"iMPACT"

A fruitful learning experience and achievement in *'i-Journey'*

Compendium of *'i-Journey'* (Second Cohort)

ISSUE 2

Interdisciplinary Learning and Entrepreneurship Education

STEM Education

Assessment Literacy

Paid Non-local Study Leave Scheme for Teachers

COME WITH AN INQUIRY LEAVE INSPIRED

INQUIRE • INSPIRE • IMPACT

Contributed by *'i-Journey'* participants (Second Cohort) and their schools

Edited by the Education Bureau, the HKSAR Government and the Hong Kong Baptist University

'i-Journey'
Paid Non-local Study Leave Scheme for Teachers

The 'i-Journey' Paid Non-local Study Leave Scheme for Teachers (the Scheme) is an education initiative pledged in the 2017 Policy Address.

The Scheme provides opportunities for secondary and primary school teachers to broaden their perspectives and enrich their experience. Through providing overseas professional development activities of a longer duration, with study leave for teachers and funding support for employment of supply teachers for schools, the Scheme aims to –

- enhance teachers' professional capacity and inspire them with the latest global education developments;
- promote a culture of research and inquiry in schools that brings positive changes and impact on learning and teaching; and
- create space for teachers to undertake professional development activities on a full-time basis.

The "i" in 'i-Journey' refers to the three crucial elements of this Scheme – "inquire", "inspire", and "impact", and together they make a fruitful learning journey for the participants. The whole learning journey begins with participants' inquiry into a particular educational topic or concern, followed by their inspiration gained in the process, and most importantly, ends with the impact they would bring to their teaching, student learning as well as school development.

The second cohort of customised programmes, with a total of 40 teacher participants, took place between February and June 2019. Three customised programmes on different themes were devised, namely:

(1) Interdisciplinary Learning & Entrepreneurship Education
(2) Assessment Literacy
(3) STEM Education

Each of these three customised programmes included the following major components:

Phase One *(2018/19 s.y.)*	i. **Pre-trip Preparation:** A one-week period for structured learning in a local university and developing a school-based project proposal
	ii. **Overseas Experience:** A five-week period for structured learning in an overseas university with school attachment / visits, during which participants further develop and finalise their proposals with the knowledge and experience gained
	iii. **Post-trip Consolidation:** A two-week period upon returning to Hong Kong for consolidation of learning in a local university, write-up of a detailed implementation plan for the school-based project and participating in related courses / activities
Phase Two *(2019/20 s.y. and 2020/21 s.y.)*	iv. **Implementation of Finalised Proposal:** A period for the implementation of the school-based project in participants' schools with a view to bringing positive changes; and the sharing of good practices with a larger professional community

The COVID-19 pandemic brought considerable challenges to teacher participants in the process of project implementation. We would like to express our gratitude to the participants for making strenuous efforts to keep on exploring, trying and implementing their projects amid various challenges and difficulties with a view to generating a positive impact to learning and teaching.

This publication, **iMPACT**, provides a glimpse of the participants' valuable experiences of project implementation and insights from the fruitful ***'i-Journey'***. The second of this issue features 18 selected reports showcasing the second cohort participants' projects carried out in schools they were serving at the time of project implementation. It comes with a range of project ideas and details that could serve as a source of inspiration for other educators.

Programme A(4) – Interdisciplinary Learning and Entrepreneurship Education
Late February – Mid April 2019
Turku, Finland

Administered by the Education Bureau, the Programme consisted of both local and overseas components. While the local part of the programme was supported by Department of Education Studies, The Hong Kong Baptist University, the overseas customised programme was conducted by the Faculty of Education, University of Turku.

The customised overseas programme aimed to enable participants to:

(a) acquire knowledge of the Finnish education system and its key features, as well as the focus of basic education modernization in Finland;
(b) learn about the Educational Reform completed in 2015 and the new National Core Curriculum implemented in August 2016 in Finland and the latest development, in particular interdisciplinary learning / entrepreneurship education and phenomenon-based learning;
(c) enrich their knowledge of teacher education in Finland and how it nurtures Finnish teachers' leadership in facilitating development of curriculum, instructions and assessment;
(d) integrate structured learning and attachment experience to become reflective practitioners; and
(e) develop teacher leadership through sharing learning outcomes in Professional Learning Communities and disseminating good practices, with a view to inspiring paradigm shifts in interdisciplinary learning / entrepreneurship education.

Interdisciplinary Project Learning – Nurturing Students into Self-directed Learners

Jane LAU Wai-sze
Lingnan Secondary School

iNQUIRE

I would like to know more about the differences between Hong Kong and Finnish education systems, particularly on how Finnish schools implement interdisciplinary project learning to allow students to integrate and apply knowledge across different disciplines and facilitate their self-directed learning.

iNSPIRE

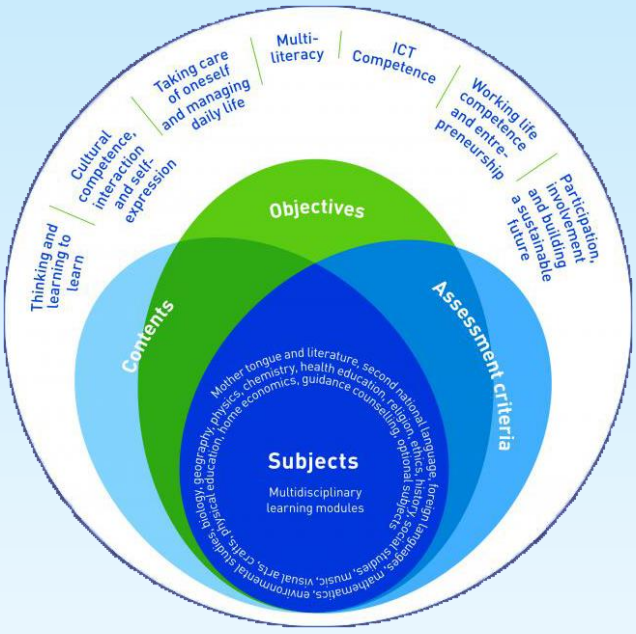
Finland has been actively promoting interdisciplinary learning, which involves teachers of different subjects to design learning contents together to enable students to apply their knowledge and skills integratively to solve problems. I was inspired by Finland's considerable effort in nurturing students' transversal competences so that they are equipped to cope with various challenges.

iMPACT

Drawing reference from the Finnish experience, I strengthened the collaboration among teachers of different disciplines, and gave students the opportunity to explore their chosen topics as well as integrate and apply knowledge of different disciplines in problem-solving. Furthermore, I developed 'A Guide for Preparing Interdisciplinary Project Learning' to assist teachers in strengthening the connection among interdisciplinary curricula and the collaboration among subject panels.

Objectives of the Interdisciplinary Project

To keep pace with the latest trends of education development and respond to the school's major concern in promoting self-directed learning, I applied the learning from ***'i-Journey'*** Scheme to the planning of an interdisciplinary project learning programme. Appropriate topics were selected by teachers to develop the blueprint for the programme, which aimed to engage students in issue-based inquiries to develop their multi-perspective thinking skills. To promote professional exchange among subject panels, teachers of Integrated Humanities were invited to share their experience in co-ordinating project learning.



Transversal Competences in the Finnish Curriculum

We expected to achieve the following objectives through the project:

i. Develop students' abilities to integrate and apply knowledge of different subjects and to construct knowledge;
ii. Develop students' generic skills, such as the skills for self-learning, creativity, collaboration, problem-solving as well as innovative thinking; and
iii. Broaden students' learning experience and develop their positive values and attitudes through diversified learning opportunities.

Details of the Interdisciplinary Project

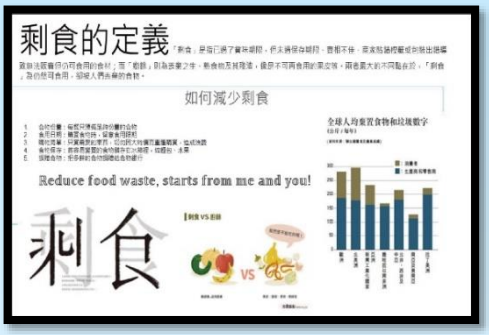
Students of S1 to S3 were divided into groups of four to six. They were tasked with gathering information, conducting observation and interviews, and recording data. Thereafter, they would consolidate and analyse the information, write up a report or produce exhibits to showcase their findings, and give group presentations. To foster their self-directed learning skills, students may decide their inquiry focus and presentation format.

The themes set for different levels and the subjects involved are as follows:

Students' Product Showing their Application of Knowledge on Intangible Cultural Heritage of Hong Kong

S1: A Case Study on Hong Kong's Intangible Cultural Heritage (Chinese Language, Integrated Humanities, Chinese History and Library)

This project learning programme involved a case study on a local intangible cultural heritage. Students would examine the significance of traditional culture to modern people and develop a sense of national identity by exploring the origin of the cultural heritage, its development and characteristics, and associated traditional customs.



S2 Students' Poster to Promote Reduction of Food Waste

S2: 'Leftovers Manager' School Programme (Integrated Humanities, English Language and Library)

Students would explore the problem of leftovers and identify possible ways to treat leftovers. They would promote the 'Leftovers Manager' campaign in school using different approaches, including designing promotional posters and four-panel comic strips, to raise fellow students' awareness of the importance of saving food. To encourage practice of English and increase their environmental awareness, students would learn food-related vocabulary and read relevant English articles, and share ideas about how to reduce leftovers in English on online forums.

S2 Students' Comics to Promote Reduction of Food Waste

S3 Students' Automatic Sensing Devices

S3: Smart City – Applications of Automatic Sensing Devices (Science, Computer, Mathematics, Design and Technology, Integrated Humanities and Library)
Students would design for a museum an automatic sensing device that facilitates the visits of people with disabilities. Exploring how human beings harness technology to solve problems could develop students' creativity and their capacity to care for others. This programme enabled students to connect a wide range of knowledge across subjects, for example, ultrasound applications, coding fundamentals, as well as the theory and application of design processes.

Challenges Encountered during Project Implementation

As the project would involve different subjects at different levels, teachers had to work out collaboratively the teaching focus and adjust the programme according to the progress. In addition, they had to unleash students' creativity and promote their self-directedness, which was no way easy. To this end, teachers gave students the autonomy to choose their own inquiry focus and medium for presenting learning outcomes, for example, digital presentation, posters and three-dimensional artworks so that they could play to their strengths irrespective of their talents.

Field trips were cancelled because of the pandemic. As suspension of face-to-face classes hampered the teaching progress, we decided that students should first get acquainted with the prior knowledge of relevant topics via online lessons. Following that, the interdisciplinary project learning programme would be conducted using the blended learning approach. As social distancing measures needed to be maintained after face-to-face teaching resumed, it was difficult to conduct group discussion and collaboration. Therefore, students were asked to gather information and discuss using e-learning platforms. Then they reported their progress, discussed follow-up issues and shared their learning outcomes in face-to-face classes.

Success of the Project – Impacts on Students and Teachers

By allowing students to set their inquiry focus and explore everyday issues using knowledge acquired from different subjects, the project sought to enhance students' learning motivation and promote self-directed learning. Students had discussion over their inquiry topics via e-learning platforms, and during this, they not only strengthened their communication and collaboration skills but also built stronger interpersonal relationship. Peer assessment was conducted to evaluate students' presentation of their learning outcomes, to enable the grasp of specific assessment criteria. Furthermore, students were encouraged to foster a culture of mutual appreciation and practise the virtue of respecting others. Students' creativity was evident in the great variety of exhibits showcased in the presentations.

For teachers, this joint effort laid a solid foundation on cross-subject collaboration. Working out the topics for the project together enabled teachers to not only promote a culture of sharing and exchange but also examine the existing curricula afresh to ensure their continuous refinement and renewal. Although the field trips

were cancelled, I developed 'A Guide for Preparing Interdisciplinary Project Learning' with reference to the practices of Finnish teachers. The Guide, which covers relevant theories, planning steps, points to note about field trips and useful forms, may serve as future reference for teachers in planning project learning.

Conclusion

The Finnish education philosophy and practices were a great source of inspiration for this project. I was also moved by my Finnish counterparts' passion and visions for education. As teachers, we need to groom our students for future challenges. Therefore, developing students' transversal competences and transforming them into self-directed learners are more important than imparting knowledge to them. By promoting interdisciplinary project learning, I hope to enhance students' self-directed learning and generic skills, and their ability to connect knowledge of different subjects, so that they can rise to challenges in the future.

Co-teaching in School Attachment during *'i-Journey'* Scheme in Finland

Foster Entrepreneurship Education

Sharon LEE Man-wai
Christian and Missionary Alliance Sun Kei Secondary School

INQUIRE

In Finland, entrepreneurship education has been widely adopted from primary schools to universities. To gain insights from their successful experience, I would like to inquire about the key elements of entrepreneurship education and its ways of implementation and explore strategies to make adaptation to the implementation in accordance with our school context.

INSPIRE

From the overseas trip, I learnt that entrepreneurship education places emphasis on cultivating students' entrepreneurial spirit, such as creativity, courage to take on challenges and perseverance when coping with stress and failure. Both internal and external entrepreneurship education are adopted to engage students in learning activities organised by the school and other institutions respectively. I was also inspired by teachers' role as a facilitator to keep students curious and active in exploring knowledge in the learning process.

IMPACT

The trip has empowered me to apply the philosophy of internal and external entrepreneurship education in designing the project. Students were encouraged to participate in entrepreneurship learning activities in school, and join the workshops, bootcamps and competitions outside school. This was conducive to cultivating students' entrepreneurial mindset and honing their problem-solving and communication skills.

Objectives of the Project

Our school has attached great importance to imparting to students knowledge and skills required in the 21st century. Entrepreneurship education aligns with our school's development focus as it places due emphasis on promoting students' creativity and problem-solving skills, and encouraging students to put their innovative ideas into action. Besides, we aim to nurture students to be responsible and enterprising individuals, and invent innovative products to improve the quality of lives. Taking these considerations, I aimed to develop a project to:

- stimulate students' creative thinking and innovation by problem-based learning; and
- develop students' knowledge, skills and attitudes by experiential learning of entrepreneurship.

Students Engaging in Group Discussion

Implementation of the Project

Major activities in internal entrepreneurship education

During the overseas trip, I gained insights into the design of learning activities on internal entrepreneurship education. With the support from 'Young Founders School', an organisation promoting entrepreneurship education, an entrepreneurship course was designed for all S3 students and conducted in Economics lessons. Relevant topics, including best practice on start-ups, entrepreneurial mindset and LEAN start-up to develop business for shortening the product development cycles, were introduced to enhance students' understanding of the essential attributes of entrepreneurs.

Representatives from a local university and a non-profit-making organisation were also invited to share about 'Marketing Strategies' and 'Innovative Market Strategies on Social Enterprises' to the whole school to promote entrepreneurship spirit amongst students.

Major activities in external entrepreneurship education

Students were encouraged to participate in competitions and activities outside school to cultivate their entrepreneurial mindset and develop their entrepreneurial alertness to viable business opportunities. Some S4 to S6 students were nominated to participate in territory-wide social venture start-up competitions to enhance their understanding of social entrepreneurship and raise their awareness of social needs. Moreover, some S3 to S5 students were selected to join start-up bootcamps and workshops, during which they participated in hands-on activities to develop start-up ideas and equip themselves with essential life skills such as decision making and critical thinking skills.

A Student Presenting in an External Competition on her Business Plan

Students Participating in an External Competition on Entrepreneurship Education

Through cooperation with 'Po Leung Kuk Life Planning & Financial Education Centre', an inter-school ideation programme named 'Youth Flea Market' was organised for twenty S4 and S5 students to engage them in problem-solving tasks, which helped develop their spirit of inquiry and ability to cope with challenges. Workshops on business strategies, proposal writing, and presentation skills were launched. Detailed rubrics were designed to assess students' performance based on the overall planning of the project proposed, team cooperation, creativity and oral presentation.

Students Engaging in the 'Youth Flea Market'

Assessment

Formative assessment was adopted for the entrepreneurship course in S3 Economics curriculum. Reflective assignments were designed for students to record their learning on key concepts. Teachers offered timely feedback after each assignment to help students improve.

Challenges Encountered during Project Implementation

As entrepreneurship education was newly promoted in our school, teachers' possession of the required knowledge and skills was essential to the success of the project. Realising that teachers lacked experience in designing and conducting entrepreneurship learning activities by adopting a problem-based learning approach, we worked in collaboration with outside organisations to familiarise teachers with relevant knowledge on entrepreneurship education.

Impact of the Project

Students acquired basic knowledge of business development, such as the components of a business plan including market analysis, product development, financial summaries and company analysis. The experiential learning activities helped cultivate students' entrepreneurial mindset, which prompted them to seize the best of the opportunities and take calculated risks. Even if students did not aspire to become entrepreneurs, the project has honed their generic skills such as problem-solving skills and creativity, which are useful for their future study and career development. Students have enhanced their 6Cs skills, including character, collaboration, citizenship, creativity, communication and critical thinking. Through problem-based learning, students' learning interest was enhanced, and they are able to conceive new ideas and turn them into action for solving problems.

6Cs of Education

Teachers' Professional Role as Inspirational Co-constructors of Knowledge

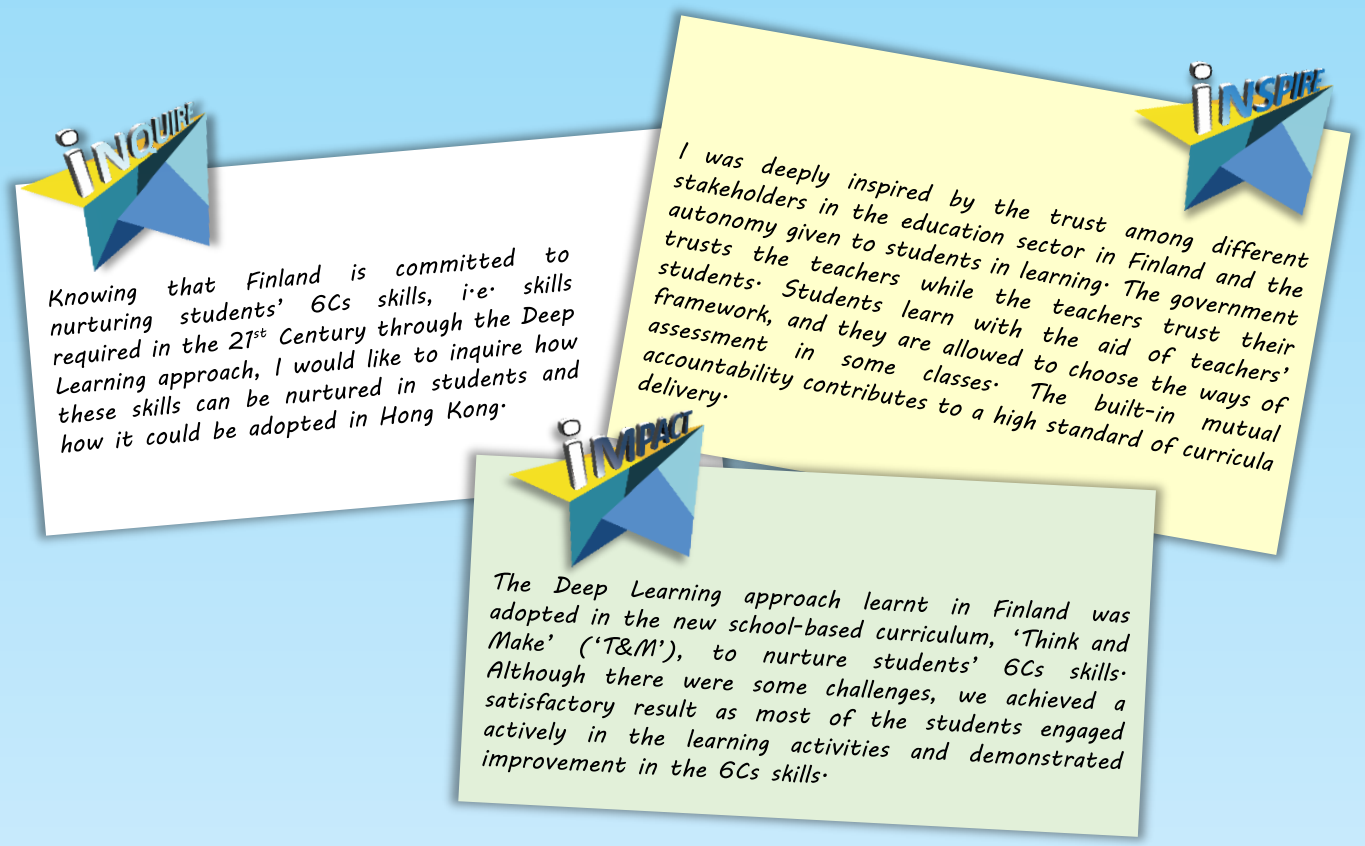
Regarding my own professional development, the project has enhanced my professional capacities and capabilities. During the project implementation, I took on a dual role as a facilitator and students' learning partner. Such partnership allowed me to review and revise my teaching approaches from students' perspective, strengthen my role as an inspirational co-constructor of knowledge with students, and guide them to set their learning goals.

Way Forward

Entrepreneurial education focuses on developing students' knowledge, skills and attitudes which will benefit their personal development as well as future endeavours. Moving forward, more problem-solving learning tasks would be designed to enable students to think critically and creatively to come up with innovative ideas with a view to adding value to the society.

Applying the Deep Learning Approach to Develop a STEAM Project-based Curriculum for S1 and S2 Students

Samuel LI Lok-shing
Cumberland Presbyterian Church Yao Dao Secondary School



I initiated the project because...

