Dedicated Funding Programme for Publicly-funded Schools

Project Number:	2020/0831 (Revised)
Name of School:	寶血會上智英文書院 Holy Trinity College
Project Title:	透過專題研習推動校本初中創科學習 School-based STEAM education for junior secondary students through project learning
Beneficiaries:	Secondary
Estimated Number of Direct Beneficiaries:	Student:500 (F.1-F.3) Teacher:12

1. Project Needs

1.1 Project aim(s)

The project aims at developing school-based junior secondary STEAM education, arousing students' interest in innovative technology and enhancing their problem-solving skills. Through STEAM-related subject knowledge together with innovative technology, our school-based STEAM education can help students enhance their understanding of new technology and hence the use of it for problem-solving.

1.2 School-based innovative element(s)

The school has been organizing STEAM interest classes and pull-out gifted programs on STEAM since 2016 to nurture the students who are interested/have good performance in STEAM learning activities. The school plans to further promote STEAM education through incorporating STEAM education into daily learning and teaching.

The school is going to rearrange the curriculum of junior form Mathematics, IS, ICT, Art and Technology & Living to provide students with relevant knowledge and skills.

The school is going to change the existing language laboratory to form a "Maker Room". It aims at providing venues and equipment which enable students to practice what they have learned and enrich their learning experiences.

1.3 Meeting with school-based/students' needs

Item: Relevance to the school development plan of this cycle/major concern

One of the key items of the school's three-year development plan (2018-2021) is to promote STEAM education. Different panels in our school have reviewed their curriculum and collaborated to develop integrated STEAM learning experiences for students. Students are expected to acquire and develop indispensable skills of the 21st century through STEAM education.

2. Project Feasibility

2.1 Key concept (s)/rationale(s) of the project

Item: Reference the Education Bureau curriculum documents/guidelines

The rationale of this project comes from the suggestions stated in the "Report on Promotion of STEM Education Unleashing Potential in Innovation" (December 2016) released by the Education Bureau. The main points include: - Renewing the curricula of the Science, Technology and Mathematics

2 7 -

Education Key Learning Areas (KLAs) - Enriching learning activities for students - Enhancing professional development for schools and teachers

We will review and modify the school--based junior secondary Mathematics, ICT, Science, Art and Technology & Living curricula such that students can have fundamental knowledge for the learning activities. Learning activities will be designed in different subjects with the view that students can integrate knowledge from multiple disciplines. Activities such as 3D printing, Mathematical Modeling, electronic circuit, force, coding in physical computing and Artificial Intelligence, will be organized for different grades of junior secondary level to enrich student learning experiences. The junior form students will be encouraged to apply the knowledge and skills they have learnt to solve some real-life problems.
Our school also plans to organize some training activities for teachers to enhance their professional capacity in designing and implementing STEAM learning activities, hence enhancing the learning and teaching effectiveness.

2.2 School's readiness

Item: Relevant school experience

Teachers are enthusiastic in promoting STEAM. Panels have introduced STEAM learning activities in their year plan and have laid solid experience in teaching STEAM topics in past three years.

The school provides ICT and T&L curricula. In addition to teaching traditional course content, our school has added STEAM topics recent years, such as 3D printing, coding and physical computing.

The school provides ICT and T&L curricula. In addition to teaching traditional course content, our school has added STEAM topics recent years, such as 3D printing, coding and physical computing. 3. Junior form students are also guided to do STEAM projects to solve daily life problems such as designing useful food utensil with 3D design software, design functional item and smart home with Micro:bit.

This plan will renovate the existing language laboratory into “Maker Room” which can provide a well-equipped, spacious, and customized venue for different STEAM activities.

2.3 Principal and teachers' involvement

School Staff: Principal **Duties:** Formulate plans, Monitor and supervise
School Staff: Vice principal **Duties:** Formulate plans, Monitor and supervise, Coordinate / collaborate, Plan curriculum / activities
School Staff: Curriculum leader **Duties:** Coordinate / collaborate, Plan curriculum / activities
School Staff: Subject panel head **Duties:** Plan curriculum / activities, Conduct / participate in activities, Consolidate learning and teaching materials
School Staff: Project leader **Duties:** Formulate plans, Monitor and supervise, Coordinate / collaborate, Process funding
School Staff: Subject teachers **Duties:** Conduct / participate in activities, Consolidate learning and teaching materials

2.4 Project period

Project Start Date and End Date: from 04/2023 to 10/2024
The project lasts for 1 year(s) and 7 month(s).

2.5 Details of project activities

a. Project implementation measures

Activity 1: Project learning 1: 3D modelling of repetitive pattern

Implementation Period:

09/2023 - 12/2023

Key learning stages and key learning areas/subjects/learning elements	Content	Number of sessions
• Maths	• To introduce the 3D modelling to F.1 students through making of 3D models by writing codes • Theory behind 3D modelling • 1. Introduce the concepts of 3 types of transformation: • a. translation • b. reflection • c. rotation • 2. Illustrate and study the images of points or shapes on a rectangular coordinate plane after different types of transformation, including: • a. Translation to the left/right, upwards/downwards. • b. Reflection about the axes, or lines parallel to the axes. • c. Clockwise/anti-clockwise rotation about the origin through multiples of 90.	• 3 sessions (35 minutes for each session)

Number of school personnel and/or appointed project staff involved and respective duties:

- 3-5 F.1 Maths teachers

Expected outcomes:

- 1. F.1 students can translate / reflect / rotate the given points or shapes with given requirements.

