects was found, which was statistically significant.

Summary and Conclusions

In sum, the HKAGE alumni performed prominently better in STEM related subjects than non-HKAGE students in the control group (i.e., same schools and genders) and Hong Kong day-school students. Besides, active HKAGE members performed, in general, slightly better than that of inactive HKAGE members. Moreover, from the estimation results of a linear statistical model, we have evidence to believe that active participation of students in the HKAGE brings positive impacts on their HKDSE Examination performance in STEM related subjects.

[1] Module 2 (Algebra and Calculus) is designed to suit the students needs, who will be involved in mathematics-related fields and careers, and those who would like to learn more in-depth mathematics at the senior secondary level.
[2] Schools were classified into different groups based on its student performance in HKDSE Examination.
[3] Student ability levels were gauged using the results of selection tests, which were administered to students at the times of their admissions.

資優學苑動向 Forthcoming HKAGE Events 2017 年 4 月至 5 月 | April – May 2017

情意教育活動及課程 Affective Education Programmes & Events

日期 Date	課程 / 活動 Programme / Event	培訓對象 Target	費用 Fee
個人成長及社交發展 Personal Growth and Social Development（小學 Primary）			
2017 年 4 月 7、21 及 28 日、5 月 5、12 及 26 日 晚上 6 時 30 分至 9 時 7, 21, 28 Apr, 5, 12, 26 May 2017 6:30p.m. – 9:00p.m.	「1+1」親子小組 Parent-child "1+1" Group (授課語言 : 粵語) (Language: Cantonese)	小四至小六香港資優教育學苑學員及其家長 P4 – P6 HKAGE student members and their parents	免費 Free of Charge
2017 年 4 月 22 日 上午 9 時至下午 1 時 [一天兩節，學員只須選擇參與一節] 22 Apr 2017 9:00a.m. – 1:00p.m. [Two sessions a day, students need to choose any ONE session]	Let Us Shine! (授課語言 : 粵語) (Language: Cantonese)	小四至小六香港資優教育學苑學員 P4 – P6 HKAGE student members	免費 Free of Charge
個人成長及社交發展 Personal Growth and Social Development（中學 Secondary）			
2017 年 4 月 7 日 晚上 6 時至 8 時 7 Apr 2017 6:00p.m. – 8:00p.m.	Fri-vers'nite: 資優是福 Fri-vers'nite: Be gifted, be blessed (授課語言 : 粵語) (Language: Cantonese)	中一至中六香港資優教育學苑學員 S1 – S6 HKAGE student members	免費 Free of Charge
2017 年 4 月 22 日 上午 9 時 30 分至下午 12 時 30 分 22 Apr 2017 9:30a.m. – 12:30p.m.	情意教育工作坊 – 社交關係 (I) Affective Education Workshop – Social Relationship (I) (授課語言 : 粵語) (Language: Cantonese)	中一至中三香港資優教育學苑學員 S1 – S3 HKAGE student members	免費 Free of Charge
2017 年 5 月 5 日 晚上 6 時至 8 時 5 May 2017 6:00p.m. – 8:00p.m.	Fri-vers'nite: 追求完美無止境？! Fri-vers'nite: Never good enough?! (授課語言 : 粵語) (Language: Cantonese)	中一至中六香港資優教育學苑學員 S1 – S6 HKAGE student members	免費 Free of Charge
2017 年 5 月 13 日 上午 9 時 30 分至下午 12 時 30 分 13 May 2017 9:30a.m. – 12:30p.m.	情意教育工作坊 – 社交關係 (II) Affective Education Workshop – Social Relationship (II) (授課語言 : 粵語) (Language: Cantonese)	中一至中三香港資優教育學苑學員 S1 – S3 HKAGE student members	免費 Free of Charge

學術課程及活動 Academic Programmes and Events

日期 Date	課程 / 活動 Programme / Event	培訓對象 Target	費用 Fee
領導才能 Leadership (中學 Secondary)			
2017 年 4 至 5 月 April-May 2017	全球化與領導 Globalisation and Leadership (LEAS2132) (授課語言 : 英語) (Language: English)	中二至中四香港資優教育學苑學員 S2 – S4 HKAGE student members	免費 Free of Charge
2017 年 5 月 May 2017	性格透視 ®@ 團隊動力 Personality Dimensions®@ team dynamics (LEAS1321) (授課語言 : 粵語) (Language: Cantonese)	中一至中三香港資優教育學苑學員 S1 – S3 HKAGE student members	免費 Free of Charge
人文學科 Humanities (小學 Primary)			
2017 年 5 月 May 2017	主題講座：作家講座 Thematic Talk: Writer's Talk (CLLT1111) (授課語言 : 粵語) (Language: Cantonese)	小四至小六香港資優教育學苑學員 P4 - P6 HKAGE student members	免費 Free of Charge
人文學科 Humanities (中學 Secondary)			
2017 年 5 月 May 2017	主題講座：向中國武俠小說致敬 Thematic Talk: Salute to Chinese Martial Arts Novel (CLLT1121) (授課語言 : 粵語) (Language: Cantonese)	中一至中六香港資優教育學苑學員 S1 - S6 HKAGE student members	免費 Free of Charge
跨學科 Multi-disciplinary (中學 Secondary)			
2017 年 4 至 5 月 April-May 2017	Big History and Collective Learning 公開講課 Big History and Collective Learning Public Lectures (授課語言 : 英語) (Language: English)	全港中學生 All secondary school students in Hong Kong	免費 Free of Charge