In Finnish education system, the 6Cs of Education in the Deep Learning approach, namely character, citizenship, collaboration, communication, creativity and critical thinking, are advocated to prepare students for the challenges of an ever-changing world. In line with such mission, our school was developing a new STEAM curriculum, 'T&M' to nurture students' 6Cs skills by incorporating the Deep Learning approach. With reference to the Craft Education subject guide in Finland, my colleagues and I devised the work plans and objectives for the 'T&M' curriculum.

I want to achieve…

Through the project, we aimed to achieve the following objectives:

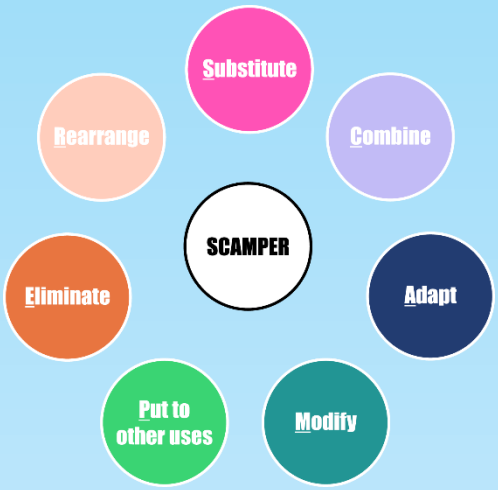
- To migrate the present iPad 1-to-1 project to STEAM project-based learning;
- To provide professional development activities about Deep Learning to all the teachers teaching 'T&M';
- To develop learning and teaching strategies of the Deep Learning approach;
- To evaluate the effectiveness of the learning and teaching strategies and make recommendations for the future development of STEAM Education in our school.

A Student Presenting the Product of a Massager for Teachers

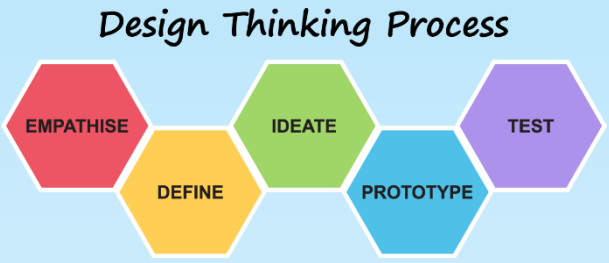
I implemented the project…

Implementation

The project, with the theme on 'Healthy Living', was implemented in two phases in S1 and S2. Students were required to design a product to improve the lives of people in school and in the society in the first and second phase respectively. Inspired by the practice in Finnish schools of providing opportunities for students to integrate and apply knowledge and skills to solve real-life problems, I deployed teachers of different subjects to conduct teaching. A Task Force comprised of teachers of different subjects was formed. Meetings were held to discuss the 'T&M' curriculum and assessment. Alongside the 6Cs skills, design thinking skills for product design and the SCAMPER technique for product improvement were introduced to students.



SCAMPER Technique



Professional Learning Community (PLC)

Inspired in the course in a local university, a 'T&M' PLC was set up to enhance teachers' professional capabilities and monitor curriculum implementation. Regular meetings were held to discuss the teaching progress and review learning and teaching effectiveness. Teaching materials were also shared among the teachers involved for timely revision. Besides, a workshop on the Deep Learning approach was organised for 11 'T&M' teachers, which emphasises the new role of teacher as an activator instead of just a facilitator. I also shared my overseas experience and organised some activities for teachers to enrich their knowledge of the Deep Learning approach.

EDB School-based Support Programme

With a view to developing quality assessment, our school participated in the EDB's school-based support programme on STEM Education. The supporting team offered us professional advice on the design of the assessment plan.

Evaluation

Mid-term and end-of-term evaluations were conducted to evaluate the effectiveness of the project. Teacher and student questionnaires, teacher observation and assignments were adopted to collect more comprehensive evaluation data.

The challenges faced…

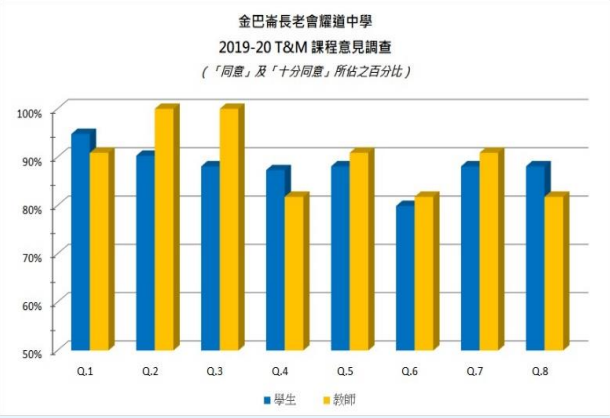
Due to COVID-19, the two planned phases in the project could not be fully executed. 'T&M' classes were cancelled due to the suspension of face-to-face classes. Instead, all S2 students were selected to join the DreamStarter Programme in the following school year, during which they acquired knowledge on product design and presentation skills.

The development of PLC was satisfactory in the first term. Although face-to-face classes were suspended, regular meetings were still held to discuss the follow-up issues relating to 'T&M' and a platform was provided to facilitate teachers' collaboration and professional exchange.

Project Outcomes

To evaluate the effectiveness of the learning activities in the first phase, an end-of-term evaluation was conducted through teacher and student survey with Google Form. Teachers' and students' response rates were 100% and 54.7% respectively.

Teacher survey indicated that teachers were fully aware of and achieved the teaching objectives of 'T&M'. Positive responses were also received towards teacher training on the Deep Learning approach. As revealed in the student survey, a majority of them indicated they made progress in the learning objectives, including setting goals, reflecting on their learning and acquiring skills on design-and-make. Moreover, based on teachers' observation, students demonstrated improvements in the 6Cs skills. For instance, students demonstrated good citizenship when serving the needy in the society. Their creativity was also enhanced in design-and-make activities. Furthermore, students have improved their collaboration and communication skills. However, there was room for improvement in students' skills in using hand tools.



Evaluation Results of Students and Teachers Survey

Q.1	(學生)	我能計劃工作及持久地產出意念、探索、實驗等。
	(老師)	我能引導學生計劃工作及持久地產出意念、探索、實驗等。
Q.2	(學生)	我能訂立目標，有序地學習及完成整個由構思到完成製品的過程，並能在當中對其學習作出評估。
	(老師)	我能引導學生訂立目標，有序地學習及完成整個由構思到完成製品的過程，並能在當中對其學習作出評估。
Q.3	(學生)	我能掌握觀察、發問、整理資料、創新意念、設計及製作的基本技能。
	(老師)	我能引導學生掌握觀察、發問、整理資料、創新意念、設計及製作的基本技能。
Q.4	(學生)	我能掌握基本技能後，按個人的性向發揮其強項，協助完成製品。
	(老師)	我能引導學生在掌握基本技能後，按個人的性向發揮其強項，協助完成製品。
Q.5	(學生)	我能感知及預計在製作過程中的風險，包括物料使用及工作環境，而作出安全的預防措施。
	(老師)	我能引導學生有感知及預計在製作過程中的風險，包括物料使用及工作環境，而作出安全的預防措施。
Q.6	(學生)	我能運用不同的資訊及通訊科技，於不同的過程包括觀察、發問、整理資料、創新意念、設計及製作等，並在社群中分享。
	(老師)	我能引導學生運用不同的資訊及通訊科技，於不同的過程包括觀察、發問、整理資料、創新意念、設計及製作等，並在社群中分享。
Q.7	(學生)	我明白「T&M」的重點目標、要求的基本技能及解難能力，是要準備我的個人生活、社會、創業家精神及工作生活。
	(老師)	我能引導學生明白「T&M」的重點目標、要求的基本技能及解難能力，是要準備他們的個人生活、社會、創業家精神及工作生活。
Q.8	(學生)	我能思考並在解難過程中作出選擇，促進一個可持續發展的生活。
	(老師)	我能引導學生思考並在解難過程中作出選擇，促進一個可持續發展的生活。

Survey for Students and Teachers on
the Eight Teaching and Learning Objectives of 'T&M' Curriculum

Besides, an assessment plan with detailed rubrics assessing students' acquisition of the 6Cs skills was developed. Different levels of attainment were set to enable students to grasp their learning progress and performance, which is conducive to their self-directed learning.

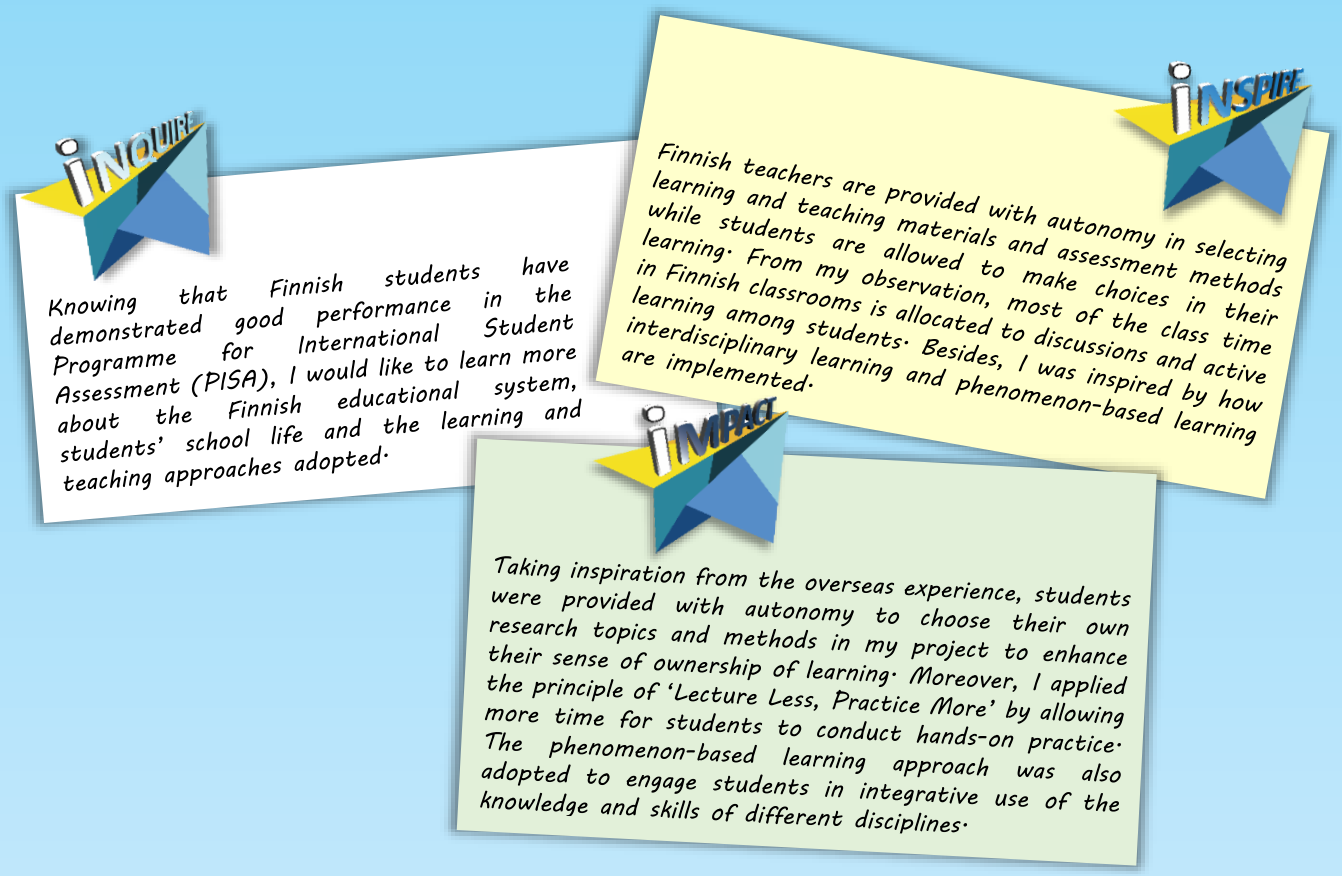
Way Forward

Although not all activities could be conducted due to the pandemic, we received encouraging feedback from teachers and students. Building on this valuable experience, the 'T&M' curriculum will be extended to S3 next school year to enable students to integrate and apply knowledge and skills across subjects and enhance the depth of their learning.

Co-teaching in School Attachment during 'i-Journey' Scheme

Thinking and Creating a Better World

Mark MAK Ting
HKSKH Bishop Hall Secondary School



Why Did We Initiate the Project?

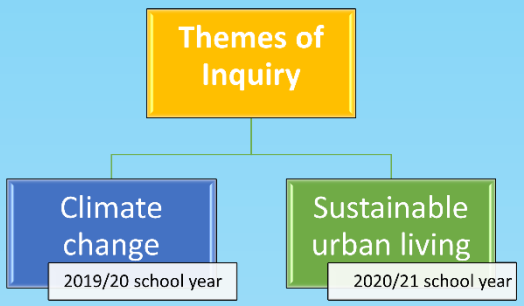
Our school had once implemented project learning at S2 level, during which students set their own sub-topics under a designated theme. However, teachers' design of project learning did not allow for opportunities for students to integrate and apply interdisciplinary knowledge, skills and attitudes. It was my wish to improve the design of project learning with the incorporation of interdisciplinary learning elements. Knowing Finland has been promoting interdisciplinary learning, I joined *'i-Journey'* Scheme to take a page from the Finnish to optimise the design of project learning in our school.

What Did We Want to Achieve through the Project?

Teachers adopted phenomenon-based learning approach in designing interdisciplinary project learning activities. They set themes of inquiry and students delved into a related phenomenon of their choice. During the inquiry process, students integrated and applied knowledge and skills from different subjects, thus developing their critical thinking, creativity, self-directed learning and problem-solving skills. Meanwhile, students were expected to apply Micro:bit knowledge to create inventions that could solve problems in everyday life.

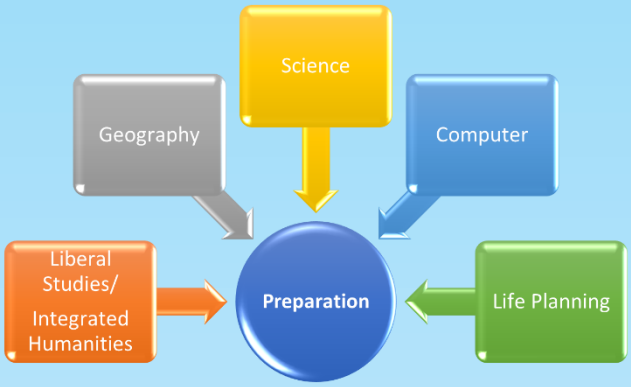
How Did We Execute the Project?

In the 2019/20 and 20/21 school years, all S2 and two S5 classes were engaged in interdisciplinary project learning through phenomenon-driven inquiry. Details of the project are as follows:



Themes of Inquiry

- **2019/20 school year**
  - Climate change
- **2020/21 school year**
  - Sustainable urban living



Preparation

Panel heads of related subjects (i.e. Liberal Studies/Integrated Humanities, Geography, Science, Computer and Life Planning) discussed the relevant knowledge, skills, attitudes and values in the learning process, and worked out detailed plans based on the chosen themes of inquiry, including setting learning goals and designing related learning activities.

Implementation

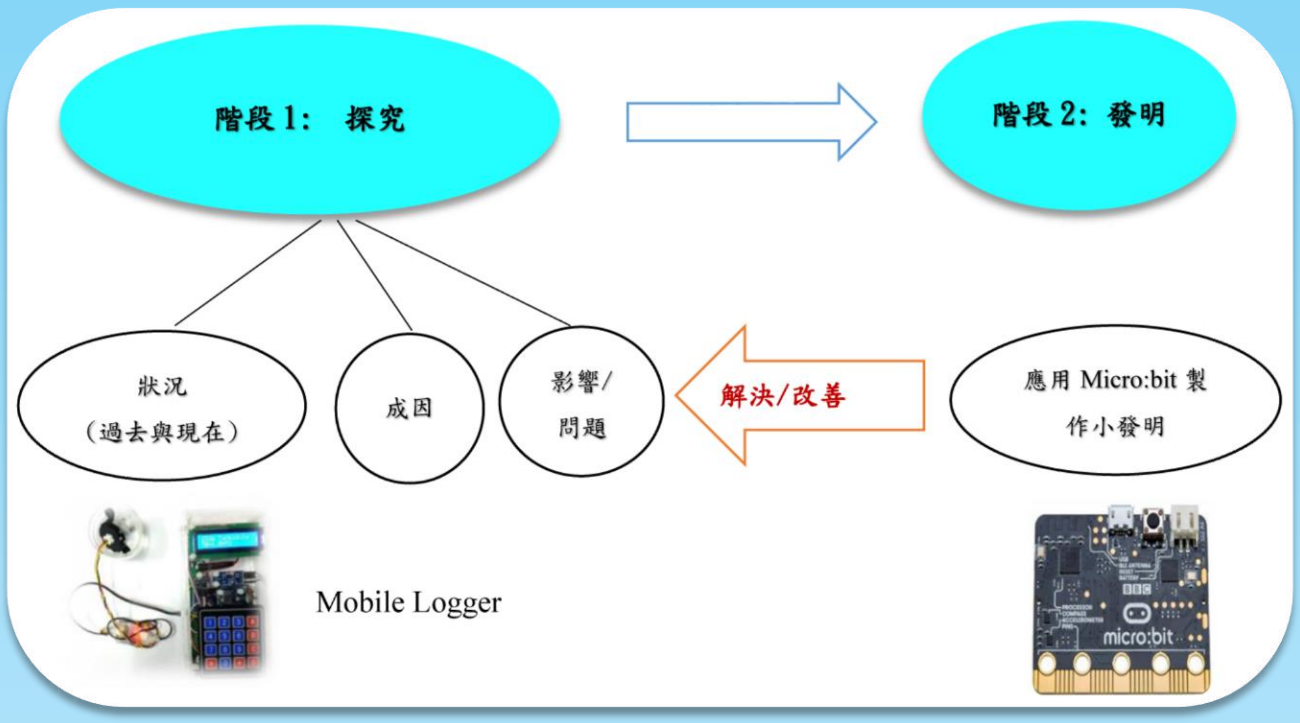
Phase 1

Each group of students selected a phenomenon based on the designated theme and analysed its causes and problems. They applied knowledge and skills across disciplines in an integrative manner to collect data and present findings. They were required to upload their analysis worksheets to Padlet so as to share and discuss their learning outcomes with their peers, thereby facilitating peer learning.

Phase 2

To address the problems identified in Phase 1, students designed a smart device using Micro:bit. Before that, students used recyclable materials to produce a scene model simulating the scenarios which the smart device would be used in. Then, students used Micro:bit and other e-tools (e.g. iPad applications) to design a smart device and conducted testing in the scene model. To showcase students' achievements, the smart devices and final reports were presented in the Academic Carnival.

A Student Collecting Data with a Mobile Logger Device



Modifications Made after the First Year

Since students were allowed to present their learning outcomes in different formats, such as posters and bookmarks, we decided to invite teachers of other subjects to join the project after the first year. For example, Visual Arts teachers could teach students compositional techniques for graphic design, and English teachers could enhance students' understanding of the themes of inquiry by selecting related reading texts. In view of the difficulties in organising activities across levels under the pandemic, project learning was arranged for S2 students only.

A Student-designed Poster on Sustainable Urban Living

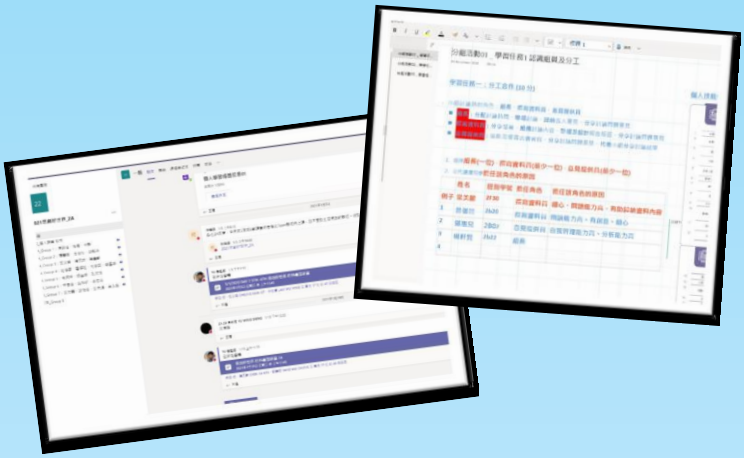
Teachers Engaging in the Professional Development Workshop

As for teacher professional development, we sought to enhance teachers' abilities to guide students to conduct inquiries and enhance their understanding of Micro:bit. Workshops covering information gathering skills and the fundamentals of Micro:bit were organised to enable teachers to effectively guide students through the processes of choosing inquiry topics and creating inventions.

How Did We Overcome the Challenges Experienced during Project Implementation?

During the first year of implementation, the second phase of learning activities were cancelled because of the pandemic. Fortunately, our school joined the STEM project learning programme 'Live Smart@Kowloon East' organised by external organisations, which was taken as an alternative to the second phase. Under this programme, students attended workshops and invented handy gadgets that addressed everyday issues.

Presentation Topic of the Awarded Team in the 'Live Smart@Kowloon East' Learning Programme



Learning Activities on Microsoft TEAMS and Microsoft OneNote

Despite the pandemic, the project could still be implemented, thanks to our school's comprehensive e-learning facilities. A tablet computer was made available for each student so students could work on their projects using a variety of apps. During online lessons, students held group discussions using TEAMS and OneNote, and shared the results of their analyses of phenomena via Padlet. With the use of apps, students managed to achieve the expected learning outcomes in topic selection, information gathering and coding with Micro:bit.

What Are the Achievements of Our Project?

The project promoted self-directed learning by allowing students to choose sub-topics, gather information and write codes by themselves. During the learning process, students fashioned smart devices by integrating and applying knowledge and skills from different subjects and made use of IT to engage in group tasks. They also creatively showcased the fruits of their learning across different media such as posters, PowerPoint slides and Minecraft videos. Building on this experience, interdisciplinary project learning will be adopted as a regular learning activity for all S2 students in our school. During project implementation, teachers of different subjects stepped up communication and collaboration to help students construct and apply knowledge. I contributed to the promotion of professional exchange by sharing with other education workers my experience of studying in Finland and implementing interdisciplinary project learning.

Conclusion

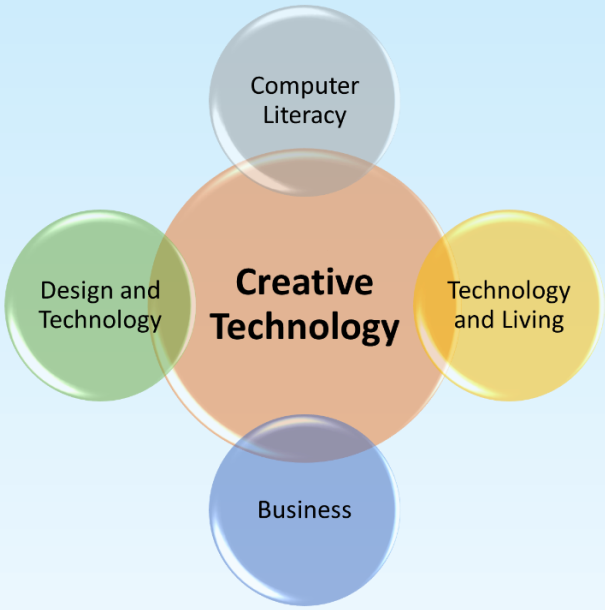
Having a cohesive team was instrumental to the success of the project. My colleagues were accommodating, supportive and cooperative throughout the preparation process. Besides, since the project had to be carried out with blended learning during the pandemic, we had to address contingencies and make adjustments, which invariably contributed to the project's success. With the successful experience, I intend to keep promoting a culture of interdisciplinary collaboration in my school and involve more subjects in the design of project learning to promote its continuous development and strengthen students' ability to integrate and apply knowledge and skills.

Develop a STEM Curriculum in Kwok Yat Wai College

Daniel TONG Sui-hong
TWGHs Kwok Yat Wai College

Establishment of the Pilot STEM Curriculum - 'Creative Technology'

The project aims to establish a pilot STEM curriculum in a school-based subject 'Creative Technology' in junior forms through integration of elements of Computer Literacy, Design and Technology, Technology and Living as well as Business. Different levels of learning materials with self-learning elements were developed to cater for learner diversity, allowing students to learn according to their progress and interests.



Stages of Implementation

The project was implemented in several stages as below.

Students Developing their Collaboration and Communication Skills in the Project

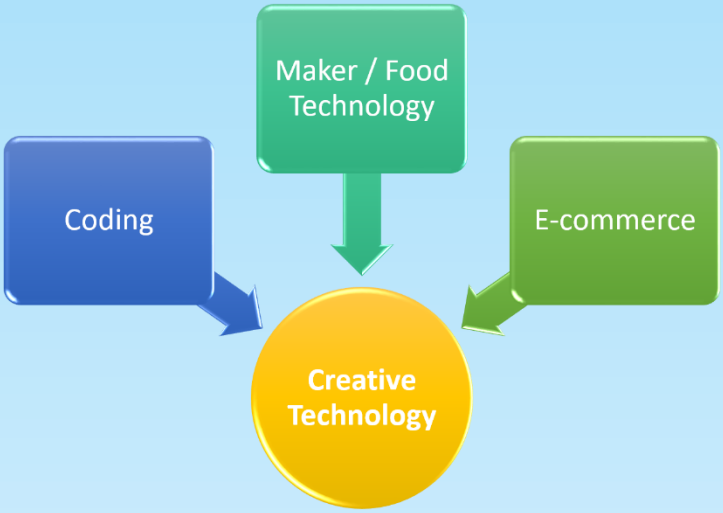
Students Recording the Oven Temperature in the Project

Trial Run of Project Learning

A trial run of cross-subject project learning named 'A4 Carton Oven', which involved Design and Technology, Computer Literacy and Home Economics, was launched for all S1 students to design an oven for cooking. In the process, students acquired the knowledge on food safety and cooking skills.

Launch of the New Subject, 'Creative Technology'

A school-based STEM subject, 'Creative Technology', was launched for S1 and S2 students with four learning modules including 'Coding' in Computer Literacy, 'Food Technology' in Design and Technology, 'Maker' in Technology and Living and 'E-commerce' in Business. Taking reference from the practice in Finland, students were separated into two groups in the first phase of the project and took turns to learn the modules on 'Maker' and 'Food Technology' for 10 weeks. The reduction in class size enabled teachers to better cater for students' diverse learning needs.



Trimming Down of 'A4 Carton Oven' Project to Individual Project due to Pandemic

In the second phase, two cross-subject projects covering the selected learning modules were launched for 8 weeks. S1 students worked on a project of making an A4 carton oven while S2 students designed a device to tackle the problems they faced during the pandemic.

Self-Directed Learning Web Platform

A self-directed learning web platform was launched in February 2020. More than 40 videos were uploaded with the learning contents being classified into three levels of difficulties. Such design enabled students to self-learn according to their abilities and pace. Due to suspension of face-to-face classes, hands-on learning activities could not be conducted. Web-based simulation exercises, for instance, learning by trial-and-error, were included in the learning platform to imitate the hands-on learning activities.

The Self-directed Learning Web Platform

S1 Students Attending a STEM Workshop

STEM Workshop

To enrich students' learning experience, a STEM workshop was organised for S1 students to allow them to make a robot by applying STEM skills.

Newspaper Article Reporting the STEM Workshop for S1 Students

Encouraging Results of the Project

Positive Changes on Students and Teachers

Through 'Learning by Doing', students gained hands-on practice on the target skills, for example, skills of using cutting tools and connecting wires on electric circuit board, and showed more interest in learning. In addition, students' communication and collaboration skills were improved through conducting group tasks. The collaborative learning atmosphere not only raised students' sense of achievement, but also boosted their self-esteem and enhanced their learning motivation.

Students Collaborating in the Class Activities of the Maker Module

The project strengthened cross-departmental collaboration among teachers. Teachers collaborated to plan and design the teaching materials and activities of 'Creative Technology', which built a culture of professional exchange and ultimately contributed to enhancing their expertise.

Positive Changes on the Curriculum

The cross-module projects facilitated students' consolidation of subject knowledge. Also, the self-directed learning web platform was useful under the blended mode of learning during the pandemic. The provision of learning materials (e.g. videos of experiments) with different levels of difficulties enabled students to learn according to their abilities and learning interests. Students were also given greater autonomy in learning which enhanced their self-directed learning.

編程習作評分標準

0-2	3	4	5
未能上載，只能電腦畫面展示部份內容	成功上載，只能完成部份要求	成功上載，能準確完成編程部份要求	成功上載，能準確完成編程全部要求

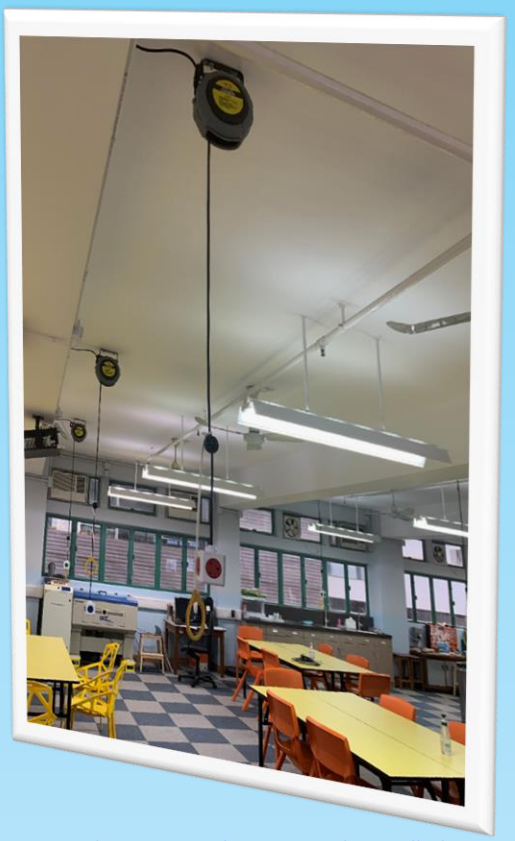
BONUS: 如完成後教導1位同學，將獲1分。(只限1次)

Assessment Rubrics of the Coding Module

Regarding the refinements on assessment, the scaling of the assessment was adjusted, and bonus mark was adopted. With reference to Finland's practice of giving marks to students for participation regardless of the accuracy of their answers, I included bonus marks to reward students who helped others in learning. Award of zero mark was also avoided to encourage students to improve.

Positive Changes on the Learning Environment

The hardware setup in the classrooms in Finland was an important reference for me to promote STEM Education. In my project, ceiling-mounted power cords were installed in the STEM room to allow greater flexibility in classroom settings to conduct different types of learning activities. This enables teachers to incorporate different lesson design and facilitate student learning.



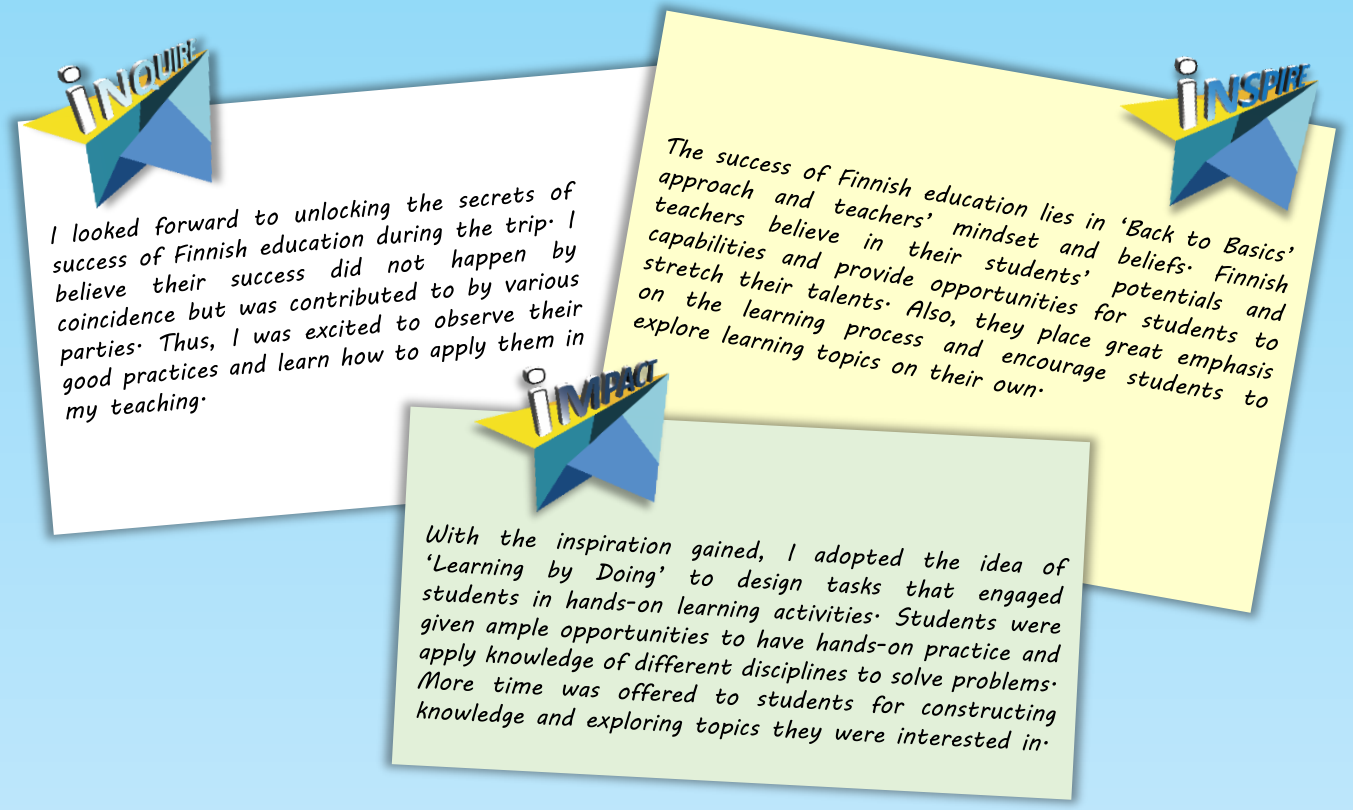
Ceiling-Mounted Power Cords Installed in the STEM Room

Conclusion

I realised the importance of developing students' learning interests and motivation in sustaining the school-based STEM curriculum development. The design of the STEM curriculum should take into consideration students' learning needs, connection to their daily life experiences and learner autonomy. Also, some subject panels showed interest in using the self-directed learning web platform, and it is hoped that we can capitalise on the potential of it to bring forth better learning efficacy.

Junior Secondary Interdisciplinary Curriculum

TSUI Ming-yan
United Christian College



Background

Finland has endeavoured to promote interdisciplinary learning in recent years, hoping to enable students to integrate and apply knowledge of different subjects to problem solving. Our school sought to develop through this project a junior secondary interdisciplinary curriculum that helps students gain a deeper understanding of their learning and better apply the knowledge acquired. Teachers joining the project would explore effective ways to promote interdisciplinary learning and enhance professional capabilities with the use of tablet devices.

Implementation

Overall Planning

The learning experience under 'i-Journey' Scheme has enlightened me on ways to optimise the learning contents and assessment practices of various subjects, and effectively plan a junior secondary interdisciplinary curriculum. The project was thus devised with the following components:

Kick-off Activity

We kicked off the project during a class-teacher period to give students a general picture of the project and teachers some ideas of the curricula of the subjects involved.

Reading across the Curriculum

Inspired by Finland's focused effort to promote a culture of reading, we included reading in the project to develop students' reading habit and deepen their understanding of respective themes. To this end, subject teachers recommended and provided the school library with relevant reference books or online articles for students to read. Educational videos for certain subjects were also made available online for students to extend their learning.

Assessment

Drawing on Finland's good practices, we improved assessment design by harnessing technology, connecting assessment to everyday life, and giving students an opportunity to showcase their creativity. For example, students created artworks using the techniques of photomontage to highlight the characteristics of the local community in Visual Arts classes; produced and analysed energy-related statistical charts in Mathematics classes; and conceived smart products that could improve daily living by comparing ancient artefacts with their modern equivalents in Chinese History classes.

Experiential Learning

To provide students with out-of-classroom learning opportunities, places were selected for them to visit in accordance with the themes set, including Nam Shan Estate and Mei Ho House for S1, local renewable energy facilities for S2, and the Hong Kong Museum of History for S3. However, the visits were cancelled because of the pandemic. To offer students other experiential learning opportunities, we organised hands-on creative activities, such as writing computer programmes and creating storybooks and smart products, which helped students learn by applying the skills, and acquire and construct knowledge through practical experiences.

Promotion

Students designed posters with visualised project details and posted them around the campus to attract peers to the activities offered under the project.

Showcasing Learning Outcomes

Observations made in Finland revealed that teachers could enhance students' learning interest and confidence by showcasing their learning outcomes. Following their example, exemplary student works were displayed at the 'Learning Outcomes Demonstration and Sharing Session' organised during the post-examination period. At the session, students presented their work and shared their ideas with the attendees.

An overview of the theme for each level:

S1: A Storybook about Shek Kip Mei Estate

Teachers guided students in creating a storybook about Shek Kip Mei Estate by exploring different aspects of public housing, with a view to encouraging students to take an interest in the local community. Collaborating subject panels included Liberal Studies, History, Chinese Language and Visual Arts.

Poster Promoting S1 Activities

南山邨的乾貨市場

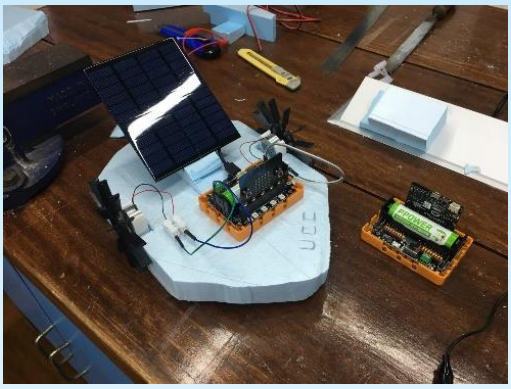
廣場的入口右轉就看到一整排的商店，當中包括跌打舖、髮型屋和紙紮舖等，多不勝數。走進去就嗅到濃濃的藥酒味，相信是由跌打舖的藥酒來。當我們前行一段路時，我的朋友告訴我，她聽到了「咔嚓咔嚓」的聲音，我們轉頭一看，就看到了理髮師為客人剪頭髮的場景。當我們走到下層的商店，我的朋友就急不及待地跑到雪糕店購買雪糕，好奇的我嚐了一小口，就連忙說：「啊！這個波子汽水味的雪糕竟然如此美味，這雪糕的味道也太特別了吧！」當我的朋友嚐了嚐也非常驚訝。走遍了廣場乾貨部份，我覺得那裏非常豐富，一次集合了不同種類的商店。

Chinese Essay Writing by S1 Students after the Visit

S2: Play to Save – Exploring Renewable Energy

Teachers inspired students to explore the room for renewable energy development through 'learning, application and promotion'. Students were encouraged to conserve energy in their daily lives using their knowledge, skills and creativity with an aim to build a low-carbon future. Collaborating subject panels included Science, Geography, Mathematics and Information Technology.

Poster Promoting S2 Activities



Student-designed Product to Promote the Use of Renewable Energy

S3: Traversing Space and Time – Smart Products of Intelligence and Love

A Student-innovated Product to Improve the Daily Living of Human Beings

After imparting to students a variety of STEAM knowledge, such as 3D designing skills, teachers guided students to create smart products that could fix day-to-day problems as a way of showing their love and care for others. Collaborating subject panels included Information Technology, Chemistry, Mathematics, Visual Arts, English Language and Chinese History.

Poster Promoting S3 Activities

Outcomes

Teachers

Teachers of different subjects held meetings to exchange ideas and familiarise themselves with the teaching contents and assessment modes of other subjects covered by interdisciplinary learning. Interdisciplinary collaboration was enhanced through collaborative class activities and assessment planning, and the introduction of a number of innovative assessment practices and diversified learning activities to arouse students' interest in learning. Teachers also developed a better grasp of the techniques for applying IT in teaching through peer sharing and exchange.

Students

The adoption of experiential learning effectively enhanced students' learning motivation. Around 70% of students agreed that interdisciplinary learning boosted their learning motivation, while a majority of students concurred that interdisciplinary learning helped them develop knowledge, skills and positive attitudes. 70% of students reflected that interdisciplinary learning enabled them to understand subject matters from different perspectives. 80% of students considered the project helpful in enhancing their communication, collaboration and IT skills, while helping them develop a concern for the community and others and raising their awareness of environmental protection. In addition, teachers adopted diversified assessment modes, such as taking photographs, writing and conducting experiments, to cater for learner diversity and enable students to put their strengths to work.

Conclusion

I realise that learning is more than acquiring knowledge from books. Schools could organise more out-of-classroom experiential learning activities to help students combine knowledge with practice. Besides, I have learnt how to systematically and holistically plan an interdisciplinary curriculum to develop students' ability to integrate and apply interdisciplinary knowledge and skills.

I had the opportunity to share my experience of running the project with people within and outside the school. More importantly, participants of ***'i-Journey'*** Scheme shared with one another details of their projects and explored together ways to seek improvement, thereby creating a learning community for promoting professional exchange and collaboration among teachers.

Programme A(5) – Assessment Literacy
Late April – Late June 2019
Southampton, the United Kingdom

Administered by the Education Bureau, the Programme consisted of both local and overseas components. While the local part of the programme was supported by Department of Education Studies, The Hong Kong Baptist University, the overseas customised programme was conducted by the Southampton Education School, University of Southampton.

The customised overseas programme aimed to enable participants to:

(a) acquire knowledge of the local education system and its key features, with a special focus on the latest development of Assessment Literacy in the United Kingdom;
(b) enhance their professional capacity in developing school assessment policy and measures to strengthen the effectiveness of Assessment of/ for/ as Learning;
(c) develop their repertoire and expertise on the design, implementation and data analysis of assessment;
(d) integrate structured learning and school attachment to become reflective practitioners; and
(e) develop teacher leadership through sharing learning outcomes in Professional Learning Communities and disseminating good practices.

Nurturing Effective English Writers through Enhancing the Assessment Literacy of Teachers and Students

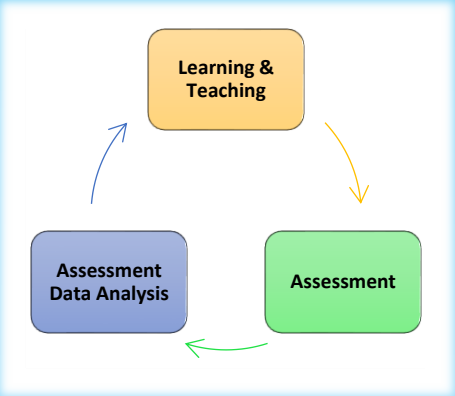
Vivian FUNG Wai-yee
Jockey Club Government Secondary School

Background

To be a good writer, one needs to be familiar with the topic, utilise proper vocabulary and sentence patterns, and present ideas logically. However, as my students study most subjects in Chinese and have limited exposure to English, they struggle to express ideas fluently in English. Moreover, poor grades and negative feedback have led students to become avoidant and unconfident towards English writing.