日期 Date	課程 / 活動 Programme / Event	培訓對象 Target	費用 Fee
科學 Sciences (小學 Primary)			
2017 年 4 月 April 2017	救救地球先生 Save Mr Earth (SCIP1311) (授課語言 : 粵語) (Language: Cantonese)	小四至小六香港資優教育學苑學員 P4- P6 HKAGE student members	免費 Free of Charge
2017 年 4 月 April 2017	主題講座：生活中的科學 Thematic Talk: Daily Life Science (SCIT1302) (授課語言 : 粵語) (Language: Cantonese)	小四至小六香港資優教育學苑學員 P4- P6 HKAGE student members	免費 Free of Charge
2017 年 5 月 May 2017	初談「熱」話 The Heat is On (SCIP1011) (授課語言 : 粵語) (Language: Cantonese)	小四至小六香港資優教育學苑學員 P4- P6 HKAGE student members	免費 Free of Charge
科學 Sciences (中學 Secondary)			
2017 年 4 至 5 月 April - May 2017	體內平衡課程 Homeostasis Course (SCIS2271) (授課語言 : 英語) (Language: English)	中一至中三香港資優教育學苑學員 S1 – S3 HKAGE student members	免費 Free of Charge
2017 年 4 至 5 月 April - May 2017	化學核心課程 Chemistry Core Programme (SCIS2101) (授課語言 : 粵語) (Language: Cantonese)	中一至中二香港資優教育學苑學員 S1 – S2 HKAGE student members	免費 Free of Charge
數學學科 Mathematics (小學 Primary)			
2017 年 4 月 1、8、22 及 29 日 下午 2 時 至 5 時 1, 8, 22, 29 April 2017 2:00 p.m. – 5:00 p.m.	幾何與拓撲課程（程度一）： 「摺」通數學 1（MATP1021） Geometry and Topology Course (Level 1): Fold Up Paper Brush Up My Math 1 (MATP1021) (授課語言 : 粵語) (Language: Cantonese)	小四至小六香港資優教育學苑學員 P4 – P6 HKAGE student members	免費 Free of Charge
2017 年 4 月 22 日 上午 8 時半至下午 4 時半 2017 年 4 月 29 日 上午 8 時半至下午 3 時半 22 April 2017 8:30 a.m. – 4:30 p.m. 29 April 2017 8:30 a.m. – 3:30 p.m.	跨範疇及跨學科課程（程度一）: 數學起動 (一) (MATP1911) Across Domains and Interdisciplinary Course (Level 1): Open Up Your Mind 1 (MATP1911) (授課語言 : 粵語) (Language: Cantonese)	小四至小六香港資優教育學苑學員 P4 – P6 HKAGE student members	免費 Free of Charge
2017 年 5 月 6、13、20 及 27 日 上午 9 時 30 分 至 下午 12 時 30 分 6, 13, 20, 27 May 2017 9:30 a.m. – 12:30 p.m.	離散數學、 概率、統計課程（程度一）： 生活中的統計 (MATP1711) Discrete Math, Probability, Statistics Course (Level 1): Statistics Around Us（MATP1711） (授課語言 : 英語) (Language: English)	小四至小六香港資優教育學苑學員 P4 – P6 HKAGE student members	免費 Free of Charge
2017 年 5 月 6、13、20 及 27 日 下午 2 時至 5 時 6，13，20，27 May 2017 2:00 p.m. – 5:00p.m.	離散數學，概率，統計課程（程度一）: 概率 - 用數學來計算運氣（MATP1521） Discrete Math, Probability, Statistics Course (Level 1): Probability - When luck meet with Mathematics (MATP1521) (授課語言 : 粵語) (Language: Cantonese)	小四至小六香港資優教育學苑學員 P4 – P6 HKAGE student members	免費 Free of Charge
數學 Mathematics (中學 Secondary)			
2017 年 4 月 1、8、22 及 29 日 早上 9 時 至 中午 12 時 1, 8, 22 and 29 April 2017 9:00a.m. – 12:00n.n.	數與算術課程 (程度二) ：處理數列與級數 Numbers and Arithmetic Course (Level 2) : Handling Sequences and Series (MATS2410) (授課語言 : 粵語) (Language: Cantonese)	中一至中三香港資優教育學苑學員 S1 – S3 HKAGE student members	免費 Free of Charge

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學術課程發展部 Academic Programme Development Division
Tel: (852) 3940 0102 Email: apd@hkage.org.hk

進階學習體驗部 Advanced Learning Experiences Division
Tel: (852) 3940 0108 Email: ale@hkage.org.hk

情意教育部 Affective Education Division
Tel: (852) 3940 0104 Email: ae@hkage.org.hk

研究部 Research Division
Tel: (852) 3940 0105 Email: research@hkage.org.hk

諮詢及評估中心 Consultation and Assessment Centre
Tel: (852) 3940 0106 Email: consultation@hkage.org.hk

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作者 Author
香港資優教育學苑有限公司
The Hong Kong Academy for Gifted Education Ltd.

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香港資優教育學苑 The Hong Kong Academy for Gifted Education
香港新界沙田沙角邨
Sha Kok Estate, Shatin, New Territories, Hong Kong

網址 Website: www.hkage.org.hk
電話 Tel: (852) 3940 0101
傳真 Fax: (852) 3940 0201
電郵 E-mail: academy@hkage.org.hk