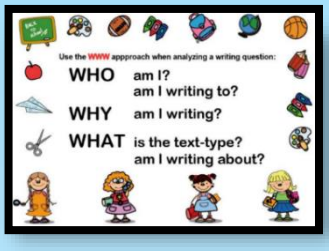
Objectives of the Project

To address my students' learning needs, this project aimed to increase students' cognitive and affective engagement in writing, deepen teachers' and students' understanding of the role of assessment in enhancing learning and teaching and strengthen their professional capacity to make use of formative assessment data to gauge students' learning performance. More importantly, it aimed to develop students' abilities to reflect on their strengths and weaknesses and monitor their learning progress using assessment data.



Interlocking Relationships between Learning & Teaching, Assessment and Assessment Data Analysis

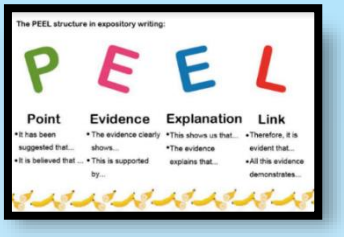
Project Implementation



'Who-Why-What' (WWW) Approach

Preparation

Realising the importance of the support from key stakeholders, I presented the ideas of the project to the Principal, Vice Principal and Head of the English Department prior to implementation. In addition, I shared with other English teachers my project details and the valuable insights gained overseas, including features of effective feedback and various writing tools, such as 'Who-Why-What' (WWW) approach and 'Point-Evidence-Explanation-Link' (PEEL) structure, which were adopted in teaching writing for my project.



'Point-Evidence-Explanation-Link' (PEEL) Structure

Upon reviewing the S4 English Language writing curriculum and assessment policy, persuasive writing was selected as the learning and teaching focus in the first term in the 2019/20 school year. Relevant writing questions were designed with reference to the HKDSE writing paper and topics in the reading curriculum.

Implementation

To sharpen students' skills in planning writing and organising ideas, they were trained to adopt the 'WWW' approach when analysing the writing questions and the 'PEEL' structure in expository writing. Visually stimulating posters were designed and displayed in classrooms to familiarise students with the concepts introduced.

A feedback form with three to four learning objectives set under the domains of 'content', 'language' and 'organisation' was designed to enhance students' understanding of the assessment criteria and facilitate peer and self-assessment. Teachers also used the same feedback form to understand students' evaluation capabilities and evaluate their writing performance.

To strengthen students' abilities in reflecting their writing performance, focus marking was adopted by teachers for 3 writing assignments in the first term, during which teachers marked one paragraph, two sentences and three words by adopting the '123 approach' using marking codes. Students were encouraged to focus on the content marked and make improvement.

Besides, a process writing package was devised, which included input for writing tasks, writing tools 'WWW' and 'PEEL' to guide students to brainstorm ideas, writing tasks as well as self- and peer assessment tasks for students to improve their drafts.

Project Evaluation and Outcomes

To evaluate the effectiveness of the project, pre- and post-tests were conducted, in which students were tasked with writing emails to ask a relative for sponsorship. Meanwhile, an interview was arranged for S4 English teachers to obtain their feedback on project implementation.

Student Level

There was a 5 to 10% increase in the average scores in the pre- and post-tests, suggesting that students' overall performance in persuasive writing improved. Some students demonstrated application of the knowledge and skills learnt, such as elaborating on ideas using 'PEEL' structure and explaining possible consequences using conditional sentences. Students also displayed greater confidence and competence in English writing. They became more aware of their own strengths and weaknesses, which together with the teacher and peer feedback created an atmosphere conducive to fostering self-directed learning.

Teacher feedback was positive overall, especially regarding the use of focus marking and feedback forms. As reflected, with concrete examples of the expected learning outcomes in the feedback form, even the less able students demonstrated improvement in expressing ideas. In addition, focus marking fostered students' positive attitudes towards mistakes making as the process of correction would not dampen their spirit. Instead, they became more engaged in exploring new vocabulary and sentence structures for improvement.

Curriculum Level

As the expected learning outcomes were included in the feedback form, teachers could evaluate students' writing performance in a more focused manner. Besides, with reference to the successful experience of project implementation, English teachers of other levels have started to set clear teaching objectives and adjust their teaching based on students' assessment performance. In view of the project's effectiveness, the project would be extended to S4 and S5 in the 2020/21 school year.

Conclusion

Inspired by *'i-Journey'* Scheme, I am more aware of the importance of incorporating formative assessment tasks in my lessons and identifying students' learning needs through analysing the assessment data. Moving forward, I will focus more on planning and evaluation of the curriculum by holding more frequent collaborative lesson planning meetings, during which we will review students' progress, adjust teaching and devise appropriate assessment tasks to enhance learning and teaching.

Meeting the Head Teacher of Cantell School

Assessment as Learning to Foster Self-directed Learning

Fred HO Hok-leong
Carmel Secondary School

iNQUIRE

I was keen to learn about effective assessment at school and classroom levels. To address the school's major concern on fostering self-directed learning through Assessment as Learning, I would like to acquire strategies for incorporating elements of assessment into classroom learning and teaching.

iNSPIRE

I was inspired by the various ways of engaging students in discussions and how peer assessment was strategically conducted in the UK. Moreover, I have learnt that a comprehensive school assessment policy is crucial to curriculum development, and professional development for middle managers on assessment is pivotal as they are in charge of the use of assessment data to inform classroom learning and teaching.

iMPACT

The EAT Framework reminds me of the importance of providing opportunities for students to conduct peer and self-assessment as well as demonstrate their learning outcomes. It was observed that students have improved their capabilities in self-directed learning and peer collaboration as well as Mathematics skills. Teachers' assessment literacy has also been enhanced.

The Idea of the Project Came from …

Enhancing students' self-directed learning was the school's major concern in the previous development cycle during which students were taught various self-directed learning strategies. Building on this foundation, Assessment as Learning is promoted in the current development cycle to further foster students' abilities in self-directed learning with emphasis on the application of insights gained from *'i-Journey'* through the project.

Objectives of the Project

- To enhance students' confidence and competence in conducting peer assessment
- To promote effective use of peer assessment to enhance learning and teaching
- To promote formative use of assessment data among teachers

Project Implementation

Learning & Teaching

Conducting Lesson Trials to Implement Peer Assessment

Three lesson trials were conducted in S4 and S5 Physics lessons to implement peer assessment using various teaching strategies that I have acquired from the UK, for example, the 4-corner approach which encourages students to seek feedback from peer 'experts'. Teachers were invited to observe the lesson trials and provide feedback afterwards.

4-corner Approach

Conducting Lesson Study

A lesson study was conducted in four S1 Mathematics classes on the topic of 'Peer Assessment and the Formative Use of Assessment Data'. After each lesson observation, in-depth evaluation and discussion was made on how to revise the strategies of peer assessment.

Promoting Teachers' Assessment Literacy

Establishing a Reading Group

A reading group for teachers was established with an aim to enrich their knowledge and pedagogy to engage students in group activities. Two books were read and meetings were held afterwards to facilitate reflections and discussions.

Sharing in Department Heads Meetings

Key concepts of assessment literacy, useful strategies to carry out self- and peer assessment and different methods of analysing assessment data were shared during department heads meetings. All department heads were asked to plan and design assessment tasks that involved self- and peer assessment.

Sharing in KLA Meetings

Useful strategies observed in Bitterne Park School in the UK were shared during KLA meetings. Examples include preparing students to be open to mistakes, seek feedback from others and give quality feedback to peers.

Forming a Task Force on Peer Assessment

Three teachers from different KLAs, namely Chinese, Personal, Social & Humanities Education (Chinese History) and Mathematics, were invited to join the Task Force.

Sharing on Formative Use of Assessment Data in Department Heads Meeting

Challenges Faced Whilst Implementing the Project

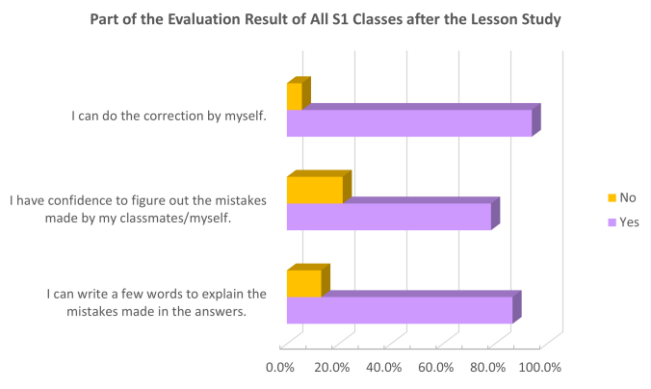
Due to the social incidents and COVID-19 pandemic, I had to bring a halt to face-to-face meetings with the Task Force and used Google Classroom for sharing and discussions instead. Videos about evaluation of my lesson trials and notes of assessment reference materials were recorded and uploaded, along with peer and self-assessment tools, for the Task Force's easy reference and enhancement of their pedagogical skills and assessment literacy.

Due to school suspension, teachers were struggling to finish the curriculum when school resumed, leaving no room for lesson study and only the Mathematics lesson study could be completed as scheduled. Besides, presentation of our lesson study originally scheduled in the last department meeting was postponed to the following school year due to re-suspension of the school.

Results & Conclusion

Student Level

The implementation of peer assessment was successful as enhanced peer collaboration was observed among the target S4 students in Physics and Biology lessons. S1 students' target Mathematics skills were also significantly improved after the intervention. A majority of the students showed confidence in identifying their own and peers' mistakes and most also responded that they were capable of correcting the mistakes by themselves.



Teacher Level

Teachers of my school have become more aware of the formative use of assessment data after the sharing from the Mathematics coordinator. Many departments now utilise assessment data in a more efficient way through analysis of assessment data to identify students' learning difficulties. Moreover, they have attempted to incorporate peer assessment into their yearly lesson study. I joined these lesson studies to give suggestions based on what I had experienced in the UK to help refine lesson planning.

Individual Level

Furthermore, this project has raised my awareness towards the importance of self- and peer assessment, and assessment should be well-planned. I have now made peer assessment and discussions common practices in my lessons, for example, exchange of notes between students with peer feedback. As a way forward, I will make refinements in my pedagogy to better cater for the learning needs of the students through more effective use of assessment data.

From Formative to Summative – Bridging Formative Assessment Activities in English Literature and English Drama Lessons and Summative Assessment of English Reading Skills

Freddie KWONG Hoi-kit
Our Lady of the Rosary College

Reasons for Project Implementation

To FIND OUT

- the relationship between formative assessment activities in English Language Arts (Drama and Literature) classroom and summative assessment in English Language

To EVALUATE

- the effectiveness of formative assessment tasks in English Literature and English Drama lessons in enhancing students' inference skills and ability to answer higher-order thinking questions and figurative language questions in English Language reading paper assessment

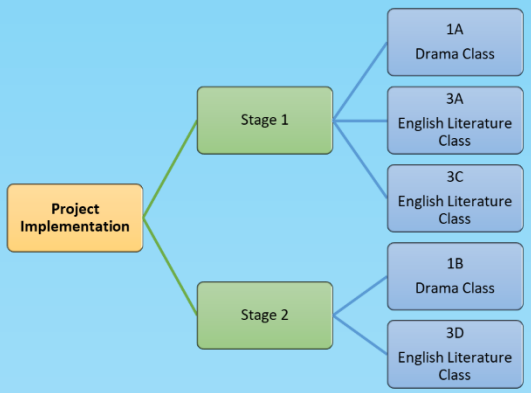
To BUILD

- students' confidence in tackling higher-order thinking questions and figurative language questions in summative assessment through English Literature and English Drama lessons

Stages of Project Implementation

Due to school suspension, the project was implemented in two stages across two academic years with the following target classes.

- ***Stage 1*** (the 2019/20 school year):
  - 1A Drama class, 3A (more able) and 3C (less able) English Literature class
- ***Stage 2*** (the 2020/21 school year):
  - 1B Drama class, 3D (less able) English Literature class



The curricula of English Literature and Drama were revised with a focus to sharpen students' reading skills and improve learning and teaching with formative assessment tasks. To that end, teaching of reading skills was incorporated.

In S1

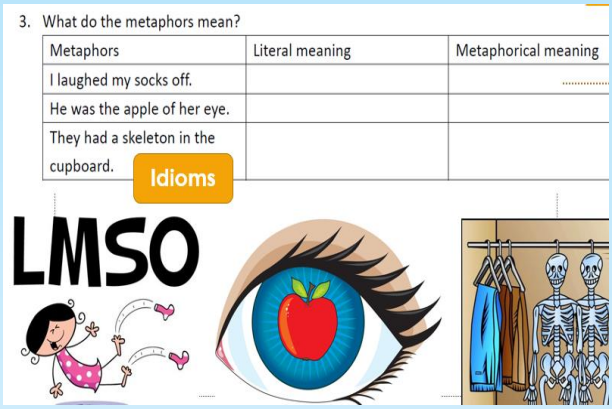
A module of one-act play was added to the Drama curriculum along with various reading activities including readers' theatre, play script writing and story reading sessions.

In S3

Greater emphasis was placed on equipping students with skills of answering higher-order thinking questions in response to short stories.

Formative assessment tasks were designed and used in lessons. Whiteboards and e-learning tools were used to collect students' responses and facilitate peer and self-evaluation. Besides, literature and drama journal were used to allow students to document their learning progress.

Alterations were also made to the assessment. Instead of class-based vocabulary quizzes, tasks that required higher-order thinking skills were used.



A Class Activity to Enhance Students' Higher-order Thinking Skills in English Literature Lesson

Collection of Data

To measure the effectiveness of the project in enhancing students' inference skills and ability to answer higher-order questions and figurative language questions in reading assessment, data of the pre- and post-intervention quizzes were collected and analysed. Questionnaires were distributed to S1 and S3 target classes to collect their views on the expectation on drama lessons and their previous learning experiences in the related subjects (i.e. English Literature, Drama and English Language) respectively. Three focus group interviews with eight S3 students were also conducted to learn more about their Language Arts learning experiences.

Project Achievements

Student Level

For S3 English Literature, the project has successfully improved the ability of more able students to answer the target question types in summative reading assessment. Some students gained more confidence in answering challenging questions in reading exams and their awareness towards the learning objectives was enhanced. Weaker students, however, showed less improvement in tasks and had not gained much confidence from the intervention.

For S1 Drama, students became more aware of the learning objectives and enhancement of their reading skills. Slight improvement was achieved by students in post-quizzes in interpreting tone and mood questions. In addition, most students were positive about the project and believed that the change in curriculum can improve their reading skills.

Curriculum Level

For S3 English Literature, the project has facilitated collaboration among teachers. With clear learning objectives, teachers were able to work together to plan lessons and offer assignments that can sharpen target skills. Moreover, more formative assessment tasks and peer and self-assessment strategies were carried out regularly.

For S1 Drama curriculum, as more activities such as script reading and writing were incorporated, students' learning opportunities and awareness towards the linkage between Drama and reading were enhanced.

Challenges in Project Implementation

Limited Lesson Time for Implementation

Due to the pandemic and school suspension, it was difficult for teachers to fully carry out formative assessment tasks and activities owing to the reduced lesson time. For instance, in S3 Literature, short stories were downsized and could only be skimmed through in lessons. As for S1 Drama lessons, the addition of reading activities required more lesson time, but the number of weeks allocated for the teaching of script reading could only be set to a maximum of 4 weeks. As a result, it hindered the effectiveness of the intervention.

Change in Learning Mode

It was difficult to carry out assessment effectively in online lessons as students were not with each other physically. Activities that required body movements and gestures had to be downsized. Verbal discussions were replaced by written tasks, which greatly hindered the provision of feedback. Even though data was collected in Stage 1, the implementation process could not be fully carried out.

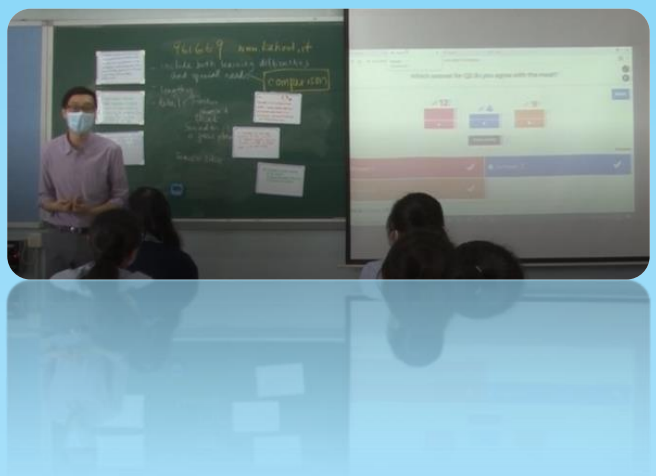
Variables Influencing Students' Learning of Target Reading Skills

Students' mastery of inferencing skills is subject to their fundamental knowledge of the world and language foundation, which could not be controlled in the project. Also, students' improvement in the target reading skills might be attributed to English Language lessons rather than the project. To enhance the project's reliability, data was collected from different means, including summative assessment, questionnaires and focus group interviews to evaluate the project effectiveness more comprehensively.

Conclusion and Way Forward

To conclude, the formative assessment tasks have proven to be effective in improving students' summative assessment results, with careful curriculum and assessment design. Building on the experience, the initiative could be further implemented in the next academic year in Language Arts lessons at all junior secondary levels. Formative assessment activities could be incorporated in S2 and S3 English Literature in teaching reading skills through literary texts and novels. This could give the curriculum a better focus and closer connection with students' learning experience. For weaker classes, teaching and learning could be strategised and question types with lower level of difficulty could be used.

The Teacher Using an e-Learning Tool to Assess Students' Reading Skills



Students' Self-assessment in Mathematics

LAM Chi-bun
Ling Liang Church M H Lau Secondary School

Background & Objectives

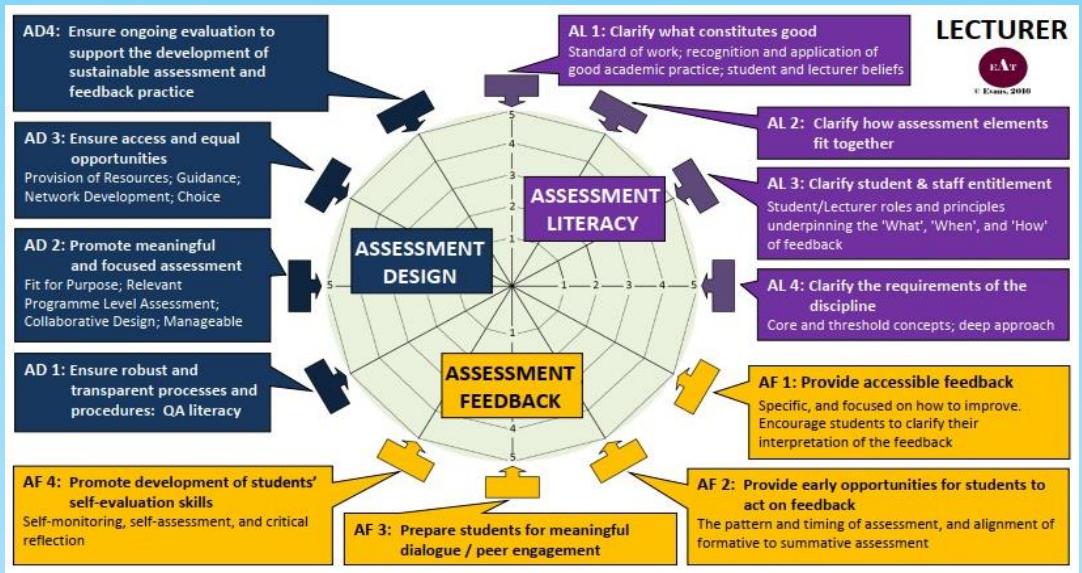
In response to our school's major concerns in promoting self-directed learning and a paradigm shift in learning and teaching, self-assessment was explored to enhance student learning. The research was developed for twenty-three S2 students to:

- improve learning and teaching through students' self-assessment in Mathematics;
- build a professional learning community among teachers to enhance their professional capabilities in adopting self-assessment; and
- prepare learning and teaching resources for self-assessment including self-directed learning worksheets and follow-up tasks, and videos for 'Talking Solution' to facilitate students' checking of answers for challenging questions.

Research Question:

Is developing students' self-assessment skills an effective strategy to promote the learning and teaching of Mathematics?

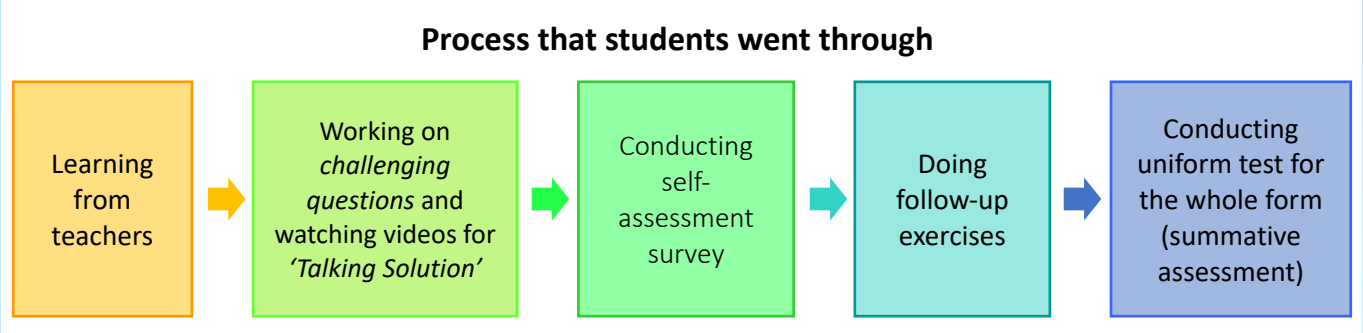
Research Implementation



The EAT Framework: Instructor Focused Areas (Evans, 2016)

Inspired by the overseas learning experience, the Evans Assessment Tool (EAT) Framework, which emphasises different aspects of assessment including its design, literacy and feedback and their linkage (Evans, 2016), was employed in the research.

First cycle



The first cycle of the research was launched in October 2019, aiming to promote self-directed learning by harnessing technology. With the implementation of 'Bring Your Own Device' policy since 2018, all the learning materials could be shared with students through Google Classroom.

The topic 'Angles Related to Triangles and Polygons', together with the sub-topics of 'Angles Related to Triangles' and 'Angles Related to Polygons', were selected for the research. Two challenging questions were meticulously designed for each sub-topic to encourage students to challenge themselves. Students who attempted the challenging questions were asked to upload their answers to Google Classroom for teacher checking. Afterwards, 'Talking Solution' videos, which included teacher's modelling of the thinking process required to solve the problem, were uploaded to facilitate students' self-checking and understanding of their strengths and weaknesses.

Taking reference from the British schools, a self-assessment worksheet was developed to enable students to reflect on their learning at the end of each sub-topic. The data collected was used to gauge students' learning progress and performance, and devise corresponding follow-up exercises to address their learning difficulties. Solutions were also provided to facilitate students' checking of the answers. At the end of the first cycle, a summative assessment in form of a uniform test was conducted.

Second cycle

The second cycle focused on the topic of 'Trigonometric identity'. However, the implementation was postponed due to the pandemic. With a view to enhancing students' assessment literacy, the rubrics in the self-assessment worksheet were amended by providing relevant Mathematical examples to illustrate the meaning of the rubrics. Therefore, students gained a better understanding on the assessment criteria, thereby strengthening their abilities to conduct self-evaluation. In addition, the level of difficulty of the challenging questions was adjusted with an easier question set first to encourage students to make an attempt. Besides, the aims of the research were explained in detail to students at the beginning of the second cycle to let them understand the reasons for conducting the self-assessment.

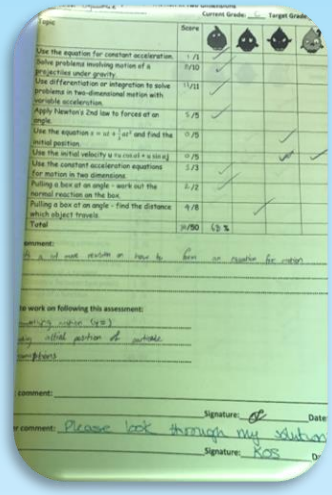
Methodology

Pre- and post-research student surveys named 'My views on Mathematics Learning' were conducted to understand their perceptions on learning Mathematics prior to the first cycle and upon completion of the second cycle. Two uniform tests were conducted for evaluating the impacts of self-assessment on summative assessment. To collect students' opinions, an interview was arranged for three students after the research.

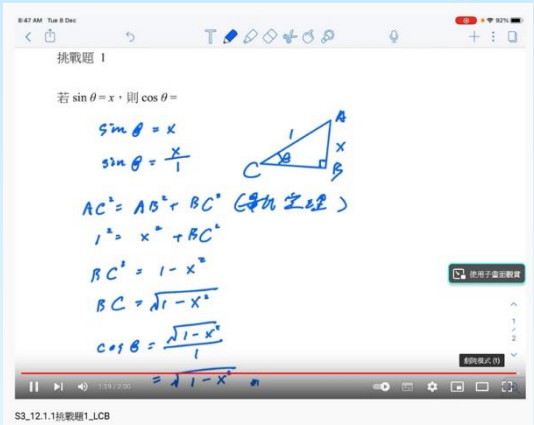
Research Result and Implications

Although students' learning motivation in Mathematics decreased as revealed from the pre- and post-surveys, which might be caused by the suspension of face-to-face classes, the survey data showed that students' self-learning skills such as making pre-lesson preparation and using online resources to self-study have been improved.

Concerning the data collected in the self-assessment, consistency was observed between the results of students' self-assessment and summative assessment, which showed that students demonstrated better abilities to review their learning according to the rubrics. However, given that only a minority of students understood the meaning of the follow-up exercises, more guidance may be needed for students to understand the crucial role of follow-up exercises in helping them improve.



Students' Self-Assessment Form



Screen Capture of 'Talking Solution' Video

The feedback from the interview was encouraging. Students considered the 'Talking Solution' videos helpful as the videos helped them understand the ways for solving the questions and facilitated their self-checking. The positive responses motivate me to extend the strategy to the follow-up exercises by using pre-recorded videos to facilitate student learning.

Comparing the rates of attempting the challenging questions in the two cycles, whilst around 56% of students attempted the challenging questions in the first cycle, the rate increased to 78% in the second cycle. To increase students' motivation to try the extended tasks, challenging questions were carefully set, which were suitably challenging and capable of stimulating student thinking. Besides, the first challenging question was set easier to increase students' sense of achievement.

Conclusion and Way Forward

The process of formulating the assessment rubrics has benefited my teaching as I gained a more in-depth understanding of the learning objectives of each topic, thereby empowering me to devise suitable teaching strategies to help students achieve the learning objectives. Moreover, thanks to the self-assessment data, I was better informed of students' learning and could make timely adjustment to my teaching strategies.

Through regular collaborative lesson planning meetings with the teachers involved, as well as the sharing sessions held in the school to share my research and overseas learning, the establishment of a learning community in the school has been initiated to foster professional exchange among teachers.

To sustain the impact of the research, more self-assessment will be conducted to develop students' habit of self-evaluation. Meanwhile, self-assessment skills will be introduced in Mathematics lessons to strengthen students' self-evaluation abilities.

References

Evans, C. (2016). Enhancing assessment feedback practice in higher education: The EAT framework. Southampton: University of Southampton.

Rethinking Quality Formative Assessment: 'Science and Technology' as a Pilot Scheme – Using the Evans Assessment Tool (EAT) Framework

Fanny LAM Yuen-fan
Heep Yunn School

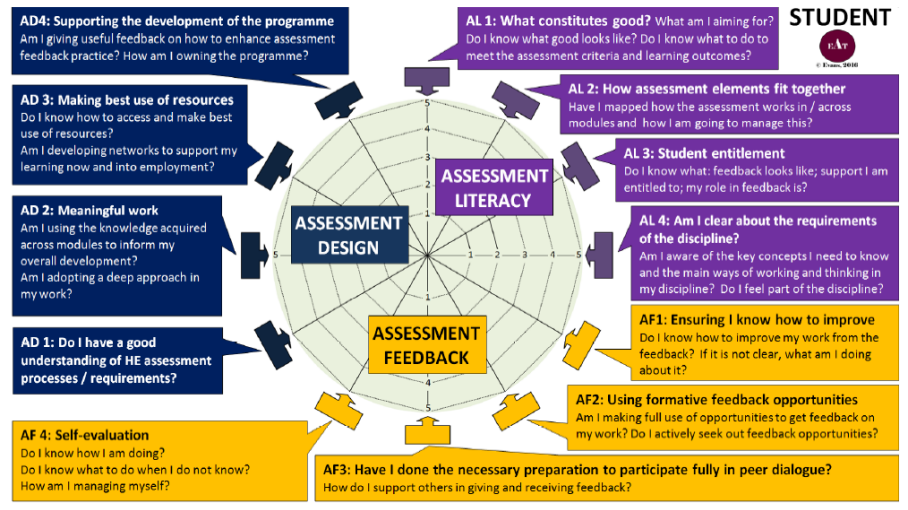
How Does the Project Design Address the Needs of Our School?

This project fulfils the school's development needs on implementing effective formative assessment to promote Assessment for Learning and Assessment as Learning in the new school-based subject 'Science and Technology' (S&T) in junior forms. It particularly aims at promoting assessment literacy among teachers and students, enhancing assessment design and facilitating teachers' delivery of quality assessment feedback.

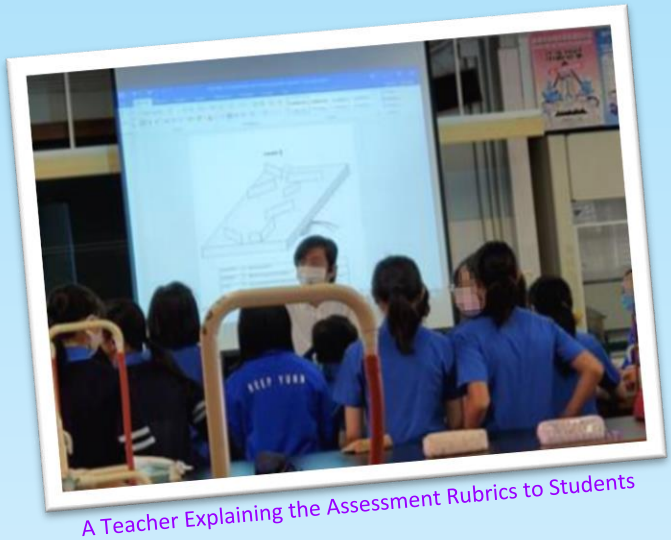
What Were the Framework Adopted and Stages of Implementation?

The Evans Assessment Tool (EAT) Framework was adopted as a design tool to hone in the curriculum and assessment design of S&T. It is also an evaluative tool to review the effectiveness of assessment feedback as well as a training tool to support the skill development of teachers and students.

In the 2019/20 school year, two S&T teachers and S1 students participated in the project. In the 2020/21 school year, three S&T teachers and S1 to S2 students joined the project. The project was implemented in three stages.



The EAT Framework: Student Focused Areas and Questions (Evans, 2016)



A Teacher Explaining the Assessment Rubrics to Students

Stage 1: Enhancing the Assessment Design of S&T and Assessment Literacy of Teachers and Students

Given that teachers' assessment literacy is essential in enhancing the assessment design, I shared my experience and observations in Southampton with S&T teachers, in particular, how the learning logbooks used could serve as a model for designing the curriculum and assessment criteria for S&T. Discussions on how the EAT Framework could be applied in framing the assessment criteria for S&T were conducted. Moreover, to enhance students' assessment literacy, teachers explained to students about the assessment criteria.

Stage 2: Making Use of Assessment Feedback to Improve Learning and Teaching

The learning logbook, which included worksheets and assessment guides, were used in S&T lessons. Teachers provided oral and written feedback to facilitate students' understanding of their learning progress and improvement. Students also conducted peer and self-assessment based on the criteria set out to monitor and reflect on their learning.

A Teacher Giving Oral Feedback to Students

Stage 3: Evaluation

Evaluation was conducted through student survey and interviews with teachers and students. Student survey in Google Form was sent to all S1 and S2 students. After collecting the data, interviews were conducted with 20 students (with 10 students each from S1 and S2), to collect more elaborative feedback and suggestions. An interview with the S&T teachers was also arranged to evaluate the formative assessment and assessment rubrics.

Students Improving Their Work after Receiving Feedback from Peers and Teachers

What Are the Positive Changes to Students?

With teachers' clear explanation of assessment criteria, students gained knowledge on the assessment criteria and enhanced their assessment literacy. Students had greater learning motivation and a better mastery of knowledge and skills required in S&T. With the teachers' feedback, students demonstrated abilities to integrate the knowledge they learnt in different subjects to refine their products.

Students opined that teachers' feedback, peer and self-assessment aided their learning. With teachers' elucidation, students were able to reflect on their own progress and work, as well as apply the rubrics to evaluate the works of their counterparts, which is conducive to promoting peer and self-reflection. Improvement on students' communication skills was also noticed. Students not only developed their confidence, the courtesy and manner in giving comments, but also learnt to be humble and receptive to others' feedback.

Nonetheless, there is room for improvement on peer assessment. As reflected in the survey, students tended to give positive feedback to avoid hurting the feelings of their classmates. Teachers can play an active role in changing this mindset by stressing the difference between positive and constructive comments. Through continued practice of peer assessment, students can develop a growth mindset in response to others' comments and make improvement.

Students' Final Products in S&T Project

What Are the Positive Changes to Teachers and the Curriculum?

Teachers were able to better gauge students' understanding of the assessment requirement and their performance. Incorporating elements of assessment literacy in the curriculum also enhanced their learning. Regarding the assessment design, diversified modes of assessment were introduced, putting great emphasis on both oral and written feedback and involving different stakeholders including students and teachers in assessment. On the whole, the curriculum has been enriched.

Conclusion & Way Forward

Individual Level

'i-Journey' programme has enhanced my understanding of Assessment as Learning, especially its role in nurturing life-long learners to meet the fast-changing world. Besides, how students respond to teachers' feedback is important to the development of their metacognitive skills so as to move learning forward. This stimulated me to go beyond my project and discuss with core subject panels on how to give effective feedback, teachers' follow-up actions and the extent of students' improvements.

Team/School Level

The project inspired S&T teachers in designing the curriculum, with formative assessment as an integral part. The assessment criteria should be manageable by students with a focus on the learning process and continuous improvement of students. To grant students greater autonomy and facilitate their self-directed learning, all relevant resources were made available to students online from the start of a new topic. To generate a greater impact in school, it is planned to organise a sharing session on the experience gained with the Assessment and Examination Team before the team embarks on the review of the school-based assessment policy.

With the positive results, the EAT Framework will be further refined and adopted in the S&T curriculum. It was also envisioned that similar change in assessment could be extended to other subjects. Inter-departmental collaboration can be considered to initiate interdisciplinary projects on topics about the history of our school or sustainable development in Hong Kong, focusing on peer and self-assessment. Thus, assessment literacy and Assessment as Learning could be promoted to a fuller extent in our school.

References

Evans, C. (2016). Enhancing assessment feedback practice in higher education: The EAT framework. Southampton: University of Southampton.

Improving the Internal Assessment Design through Strengthening Assessment of / for / as Learning

Joyce WONG Pui-shan
Yan Chai Hospital No.2 Secondary School

Why Did I Initiate the Project?

In view of the challenges faced by my students in learning English, I hope my overseas experience could lend some inspiration to English teachers on how to enhance the design of our English curriculum.

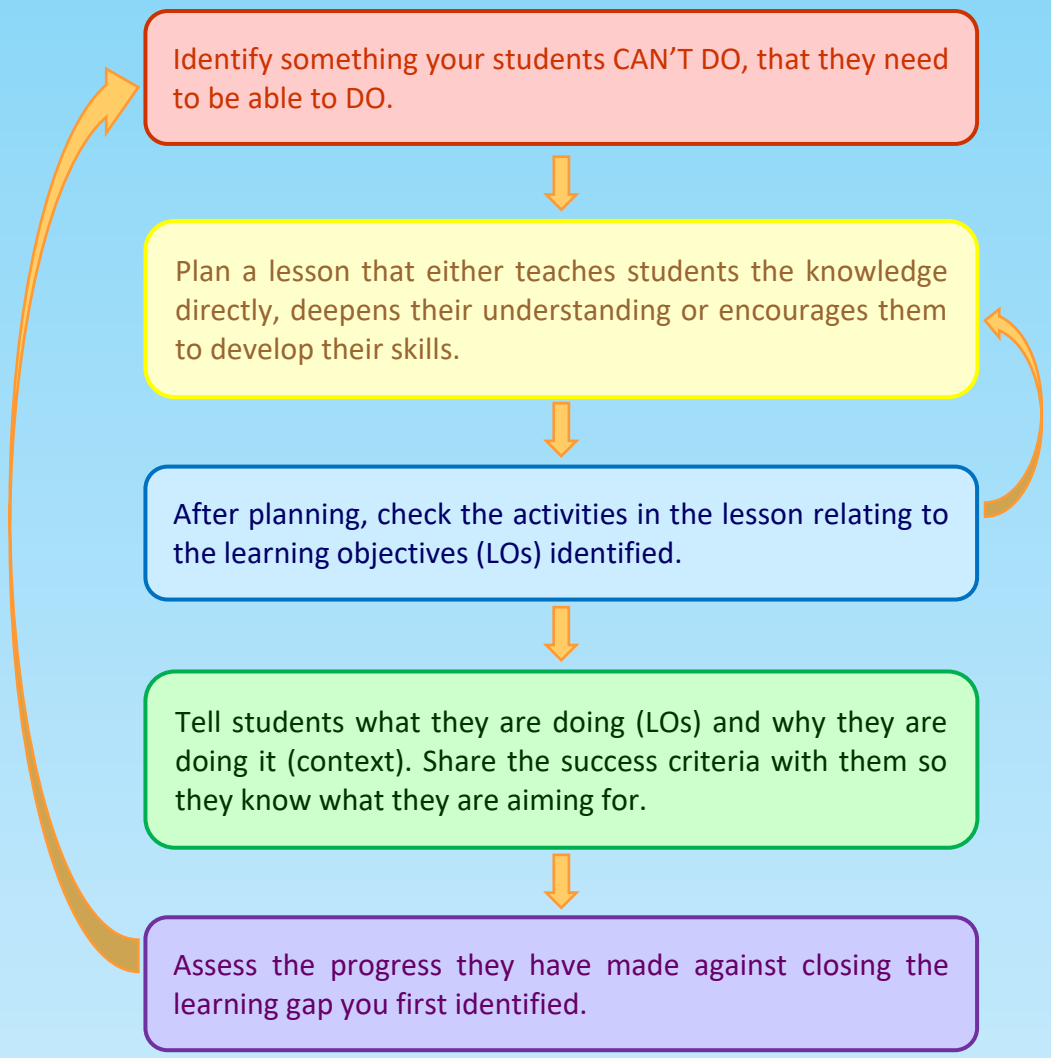
What Would I Like to Achieve through the Project?

My initiative was set out to enhance Assessment of/for/as Learning in the English Department by:

- ✧ improving lesson planning by setting clear learning objectives;
- ✧ setting up clear assessment/feedback policy on focus marking with clear learning objectives; and
- ✧ designing peer and self-assessment tasks for students.

How Did I Execute the Project?

Internal Professional Sharing and Developing a Flow Chart for Lesson Planning



Upon return to school after the overseas trip, I hosted a talk on Assessment Literacy for all the teaching staff at school to share the insights gained from the trip. Some practical learning and teaching models, for instance, Solo Taxonomy, and questioning techniques were introduced to enhance teachers' assessment literacy.

Inspired by the overseas learning experience, I have developed a lesson planning flow chart for the English Department, aiming to guide teachers to plan well-structured lessons with clear learning objectives. The assessment criteria were devised in alignment with the learning objectives which increased the validity of the assessment tasks and facilitated more accurate reflection of students' learning performance.

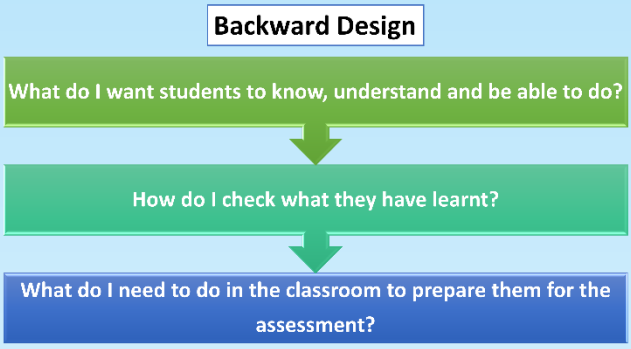
Developing a Framework for Lesson Planning

A Task Force was formed, aiming at devising strategies on English curriculum and assessment to improve learning and teaching. S2 and S4 students were chosen as the target groups for the project. During the collaborative lesson planning meetings, teachers were encouraged to plan the lessons with reference to the framework on the next page.

Teaching Phase		Purpose
1.	Learning Objectives (LOs)	Describe what students should be able to do at the end of the lesson. Learning objectives should be: ✶ **'SMART'** ✦ **S**pecific ✦ **M**easurable ✦ **A**chievable ✦ **R**ealistic ✦ **T**imely ✶ visually shown to students ✶ written with active verbs such as 'state', 'explain', 'outline', 'list' or 'describe' instead of verbs that are difficult to measure objectively like 'know', 'understand' and 'learn'
2.	Lead in	Use different means like pictures, videos and riddles to: ✶ arouse learning interest ✶ introduce the topic
3.	✶ Instruction ✶ Knowledge Check	✶ Teach students by providing input with examples when explaining rules ✶ Check students' understanding, collect data and adjust teaching strategies by using different questioning techniques ✶ Include formative assessment
4.	Guided Practice	Help students put what they have learnt into practice by including e-learning activities (pair work or group work are advocated to encourage cooperative learning)
5.	Conclusion	Restate the LOs and summarise the lesson by ✶ inviting students to reiterate a main point of the lesson ✶ using an Exit Ticket to check what students have learnt
6.	Consolidation	Assign individual work to consolidate students' knowledge

Developing a Blueprint for Summative Assessment and Analysing Assessment Data

A newly-developed blueprint was adopted for the English examination paper, which helps teachers gain a better understanding of the question types and the level of difficulty of the examination papers. A clear understanding by teachers about what to assess in examination is conducive to effective lesson planning. This concept is also in line with the 'Backward Design' approach.



A comprehensive analysis on summative assessment data was initiated, which aims to evaluate the extent to which summative assessments are linked with the curriculum. In-depth analysis was conducted on S2 G.E. Paper in the 2019/20 school year, S5 Reading, Writing (Part B), and Listening & Integrated Skills in the 2020/21 school year. By analysing students' performance, and evaluating the alignment between learning, teaching and assessment, teachers could better understand students' weaknesses and implement follow-up measures to address their problems. For instance, teachers could provide tutorial videos and reading materials about certain text types, or allow students to write a piece of short article with peer or self- evaluation to consolidate their understanding of the writing requirements.

Due to the drastic reduction in lesson time brought by the social incident and COVID-19 pandemic, I have not put emphasis on implementing a focus marking policy on writing for S1, S2 and S4 although it was proposed in the final proposal.

Developing a Self- and Peer Assessment Resource Pack

With the insights gained abroad, a Self- and Peer Assessment Resource Pack was developed to guide students to reflect on their learning and increase their sense of responsibility towards learning. The inclusion of five tasks with different levels of difficulty allows teachers to adopt peer and self- assessment tasks that cater for students' diverse learning needs.

What Are the Impacts to All?

After the project, enhancement on assessment literacy and increased awareness of the importance of assessment among teachers are observed. Assessment for Learning is strengthened as teachers could design relevant assessment tasks to gauge students' understanding and learning progress using the framework for lesson planning.

By evaluating meticulously the linkage between summative assessment and the curriculum, and the alignment between learning, teaching and assessment, teachers receive useful insights. The assessment data can truly inform our teaching as it reflects the strengths and weaknesses of our curriculum and daily teaching, and facilitate the design of formative assessment and follow-up tasks. With the Self- and Peer Assessment Resource Pack, students could follow teachers' guidelines to evaluate their own and peers' performance, which in turn enhances Assessment as Learning.

Conclusion

It is hoped that with the initiatives launched by the Task Force, my colleagues would recognise the importance of conducting a lesson with a structured framework and can set high quality assessment. Building on the foundation of the project, use of assessment data would be more extensively promoted to generate a stronger impact on learning and teaching.

Sharing at University of Southampton on how 'i-Journey' impacted me

Programme A(6) – STEM Education

Mid March – Early May 2019

Singapore

Administered by the Education Bureau, the Programme consisted of both local and overseas components. While the local part of the programme was supported by Department of Education Studies, The Hong Kong Baptist University, the overseas customised programme was conducted by the National Institute of Education, an institute of Nanyang Technological University.

The customised overseas programme aimed to enable participants to:

(a) acquire knowledge of Singaporean education system and its key features, with a focus on the latest development of STEM education in Singapore;

(b) enhance their professional capacity in the teaching of Science subjects, particularly Science and Mathematics;

(c) develop their expertise in implementing and promoting STEM education holistically and effectively at school level;

(d) become reflective practitioners through putting into practice the observations and insights gained in structured learning and school visits ; and

(e) develop teacher leadership through sharing learning outcomes in Professional Learning Communities and disseminating good practices, with a view to strengthening cross-curricular and / or cross-sector collaboration among teachers and the partnership with community stakeholders.

School-based STEM Education in CLSMSS

Ray CHAN Wai-leong
Chiu Lut Sau Memorial Secondary School

iNQUIRE

Being a keen STEM coordinator, I would like to equip myself with a wider repertoire of learning and teaching strategies in promoting STEM Education. Besides, I wished to gain a thorough understanding of the concepts and approaches of promoting STEM Education in Singapore and explore the possibility of applying them in Hong Kong.

iNSPIRE

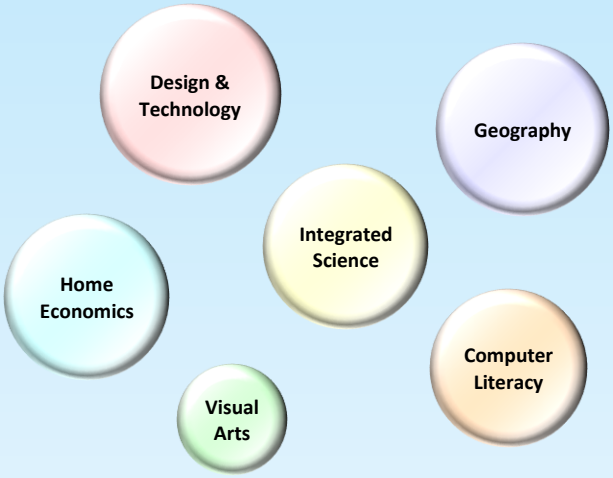
During various visits and workshops on the learning journey, I was greatly inspired by the elements of design thinking such as scaffolding and prototyping. The use of SCAMPER, a creative brainstorming technique to generate ideas for new products and services, also appealed to me.

iMPACT

Taking reference to the practice in promoting STEM Education in Singapore, I adopted the design thinking approach and SCAMPER technique in designing the school-based STEM curriculum, aiming to actualise students' ideas in real life and encourage them to make inventions for improving the quality of life.

Objectives of the Project

To realise the goal of 'putting STEM to Life', project-based learning (PBL) activities were implemented to empower students to improve people's daily lives by applying STEM knowledge. Besides, we aimed to review the current curricula and pedagogical practices in related subjects including Design & Technology (D&T), Computer Literacy (CL), Integrated Science (IS), Visual Arts (VA), Home Economics (HE) and Geography (Geog). It was planned to develop an innovative school-based STEM curriculum through integrating programming, technology and engineering into the subjects. The ultimate objective was to establish a 3-tier STEM learning framework with elementary, application and enhancement levels.



Subjects Reviewed for Developing the STEM Curriculum

Project Implementation

The project was conducted in two phases:

Phase 1 (Aug 2019 – Jul 2020)

Demonstration of STEM-related concepts and activities learnt from Singapore to enrich the related pedagogical knowledge of colleagues

Establishment of the STEM Education Committee with representatives from the subject panels involved, who would work closely to review the subject curricula and assessment policies

Selection of appropriate topics in the design of the STEM curriculum, student projects and Other Learning Experiences (OLE) activities

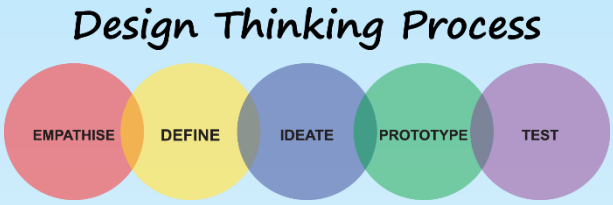
Establishment of the STEM Club to organise training workshops for students joining outside- school competitions and unleash their potentials

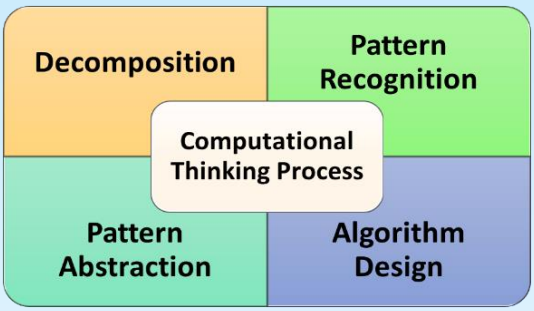
Phase 2 (Aug 2020 – May 2021)

PBL was conducted in S1-S3 with a designated theme for each level as shown below:

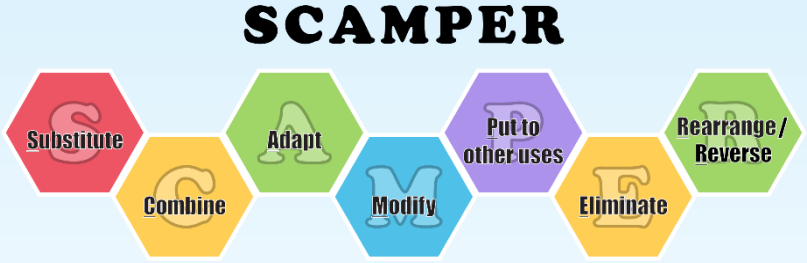
Level	Theme for PBL	Subjects Involved
S1	Smart Desk Tidy	D&T, CL, VA
S2	Smart Mini Greenhouse	D&T, CL, VA, IS, HE and Geog
S3	Smart Solar-cell Powered Floating Platform	D&T, CL, VA and IS

PBL activities were designed with meaningful contexts in which students integrated and applied knowledge and skills of relevant subjects to solve daily life problems and learn collaboratively.



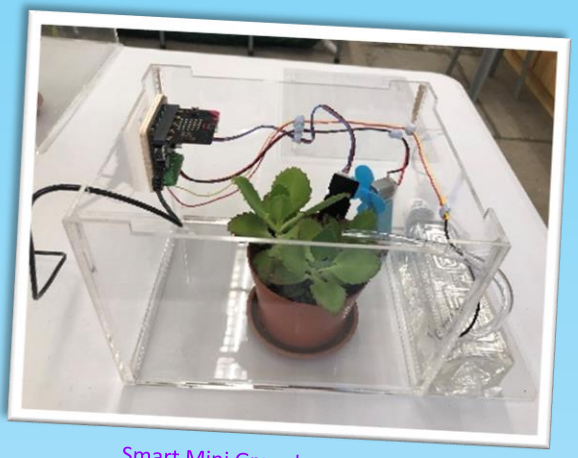


To put learning into practice, three essential concepts introduced in Singapore were adopted in the design of student projects in each level, including design thinking approach for facilitating students' design of drafts, SCAMPER technique for refining their original designs, and computational thinking process for developing their logical thinking in coding.



Evaluation and Outcomes of the Project

Evaluation tools, such as student survey and teachers' observation, were deployed to evaluate the effectiveness of the project. Two sets of student surveys (i.e. pre-lesson and post-lesson) were conducted in junior forms for comparison. Upon analysis of the data collected, the following outcomes were noted.



Smart Mini Greenhouse System
Designed by Students

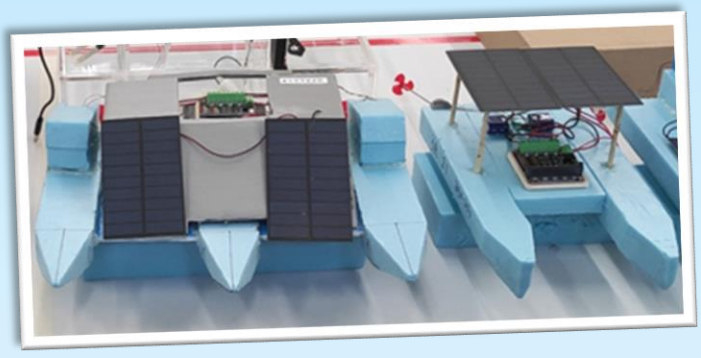
Smart Desk Tidy Project
Created by Students

Student Level

According to the pre-lesson survey, a majority of students possessed basic knowledge in STEM thanks to their prior exposure to STEM in primary school. Therefore, they demonstrated understanding on concepts like 'Problems and Scenarios', 'Design Brief', 'Design Consideration', 'Design Specification' and 'Idea Generation'. Also, they showed confidence in using technology such as hand tools and related equipment for sketching and product design.

As reflected in the post-lesson survey, the PBL approach greatly raised students' interest in Science and Technology related subjects. With a keen learning interest in STEM, around half of the students would like to pursue their studies in Science-related subjects at senior secondary levels. Most students strongly agreed that hands-on practice was crucial in the learning process and they displayed eagerness in learning STEM under design thinking and computational thinking process.

According to teachers' feedback, promoting STEM Education through conducting various class activities, PBL projects and joining external competitions helped nurture students' creativity and innovative thinking in learning.



Smart Solar-cell Powered Floating Platforms
Designed by Students

Curriculum Level

New elements such as freehand sketching, perspective and isometric drawings were integrated in the junior VA curriculum to foster students' creative thinking by encouraging them to draw and select elements for product design.

Students Learning How to Use Various Hand Tools

The D&T curriculum was reformed. Students were taught the concepts and technical skills of sketching, designing, prototyping and making models using hand tools like 3D printers and laser cutters. Meanwhile, programming knowledge, such as Scratch, Lego EV3 and Micro:bit, was taught more intensively in CL lessons to promote the use of smart technology.

To arouse students' interest in learning STEM, topics in IS and Geog curricula, e.g. global warming, greenhouse farming and living on the sea under extreme climates, were selected as contexts in which students were tasked to design products through integrative application of STEM knowledge and skills.

School Level and Education Sector

Two rounds of open class observation were conducted during the project to share good practices with other teachers. Post-lesson evaluation meeting was held to collect feedback from the teachers on the design and implementation of the lessons, thereby fostering professional exchange in STEM Education among them.

A scholar scheme was introduced to show appreciation to the more able students for their achievements in the STEM project.

Implications and Way Forward for the Project

Students Designing a Solar Rideable Car for a Competition

Student Level

S1 and S2 students were more interested in hands-on practices which allowed them to apply knowledge and skills in an integrated manner. However, it was noted that a minority of S3 students with high academic achievement were less motivated in the project as they valued traditional assessments more, which focused on drilling of exam skills. More hands-on STEM activities will be introduced to change such perception, hoping that they will understand participation in hands-on activities is conducive to the acquisition of STEM knowledge and skills.

Students Designing a Marble Run Machine for Learning & Teaching Expo 2019

Students Participating in a Competition of JA-Building a Financially Capable Generation

Curriculum and School Levels

To foster active learning through further promotion of STEM Education, STEM elements are incorporated in the junior form curriculum through cross-curricular project learning. Also, it is proposed for the subject panel of Science and Technology to collaborate with Business, Accounting and Financial Studies to further promote STEM Education with a focus on coding and AI for Business.

Promoting STEM Education through Design and Make Activities - Balloon-powered Cars

Karen HUNG Lok-kay
SKH Li Fook Hing Secondary School

Background

Since the 2017/18 school year, our school has been actively promoting STEM Education through introducing a new subject 'STEM'. Two STEM lessons are arranged for junior secondary students every two teaching cycles with a designated theme for each level.

In accordance with the school's development focus of implementing STEM Education with an interdisciplinary approach, a STEM project was developed for all S1 students to deepen their learning of STEM Education-related topics and facilitate their integration and application of relevant knowledge and skills through hands-on activities.

Objectives

By setting the theme of 'Balloon-powered Cars', the project was set out to allow students to:

Integrated Science

- understand the concepts of 'action' and 'reaction'
- identify the factors which affect the speed of a balloon-powered car
- conduct fair tests to examine the influence of different factors on the speed of a balloon-powered car

Information Technology

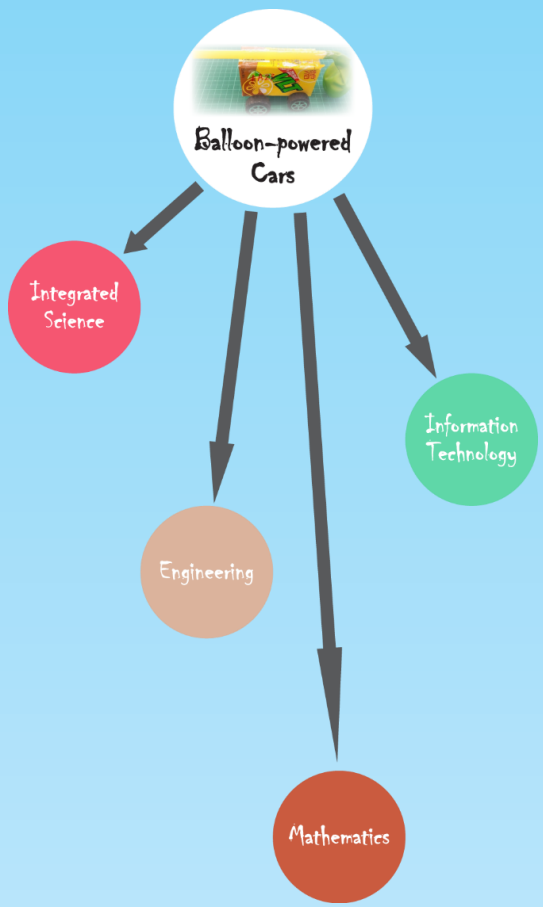
- understand the use of Arduino programmes, in particular for recording speed

Engineering

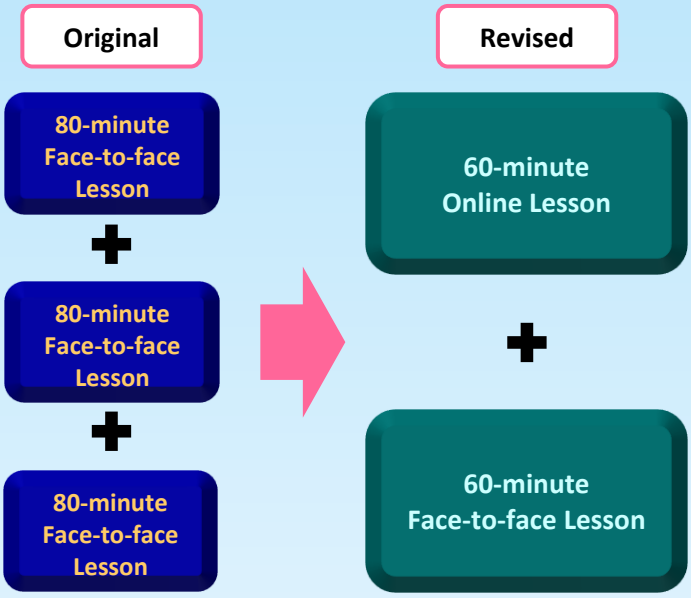
- create a balloon-powered car for a competition, taking into consideration the favourable factors for increase in car speed
- use different hand tools such as hot melt glue gun and cutters

Mathematics

- calculate the speed of a balloon-powered car and use appropriate units of measurement for speed



Subjects Involved in the Project



Project Implementation

The project was originally scheduled for February 2020. However, in light of the prolonged suspension of face-to-face classes due to COVID-19, the project was postponed to May and June 2020. Due to a reduction in lesson time, the three 80-minute lessons planned were replaced by two 60-minute lessons (i.e. one online and one face-to-face lesson after class resumption).

	Revised Lesson Arrangement
Online Lesson	❖ Watched videos of experiment and recorded the speed of different balloon-powered cars ❖ Examined the factors affecting the speed of the balloon-powered cars
Face-to-face Lesson	❖ Produced the balloon-powered cars which could run for one metre ❖ Conducted testing on car speed

First Phase – Online Learning

During the online lessons, STEM knowledge and skills required for making balloon-powered cars, such as the concepts of action and reaction and the formula for calculating speed, were introduced in authentic contexts to provide students with the basic knowledge for the learning task. Besides, students were prompted to examine the factors which may affect the speed of a balloon-powered car, including the weight of the car, the air ejection position and the diameter of the straw for ejecting the air. Teachers explained to students the meaning of fair tests and guided them to make hypothesis. Then, students watched the videos of experiments and recorded the speed of the cars in different scenarios for comparison. Finally, conclusion was drawn on how different factors affect the speed of the balloon-powered cars.

Designs of Balloon-powered Cars which Hinder their Speed

Balloon-powered Car with Load

Balloon-powered Car with a Downward Straw

Balloon-powered Car with a Narrow Straw

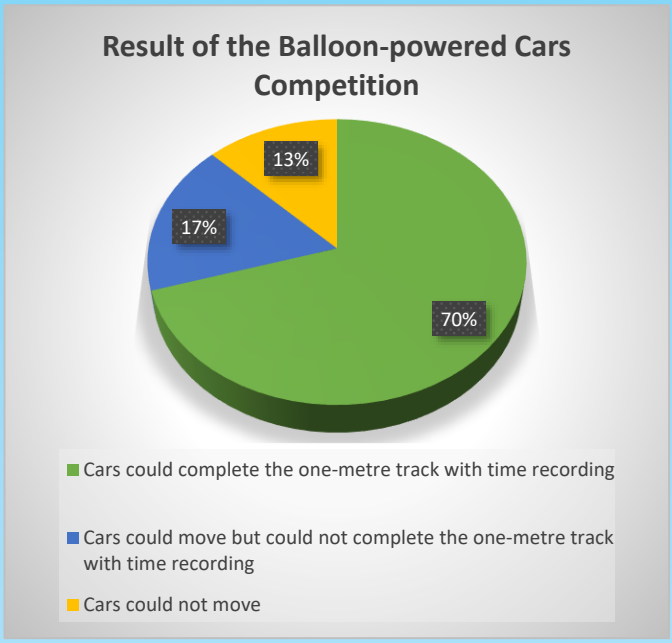
Students Designing Their Own Balloon-powered Cars

Second Phase – Face-to-face Learning

When face-to-face classes resumed, teachers helped students revisit the topics learnt in the online lesson for consolidation. Taking into account the factors affecting the speed of balloon-powered cars, which were identified through experimental observation, students designed and made their own balloon-powered cars by applying the knowledge and skills gained in the first phase with hand tools. Under teachers' guidance, students refined their products by adjusting the accessories to increase the speed of the cars.

Upon completion of their balloon-powered cars, competitions were organised for students to display their learning outcome, which further enhanced their motivation and confidence in learning STEM. As a follow-up activity to reinforce student learning, students were guided to identify the features of the high-performance cars and proposed suggestions for improvement. However, constrained by the reduced lesson time, discussion could only be held in haste and peer and self-assessments were cancelled.

High-performance Cars Produced by Students

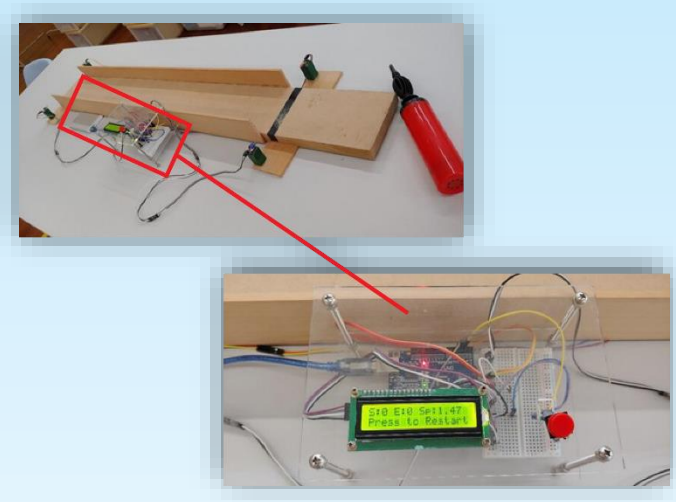


Project Outcomes

All S1 students managed to create their balloon-powered cars. About 70% of them successfully finished the competition with their balloon-powered cars running for one metre. The project fostered students' integrative use of knowledge and skills among different STEM disciplines, enhanced their scientific inquiry skills and problem-solving skills through hands-on activities. The use of hand tools also strengthened students' perceptual and visual-motor coordination abilities. Based on teachers' observation, some students demonstrated application of the scientific knowledge acquired, during which they made conscious attempts to make the cars taking into consideration the favourable factors for increase in car speed.

Concerning students' cognitive and affective engagement, some students immersed themselves in the learning activities and were motivated to explore different methods to make improvement. Students with less confidence in creating the car displayed stronger abilities to self-reflect and identify areas for improvement through taking notice of the design of other cars. Students' strenuous effort in making refinements not only fostered their scientific inquiry skills, but also enhanced their affective engagement and confidence in participating in the learning activities.

Students Conducting Testings on the Speed of the Balloon-powered Cars



The One-metre Track and Aurino Device for Recording the Speed

Although students were not provided with the opportunities to design the programme using Arduino for recording the car speed due to school suspension, they had a taste of using the Arduino programme pre-designed by the teacher to compare the speeds of different cars, which helped enhance their Mathematics knowledge regarding speed calculation.

Conclusion and Way Forward

Building on the success of the project, we plan to conduct the project in S1 next year. To further improve the project design, more time would be allocated to guide students to conduct self-evaluation through comparing the design of their cars and the high-performance cars, as well as allowing them to refine the design to achieve better performance.

Pen Holder Designed in Structured Learning Course at NIE, Singapore during i-Journey

In promoting STEM Education, Singapore puts great emphasis on strengthening students' problem-solving skills. Students are given the opportunities to engage in inquiry learning in a coherent manner, during which they conduct a series of well-connected activities, including inquiry, experiment, data collection and analysis. Taking a page from the practice in Singapore, I plan to infuse elements of inquiry into the curriculum and design hands-on and minds-on STEM learning activities to foster students' inquisitive mind and cultivate their learning interest and curiosity in STEM. With the STEM lessons, I hope to deepen students' learning and lay a solid foundation for STEM learning.

Technology for Smart Living 3.0

LAI Kai-hoi
Po Leung Kuk Yao Ling Sun College

iNQUIRE

As a STEAM coordinator in school, I had a thirst for understanding how STEM Education has been promoted in Singapore and its development in recent years.

iNSPIRE

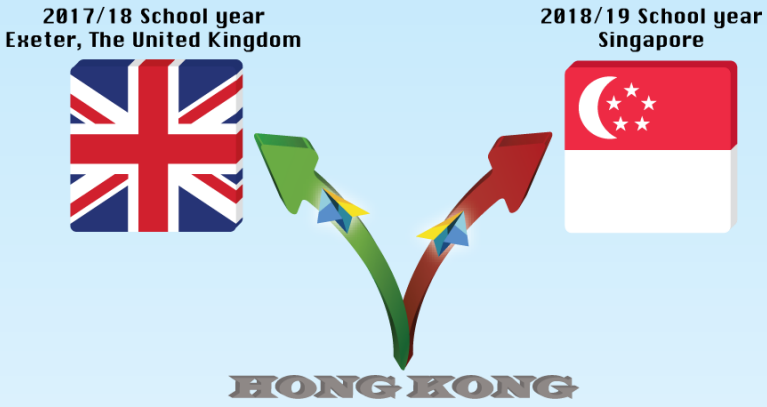
Design and Technology is a compulsory subject in junior secondary education in Singapore. I was impressed and inspired by Singaporean teachers who could find a way to transform it from a skill-based subject to a generic subject by infusing STEM elements into the curriculum. Being exposed to more technological tools, such as IR camera, 360 camera and Micro:bit, I gained insights into their application in promoting STEAM Education at school.

iMPACT

Some insightful concepts learnt in Singapore, for example, design thinking and computational thinking approach, were expressly adopted in designing the STEAM curriculum at school, which engaged students in solving problems with STEAM knowledge. Also, adoption of different technological tools such as Micro:bit and 3D printers in learning and teaching facilitated students' application of computer knowledge and programming skills.

Background and Rationales behind My Research

Our school started implementing STEAM Education in the 2017/18 school year. A colleague and I joined *'i-Journey'* Scheme and enrolled in a related overseas programme. Upon returning to Hong Kong, we applied our newly acquired knowledge and refined the school-based STEAM curriculum under the theme of 'Technology for Smart Living', with a view to enabling students to study relevant topics in a more focused way. With 'Technology for Smart Living 3.0' as the main theme, 2019/20 was the third school year we promoted STEAM Education. To ensure the continuous development of STEAM Education, it was necessary to consolidate our past experience and review the effectiveness of the learning activities. While students' understanding of STEAM knowledge and skills could be gauged using general testing tools, it was difficult to assess students' values and attitude towards STEAM learning. With this research project, I attempted to use the assessment tools acquired overseas to assess the effect of our school's STEAM activities on students' attitude towards STEAM learning.



The Two *'i-Journey'* Programmes on STEM Education My Colleague and I Joined

Implementation of STEAM Education at School

A variety of STEAM programmes and activities were held under themes such as coding, scientific inquiry and reading across the curriculum for students of all levels in our school. Highlights included the immersive VR CAVE experience class, STEAM activities during junior secondary weekly assemblies, and junior secondary biotechnology programme.

A Variety of STEAM Programmes and Activities Organised at School

S1 Students Exploring Temperature Data Logger by Using Micro:bit

Game Coding Workshop for S1 Students

STEAM Ambassadors Engaging in a STEAM Activity

Seminar for S4 Students by CLP Power Hong Kong Limited

S5 Students Participating in PolyU Jockey Club 'Operation SoInno - Design Education'

Students Experiencing the Immersive VR CAVE

Immersive VR CAVE Experience Class

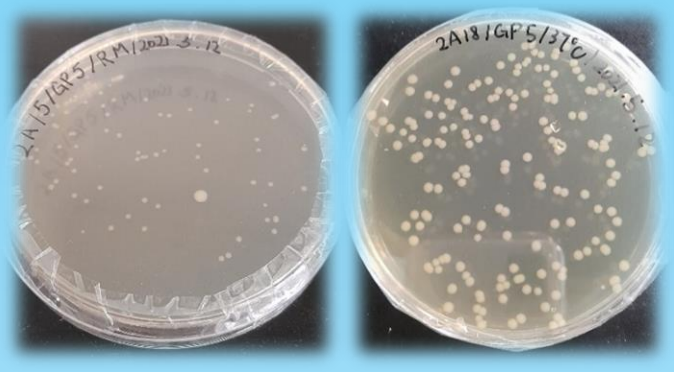
An immersive VR CAVE system has been installed for students to explore in a life-like virtual reality environment, thereby helping them understand abstract STEAM-related knowledge and skills. Moreover, senior secondary students studying computing subjects were engaged in writing code for the VR CAVE system to hone their computational thinking skills and competence in using IT.

Junior Secondary STEAM Activities during Weekly Assemblies

To develop students' creativity and strengthen their ability to integrate and apply STEAM knowledge, our STEAM team conducted an interdisciplinary STEAM programme at the junior secondary weekly assemblies. Activities for the programme included 'A Well-Kept Secret' (S2) and 'High Tower Challenge' (S3). With these hands-on and minds-on activities, students were encouraged to improve their STEAM designs through repeated trial and error, and to use multi-perspective thinking to tackle problems from different angles. Teacher feedback revealed that even students with low learning motivation participated actively in these activities.

'A Well-Kept Secret' Activity for S2 Students

'High Tower Challenge' Activity for S3 Students



Bacterial Culture Experiments in Biotechnology Programme for S1 & S2 Students

Junior Secondary Biotechnology Programme

To gain new knowledge and broaden their horizons, S1 and S2 students studied how different temperatures affect the growth of microorganisms by conducting bacterial culture experiments. Students gained a valuable learning experience since this kind of experiment is normally conducted at tertiary institutions.

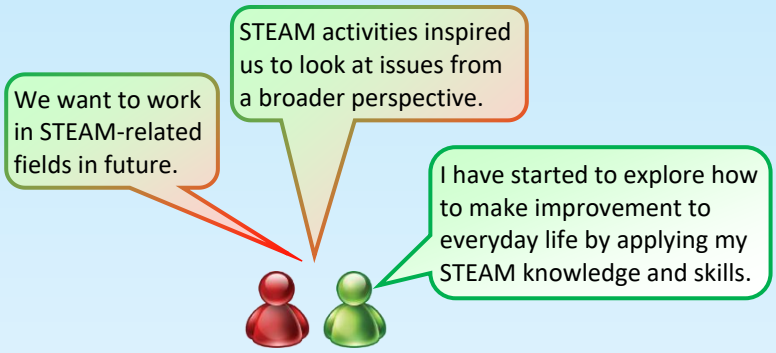
Research Methodology

To evaluate the effects of STEAM activities on students' attitude towards STEAM learning, I adopted the 'Questionnaire on Students' Attitude towards STEM', which was designed by a team at Singapore's National Institute of Education, and enriched it with relevance to the arts for research purpose. Besides, to assess the effectiveness of STEAM activities in a more comprehensive manner, all S1 students were invited to complete the pre- and post-research questionnaires in August 2019 and June 2020 respectively, while two S4 students (both were STEAM Ambassadors) shared their STEAM learning experience in a focus group interview.

Findings from the Research

Data gathered from the questionnaire surveys were sorted for further analysis by three groups, namely 'Average Aptitude Students', 'Strong Aptitude Students' and 'All Students', according to students' aptitude for STEAM learning. The findings of the pre- and post-research questionnaire surveys showed that there was no demonstrable improvement to S1 students' interest in participating in STEAM activities or their attitude towards STEAM learning. The reason for this might be the STEAM activities could not be implemented coherently with school suspended intermittently during the pandemic.

It is worth mentioning that in the surveys, the item 'Only experts understand STEAM' drew diverse responses from students. 'Average Aptitude Students' believed that non-experts like them could understand STEAM as well. I came to realise that STEAM activities could serve as a differentiated instruction strategy, and this is an area in which I will conduct further action research. As reflected by the data, students from the 'Average Aptitude Students' group also agreed that they learnt interesting things from the activities, which in turn enhanced their interest in STEAM learning. In the focus group interview, the STEAM Ambassadors remarked that STEAM activities inspired them to look at issues from a broader perspective, and indicated the likelihood of working in STEAM-related fields in future. One of them had even started to explore how she could make improvement to everyday life by applying her STEAM knowledge and skills.



Extracted Dialogue from the Focus Group Interview with STEAM Ambassadors

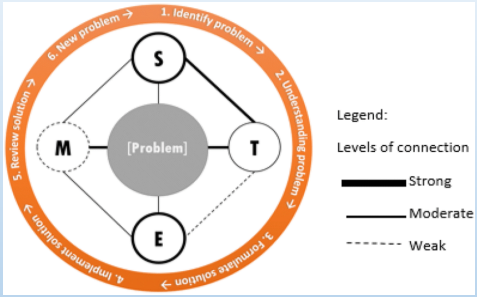
Sustainable Impact at Different Levels

Student Level

The interdisciplinary STEAM programme conducted at junior secondary weekly assemblies nurtured students' creativity and problem-solving skills. Also, students' computational thinking, communication and collaboration skills were enhanced through various types of STEAM activities, such as game coding workshops and shadow art creation, etc.

School Level

Upon completing the overseas programme of 'i-Journey' Scheme, the two teachers were able to apply what they have learnt to promote STEAM Education in the school. Looking ahead, our school will build a STEAM Lab, continue to develop school-based interdisciplinary STEAM programmes, and further encourage cross-curricular collaboration, with a view to providing students with more room for creativity and grooming talents for the society. Separately, our newly installed immersive VR CAVE system has attracted the visits of many teachers from other schools, which is a boon for promoting professional exchange on STEAM Education.



S-T-E-M Quartet Instructional Framework

Personal Level

By applying what I learnt from 'i-Journey' Scheme, I reviewed the planning and design of the STEAM curriculum. For example, I used the S-T-E-M Quartet (Tan, Teo, Choy & Ong, 2019) to review the connections between different STEAM subjects and designed related learning activities accordingly. Although the effectiveness of the curriculum remains to be seen, I realise from the process that teachers' participation and support are essential to effective curriculum reform. Two beliefs have empowered me to persevere. Firstly, I consider myself a 'servant leader'. I am happy to listen and serve, and I hope to grow with my colleagues professionally and build a learning community together. Secondly, I believe what we do will bring lifelong benefits to students.

References

Tan, A. L., Teo, T. W., Choy, B. H., & Ong, Y. S. (2019). The STEM Quartet. Innovation and Education. 1(1), pp. 1-14.

The Effects of Implementing Transdisciplinary and Thematic Approach in STEM Curriculum on Students' Perception in Learning

Kevin LAW Lok-kan
Delia Memorial School (Glee Path)

iNQUIRE

I would like to learn about how STEM is implemented in Singapore, the conceptual frameworks to integrate different STEM disciplines, and how to evaluate STEM literacy among students. I hoped my overseas experience could provide me with insights into the design of a blueprint for the STEM curriculum.

iNSPIRE

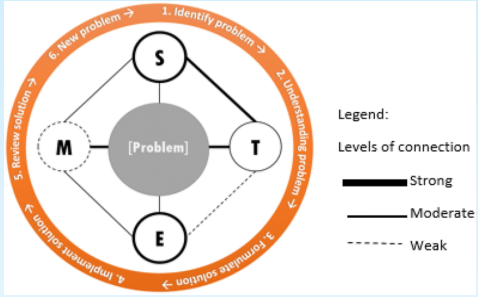
My trip to Singapore enabled me to learn about the latest trends in STEM curriculum design, pedagogies, and innovative technologies. In-depth discussions with the educators of local schools and professors at National Institute of Education (NIE) have also enabled me to gain insights into implementing STEM in a transdisciplinary and thematic approach. Furthermore, I have learnt how to evaluate STEM literacy of students in terms of their subject knowledge, metacognition and attitudes.

iMPACT

The trip has given me inspirations on how to design a school-based STEM curriculum for junior forms with a transdisciplinary and thematic approach. I was greatly inspired by the S-T-E-M Quartet shared in NIE, which was adopted as the conceptual framework for connecting knowledge across different STEM disciplines. Better evaluation of students' STEM literacy was also conducted through the integrated STEM exam and assessment of students' learning portfolio.

Implementing the STEM Curriculum Using a Transdisciplinary and Thematic Approach

During the overseas trip, I was greatly inspired by the S-T-E-M Quartet suggested by Tan, Teo, Choy, & Ong (2019) as it serves as a useful reference for teachers to plan for problem-based learning in STEM curriculum. With the knowledge gained in the S-T-E-M Quartet, the school-based STEM curriculum was developed using a transdisciplinary approach, with an aim to develop students' problem-solving skills through integrative application of knowledge and skills.



S-T-E-M Quartet Instructional Framework

Objective of the Research

The objective of the research is to examine the effects of implementing a transdisciplinary and thematic approach in STEM curriculum at junior secondary levels.

Research Question

What are the effects of implementing a transdisciplinary and thematic approach in STEM curriculum on students' perception in learning STEM?

Research Design and Approaches Adopted

Transdisciplinary Approach

The STEM curriculum targeted three classes of S3 students and was designed as a one-year programme with a 55-min STEM session per week. The programme was divided into four modules on Science, Technology, Engineering and Mathematics. In each module (which lasted for an academic term), students solved authentic problems with design thinking approach. Consisting of five steps (namely empathise, define, ideate, prototype and test), the structured process of design thinking provided a platform for fostering transdisciplinary learning.

Greenhouse Prototypes Designed by Students

Students Creating the Prototype of a Stationery Box

Thematic Approach

Design-and-make learning activities on the two themes, 'Greenhouse' and 'Stationery Box', were conducted to develop students' creativity and problem-solving skills. For the theme 'Greenhouse', students were provided with opportunities to design and make a prototype of a greenhouse for growing vegetables in school. As for the theme on 'Stationery Box', students were tasked with designing a stationery box that can notify the owner when someone leaves a memo message.

Research Instruments and Findings

To collect data about the effects on students' perception in learning STEM, pre- and post-research questionnaires were used before the commencement and upon the completion of the project respectively. The questions were categorised into five aspects below for analysis.

- ***Participation in STEM***
  - Students' motivation to participate in STEM activities
- ***Attitude towards STEM***
  - Students' willingness to accept challenges in STEM
- ***Self-concept in STEM***
  - Students' confidence in completing STEM-related tasks and activities
- ***Construction of 'STEM identity'***
  - Students' sense of identity of possessing STEM knowledge and skills
- ***Career decision***
  - Students' preference to pursue STEM-related careers

Group Statistics

	Time	N	Mean	Std. Deviation	Std. Error Mean
Participation	First	78	3.4282	.61852	.07003
	Second	119	3.3395	.50627	.04641
Attitude	First	78	3.4308	.63005	.07134
	Second	119	3.5134	.61794	.05665
SelfConcept	First	78	3.2718	.63469	.07186
	Second	119	3.2025	.58909	.05400
Identity	First	78	3.1103	.45172	.05115
	Second	119	3.1403	.50039	.04587
Career	First	78	3.0936	.63560	.07197
	Second	119	3.1050	.62908	.05767

- **'First':** the pre-research questionnaire
- **'Second':** the post-research questionnaire
- **'N':** the number of respondents to the questionnaires

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Participation	Equal variances assumed	5.978	.015	1.100	195	.272	.08871	.08061	-.07027	.24769
	Equal variances not assumed			1.056	141.651	.293	.08871	.08402	-.07738	.25480
Attitude	Equal variances assumed	.018	.894	-.911	195	.363	-.08268	.09072	-.26160	.09625
	Equal variances not assumed			-.908	162.543	.365	-.08268	.09109	-.26256	.09720
Self Concept	Equal variances assumed	1.455	.229	.783	195	.435	.06927	.08850	-.10527	.24382
	Equal variances not assumed			.771	156.043	.442	.06927	.08989	-.10829	.24684
STEM Identity	Equal variances assumed	.255	.614	-.429	195	.669	-.03008	.07018	-.16850	.10834
	Equal variances not assumed			-.438	176.268	.662	-.03008	.06870	-.16567	.10551
Career	Equal variances assumed	.002	.962	-.124	195	.901	-.01145	.09202	-.19294	.17004
	Equal variances not assumed			-.124	163.610	.901	-.01145	.09222	-.19355	.17065

A T-test was performed to compare and analyse the data. Comparing the data collected in the pre- and post-research questionnaires, although there was a slight increase in the aspects of 'Attitude', 'Identity' and 'Career', the difference was not significant for drawing a conclusion on the effects of the project. Therefore, longer time is needed to observe the effect of the transdisciplinary and thematic approach in STEM curriculum on students' perception in learning STEM.

Positive Impacts Brought about by the Research

When implementing the project, I adopted a transdisciplinary and thematic approach in designing the STEM curriculum, offering students opportunities to integrate and apply the knowledge gained from different subjects.

With reference to the STEM Lab that we visited in the secondary schools in Singapore, a STEM room was designed, where students could post their learning outcomes on the wall and encourage their peers to provide feedback for improvement. The installation of the partitions in the room also allowed greater flexibilities in classroom settings for conducting learning activities.

From teachers' perspective…

Their understanding of how to apply the design thinking approach in teaching problem-solving skills has been enhanced. Such approach has been adopted in designing one of the school-based subjects, 'Research and Enquiry', to teach students how to conduct interviews and design questionnaires to collect users' views. The project has also inspired us to organise a school-based competition on designing a multi-purpose teacher desk in the following academic year.

From students' perspective…

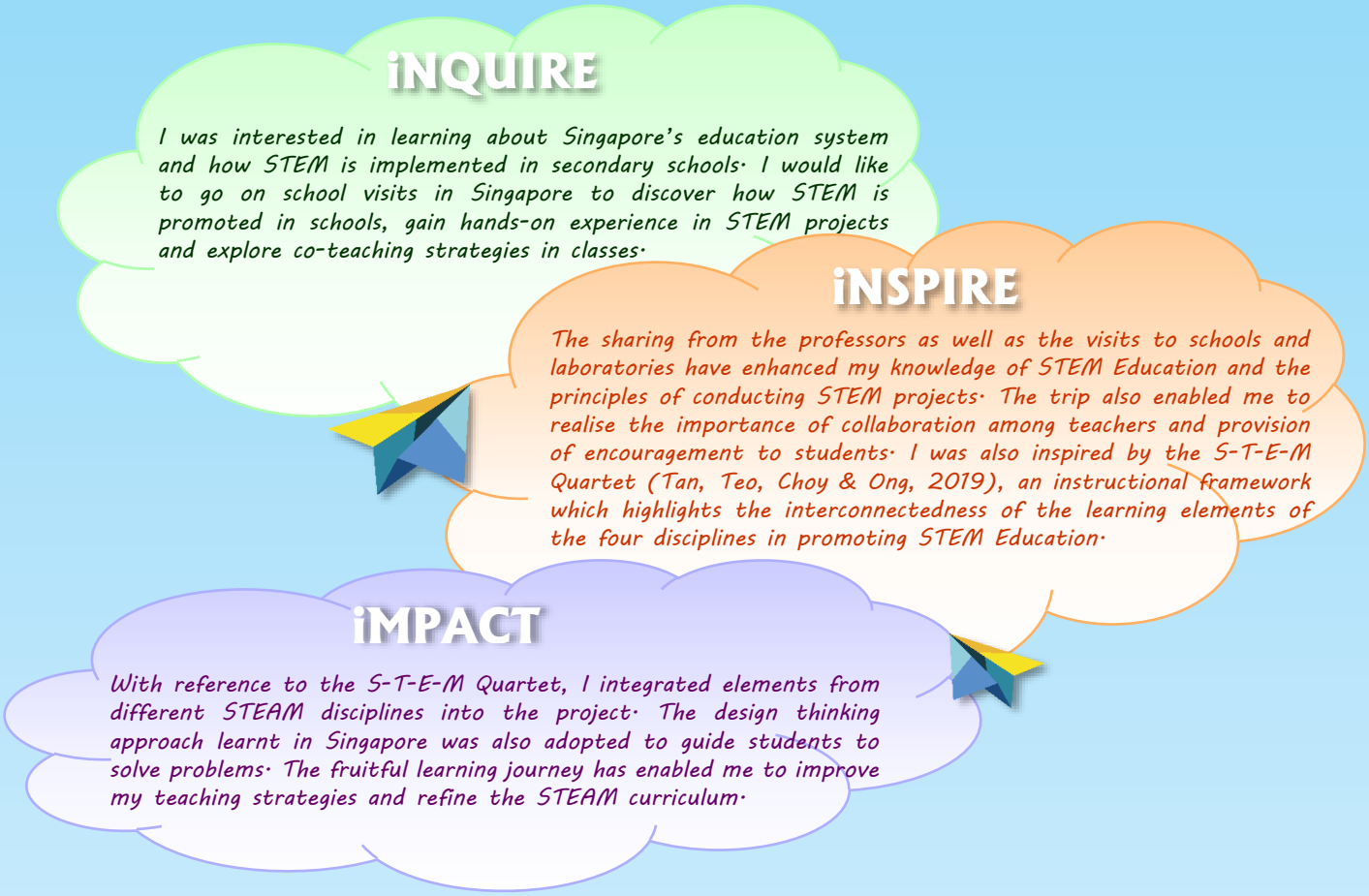
They engaged in problem-based learning to create solutions and prototypes through hands-on activities with their peers. With the design thinking approach, students were taught to understand the needs of the product users and plan meticulously during the design process to create products for satisfying users' needs. Besides, students' STEM literacy can be assessed more accurately. Students' learning portfolios were collected by teachers for gauging their learning progress. An integrated STEM exam was also conducted to assess students' integrative application of STEM knowledge. The project implementation also facilitated the setting up of the STEM Team with talented students who are nominated to participate in different competitions to stretch their potential.

References

Tan, A. L., Teo, T. W., Choy, B. H., & Ong, Y. S. (2019). The STEM Quartet. Innovation and Education. 1(1), pp. 1-14.

Using e-Tools to Facilitate the Project-based Learning of Physics

Calvin LEE Ka-fai
Tsuen Wan Public Ho Chuen Yiu Memorial College



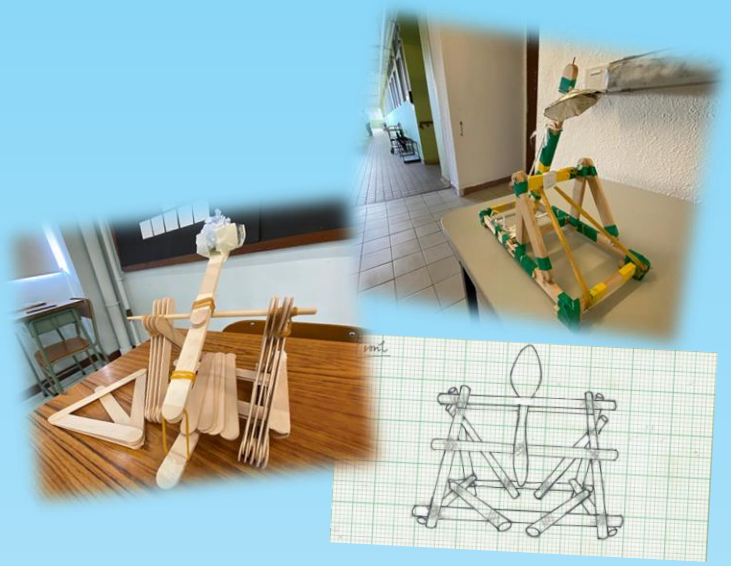
Why Would I Implement the Project?

I serve in a traditional EMI school where lessons are conducted in a teacher-centred manner and students have little chance to conduct scientific investigation. For the betterment of student learning, I would like to explore new ways of teaching Physics and Mathematics to foster students' scientific inquiry skills. I also intended to introduce the use of interactive devices such as smartboards and tablets to help students understand abstract concepts and get an immediate understanding of their learning progress. Moreover, I would like to foster collaboration among teachers of different subjects to promote professional sharing and enhance their capabilities in teaching interdisciplinary topics.

What Would I Like to Achieve Through the Project?

1. To increase students' learning interest towards STEAM-related subjects
2. To enable students to make connections between STEAM subjects
3. To enable students to integrate and apply cross-subject knowledge and skills
4. To enable teachers to collaborate and exchange teaching methods and subject knowledge

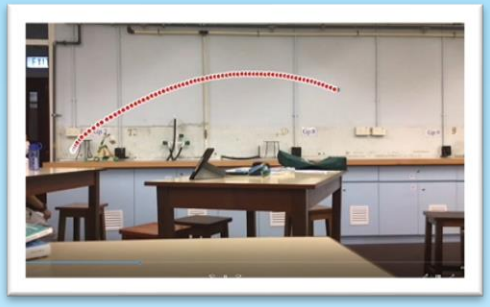
How Was the Project Implemented?



Models of Artilleries Designed by Students

A STEAM project was designed for S4 students studying Physics in which they were asked to find out the numerical value of gravitational acceleration with different e-learning tools. Prior knowledge and skills required of the project were taught in Physics, Mathematics and Visual Arts lessons, including sketching graphs, designing 3D figures and applying the equations of motion. To promote the use of e-learning tools in solving the assigned problems, apps such as 'Desmos' for graph sketching and 'Video Physics' for motion analysis were introduced.

Students worked in groups to design experiments, build models, perform experiments and collect data. Data was then analysed to work out the gravitational acceleration and field strength. To develop students' presentation skills, they were required to explain the investigation process and methods in detail during the final presentation session.



Use of 'Stop Motion' App for Viewing the Slow Motion of Travelling Objects

STEAM Videos Shown to Students During Recess

To boost students' learning interest in STEAM, some STEAM video clips were shown to them during recess on Mondays or Fridays in the covered playground. Game sheets were designed as the assessment tasks for teachers to gauge students' understanding. Prizes were given to students as positive reinforcement.

Ten S4 and S5 students studying Physics were selected to set up a STEAM game booth for the school open day, with an aim of strengthening their design thinking skills in the product design process. Aside from the hands-on practice, students were provided with the opportunities to introduce their prototypes and other STEAM experiments such as the Gaussian rifle and the Da Vinci bridge to primary students, thereby enhancing their presentation skills and confidence in learning.

What Were the Challenges Faced During Project Implementation?

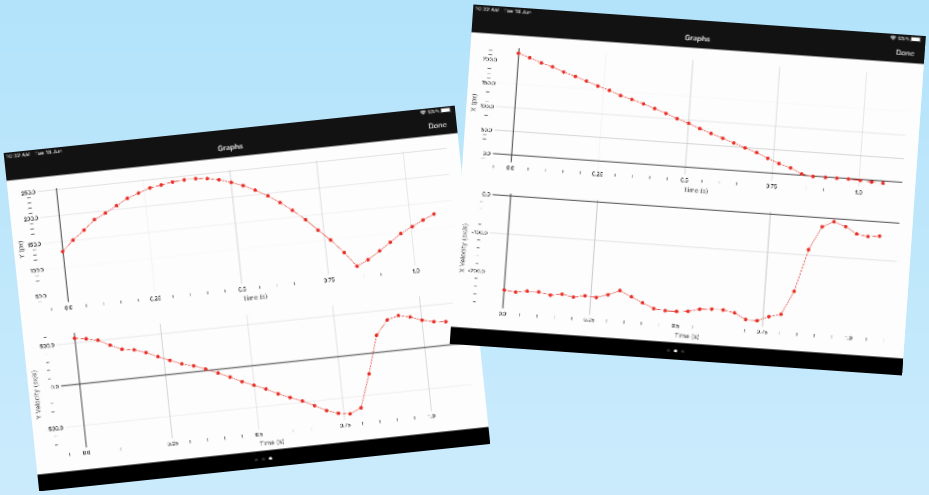
It was difficult to achieve consensus during project planning as teachers involved were from different disciplines and had different mindsets. However, we managed to decide on the details of the project after numerous meetings. Taking into consideration students' abilities in using different apps, effort was made to select the most suitable apps for them. Concerning the project schedule, the project was heavily delayed due to COVID-19 pandemic. Nonetheless, with detailed planning and close collaboration among teachers, the project was conducted smoothly and satisfactorily.

Project Variation

During the 2020/21 school year, the STEAM project was rerun with some adjustments to enhance student learning. Firstly, the introduction of a new app allowed students to observe the motions of the object travelling in air through producing slow motion videos. Secondly, to stretch students' potential in conducting scientific investigation, they were not allowed to use the equations of motions from the textbook while finding out the gravitational acceleration but designed a brand-new experiment to solve the problem.

What Were the Outcomes of the Project?

By the end of the project, student questionnaire was used to collect data for evaluating the effectiveness of the project. Teachers' observation and summative assessment were also deployed as evaluation tools.



Data on Gravitational Acceleration Collected by Students Using Apps

Student Level

Questionnaire results showed that students were more interested in STEAM after the project. They were more capable in applying design thinking skills to create prototypes and models, and designing experiments for scientific investigation. Not only did the hands-on practice facilitate students' acquisition of problem-solving skills, but it also enabled students to have a firm mastery of the theories and concepts. Besides, the use of e-learning tools and apps facilitated inquiry learning, which helped develop their spirit of inquiry and ability to cope with challenges in their daily lives. Improvement in test results in Physics was also noticed among students. Besides, the experience of setting up a game booth aroused students' learning interests in STEAM. They acquired practical skills when designing and making the final product, and displayed eagerness in learning the techniques of creating different models for problem-solving.

Subject Level

The panel heads of Physics, Visual Arts and Mathematics departments played active roles in discussing the suitable elements to be incorporated in the project in planning process, fostering their collaboration and synergy. Building on the existing foundation, our school has decided to continue to implement interdisciplinary STEAM projects in the coming years.

Conclusion

It was rewarding to witness students making improvements and constructing their final products. The project has succeeded in raising students' learning interest in STEAM and improving their learning performance. It has also enhanced their problem-solving and design thinking skills in creating prototypes and models. Inter-departmental collaboration was also fostered.

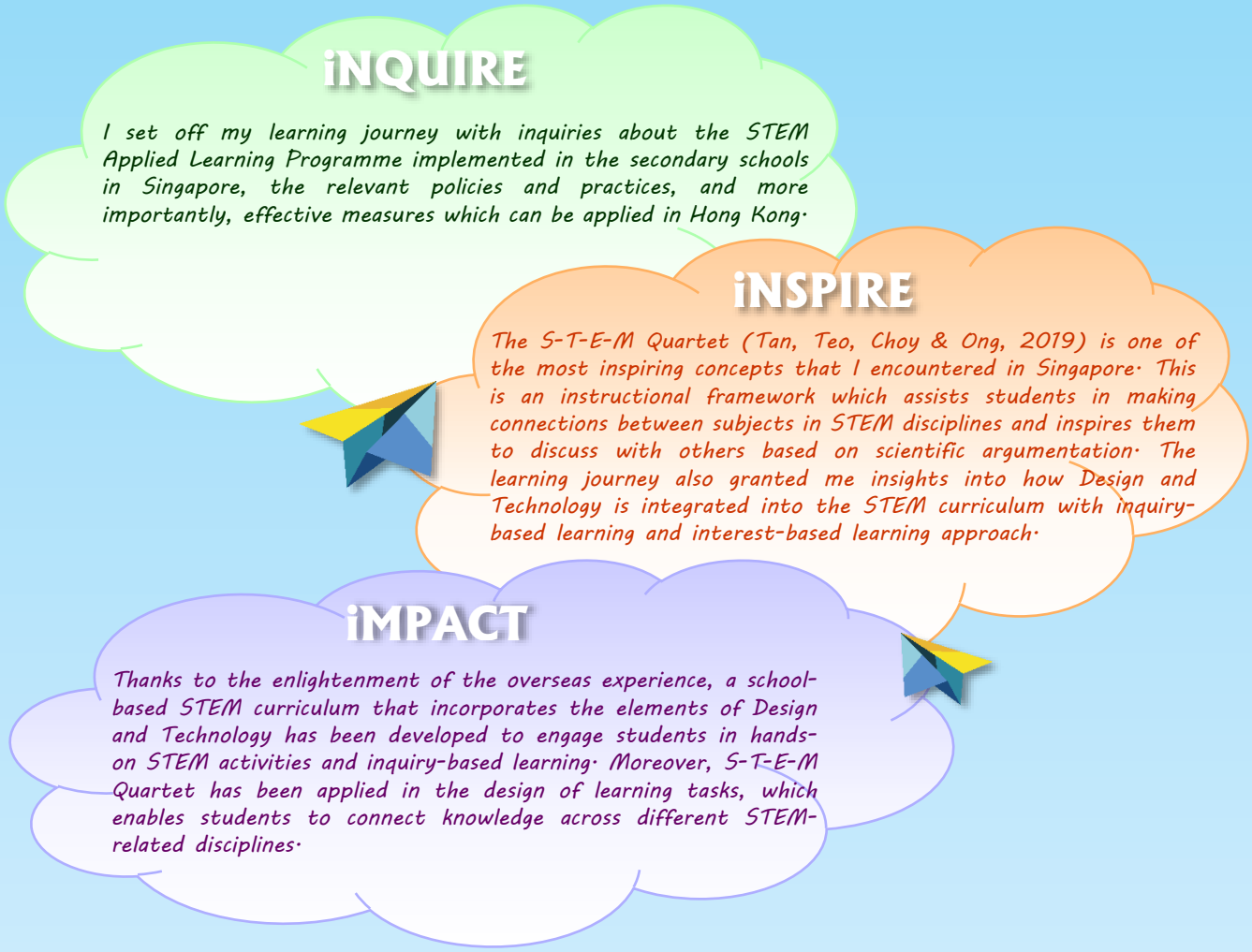
A Stationery Box Designed During Structure Learning Course at NIE, Singapore

References

Tan, A. L., Teo, T. W., Choy, B. H., & Ong, Y. S. (2019). The STEM Quartet. Innovation and Education. 1(1), pp. 1-14.

Innovation and Technology Exploration Programme

Alex TONG Wai-yin
Nam Wah Catholic Secondary School



What Do We Want to Achieve through Innovation and Technology Exploration Programme?

In view of the importance of equipping students for the 21st Century, our school has planned to design a school-based STEM curriculum 'Innovation and Technology Exploration Programme' to:

a) strengthen students' abilities to integrate and apply knowledge and skills in STEM-related subjects;
b) nurture students' creativity, collaboration and problem-solving skills;
c) enhance teachers' professional capacity in teaching Science, Technology and Mathematics;
d) establish an in-house learning community and promote a culture of sharing and exchange among teachers; and
e) cater for students with different learning needs and abilities in STEM.

How Was STEM Education Promoted at School?

Teachers' Professional Development in STEM Education

Collaborative lesson planning meetings were arranged to engage teachers in professional dialogue and enhance their professional capacity in teaching STEM. Besides, training workshops were conducted for teachers of STEM subjects to develop an in-house learning community and promote a culture of sharing and exchange. The themes of the workshops included design and assessment of STEM learning activities, coding and 3D printing.

Teachers' Professional Development Workshop on STEM Education

STEM Curriculum and Learning Activities

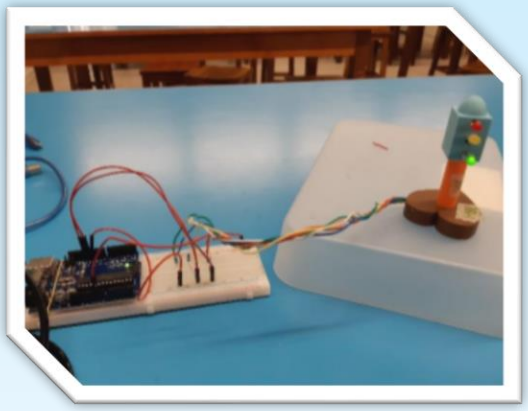
With inspiration from the tiered STEM curriculum in Manjusri Secondary School, our school-based STEM curriculum was designed in three tiers to address students' diverse abilities:

Tier 1 (S1 - S3: STEM Learning Activities)

Various STEM learning activities were designed for all S1 to S3 students, aiming to stimulate their learning interest in STEM and strengthen their abilities to integrate and apply knowledge and skills in Science, Technology and Mathematics. These learning activities included designing a water purifier in S1, estimating the height of school hall in S2 and designing a hook using digital design and 3D printing in S3.

A Digital Hook
Designed by Students

Students Designing a Water Purifier



Students' Final Product of the Intelligent Traffic Light

Tier 2 (S2: STEM Project-based Learning)

With a view to nurturing students' creativity, collaboration and problem-solving skills, a STEM project was conducted for all S2 students, with a focus on alleviating traffic congestion through designing intelligent traffic lights. Through adopting inquiry-based learning approach in project learning, students were provided with ample opportunities to explore and construct knowledge and develop skills in investigating solutions for problems.

Tier 3 (S3 - S4: STEM Advanced Exploration Programme)
This programme offered opportunities for selected students in S3 and S4 to identify problems in daily life and design products to tackle them. With a variety of learning activities, for example, group discussion, workshops and building prototypes, students were encouraged to think from multiple perspectives and develop problem-solving and higher-order thinking skills. Some students were nominated to take part in STEM competitions outside school to stretch their potential.

Students Learning at STEM Advanced Exploration Programme

What Were the Challenges Faced in Project Implementation?

Suspension of Face-to-Face Lessons and Resumption of Half-Day Classes
During the past two years, some hands-on activities and workshops in STEM were postponed or cancelled due to suspension of face-to-face lessons. Even with the menace of the pandemic subsiding, the school could only provide half-day face-to-face classes. To catch up on the teaching progress, some planned learning activities could not be implemented as scheduled.

What Impacts Has the Project Brought?

Evaluation tools included teachers' observation, performance of students' works and interviews with teachers and students. According to these data, research outcomes were noticed on various aspects.

Student Level

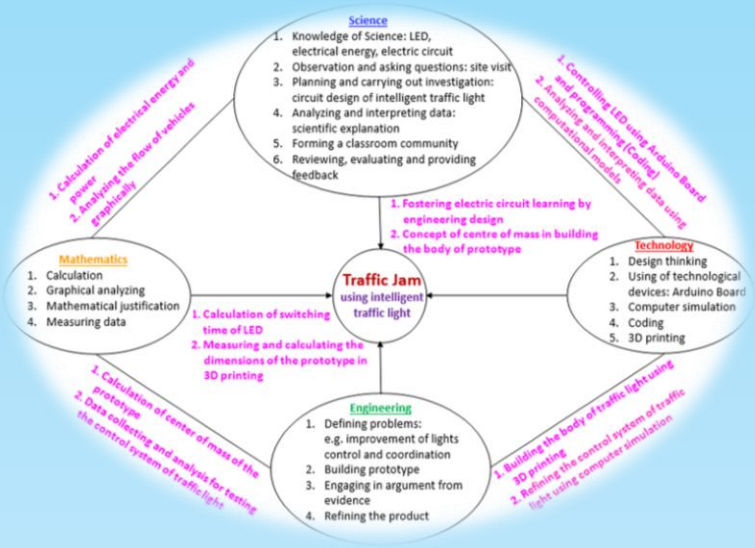
Students demonstrated abilities to integrate and apply knowledge and skills acquired in different STEM subjects. They were impressed by the meaningful learning experience and became more motivated to discuss with others and understood the importance of designing prototype. Regarding Tier 1 STEM curriculum, students were capable of designing the products and making refinement to the models to enhance the efficiency. In some activities, students successfully stretched their abilities by challenging themselves with the extended tasks (e.g. investigating another method to measure the height of the school hall). Concerning Tier 2 and 3 curricula, students demonstrated creativity, collaboration and problem-solving skills when designing the products.

Curriculum Level

The three-tiered structure was developed for the school-based STEM curriculum to cater for students' different learning needs and abilities. The focuses of Tier 1, Tier 2 and Tier 3 curricula are on (1) stimulating students' learning interest in STEM, (2) developing their abilities to propose solutions and (3) deepening learning of the more able students respectively. Relevant teaching content has been developed, involving different disciplines including Science, Technology and Mathematics. Furthermore, integration of Design and Technology elements in the STEM curriculum (e.g. 3D graphing, Sketch to Think) and use of demonstrations have enriched the STEM curriculum and heightened students' interest in scientific investigation.

School Level

The readiness of teachers is a crucial factor in implementing STEM Education in our school. The in-house learning community in the form of workshops and collaborative lesson planning contributes to the enhancement of teachers' expertise in promoting STEM Education, which in turn helps equip them with relevant knowledge and skills to teach STEM subjects.



The S-T-E-M Quartet Adapted and Used
in Planning the STEM Activities in Our School

Conclusion

'i-Journey' programme has given me great inspiration in designing the school-based STEM curriculum. The invaluable experience of the overseas trip and the inspiring S-T-E-M Quartet have sharpened my skills in designing curriculum with different tiers and guiding students to connect knowledge in different subjects. Looking forward, we shall keep abreast of the latest development of STEM Education. Making reference to that, our STEM Management Committee will review the STEM curriculum regularly and make timely revision when necessary.

References

Tan, A. L., Teo, T. W., Choy, B. H., & Ong, Y. S. (2019). The STEM Quartet. Innovation and Education. 1(1), pp. 1-14.