Activity 2: Project learning 1: 3D modelling of repetitive pattern

Implementation Period:

09/2023 - 12/2023

Key learning stages and key learning areas/subjects/learning elements	Content	Number of sessions

• ICT	• Coding for 3D modelling • 1. Basic design skills of 3D modelling • Learning moves; camera controls; creating holes; scale, text, use of work plane; knowing x, y, z axis; exporting & printing of design • 2. Advance 3D model programming skills • Use of variables; Use of iteration for repetition pattern; to create patterns with different type of transformation included • Making of 3D models • Print out the model. Refurnish the model. Color the model. Evaluate the print out (size, structure etc).	• 8 sessions (35 minutes for each session)

Number of school personnel and/or appointed project staff involved and respective duties:

- 2-3 F.1 ICT teachers

Expected outcomes:

- 2. Create 3D model designs (involving different types of transformation) with block programming skills.

Activity 3: Project learning 1: 3D modelling of repetitive pattern

Implementation Period:

01/2024 - 07/2024

Key learning stages and key learning areas/subjects/learning elements	Content	Number of sessions
• ICT, Art, Technology & Living	• Projects • 1. ICT & Art panel collaboration: Typography design • Students learnt typography concepts (style, typeface, tracking, leading, kerning) in Art lessons • 3D modelling skills are covered in ICT lessons • Students are guided to complete their work of typography design and print out their product • 2. ICT & T&L panel collaboration: Chocolate piece design	• 2 sessions for each project (35 minutes for each session)

	• history and process of chocolate production are introduced in T&L lessons • 3D modelling skills are covered in ICT lessons • Students are guided to complete their work of chocolate piece • Students are guided to evaluate their design after printing the product with chocolate solution	

Number of school personnel and/or appointed project staff involved and respective duties:

- 2-3 F.1 ICT, VA, T&L teachers

Expected outcomes:

- 3. Produce 3D models with their designs

Activity 4: Project learning 2: Rocket car

Implementation Period:

09/2023 - 12/2023

Key learning stages and key learning areas/subjects/learning elements	Content	Number of sessions
• ICT	• To enhance problem solving skills of F.2 students through making air bumped foam board rocket car. • Coding with Micro:bit • 1. Basic input & output: • Pins; Buttons; LED lights; Light sensors; Temperature sensors • 2. Music & speakers • 3. Selection structure • 4. Iteration structure • 5. Advanced input & output: • Accelerometer; Compass; Running time; More about LED screen • 6. Make timing gate with Micro:bit. Use IR sensors. • 7. Make remote control with Micro:bit using radio.	• 12 sessions • (35 mins for each session)

Number of school personnel and/or appointed project staff involved and respective duties:

- 2-3 F.2 ICT teachers

Expected outcomes:

- 1. F.2 students can program Micro:bit with different input sensors and output devices.

Activity 5: Project learning 2: Rocket car

Implementation Period:

09/2023 - 12/2023

Key learning stages and key learning areas/subjects/learning elements	Content	Number of sessions
• IS	• Theory concepts behind rocket car: • 1. Motion • Basic idea of distance, average speed and motion graphs. • 2. Force • Force and the effect of forces on the motion; identify different external forces acting on an object and draw a free-body diagram. • 3. Gravity • Gravity on the object and the factors affecting the force of gravity • 4. Friction and air resistance • 5. Action and reaction • 6. Space flight • Escape of rockets from the gravity. They recognize the effect of streamlined shape of rocket and design of spacecraft for returning to the Earth. • 7. Make use of mobile app "Windtunnel" to elaborate the factors affecting total air resistance, especially the relationship between the shape of the car and the flow of air passing through the car.	• 36 sessions (35 mins for each)

Number of school personnel and/or appointed project staff involved and respective duties:

- 2-3 F.2 IS teachers

Expected outcomes:

- 2. F.2 students understand the principal of action and reaction behind the rocket car

Activity 6: Project learning 2: Rocket car

Implementation Period:

01/2024 - 05/2024

Key learning stages and key learning areas/subjects/learning elements	Content	Number of sessions
• ICT, IS	• Micro:bit Rocket Car Competition	• 1 session

	● Students will be guided to make foam block cars that are driven by air pump. Test the rocket car. ● Students compete for the fastest air-bumped rocket car in Rocket Car competition. ● background knowledge of force and coding are introduced in IS and ICT lessons respectively (activity 4, activity 5) ● External tutors are responsible for teaching the production of foam block rocket car, building, setting up competition lane and equipment, conducting the competition. School teachers will be assistant for supervising the competition	● (4 hours)
	● Re-engineering of Rocket Car - to be conducted in F.2 IS lessons - guide student to make hypothesis for improvement of their design - investigate the factors affecting performance of rocket car with mobile app "PhysMo" - enhance the design of rocket car accordingly	2 sessions (35 mins for each)
	● Fair test of Rocket Car - to be conducted in F.1 IS lessons - by using the Rocket Car made by F.2 students, F.1 students will be taught to identify different variables affecting performance of Rocket Car, which aims to consolidate the concepts of design a fair test	2 sessions (35 mins for each)

<u>Number of school personnel and/or appointed project staff involved and respective duties:</u>

- Hired coaches & 3-4 ICT, IS teachers

<u>Expected outcomes:</u>

- F.2 students are able to apply the concepts learnt to design and make a sensible design rocket car
- F.2 students are able to investigate their hypothesis by using IT tools
- F.1 students are able to conduct fair test on pre-made Rocket Car

Activity 7: Project learning 3: Advanced Micro:bit making for smart campus

Implementation Period:
01/2024 - 05/2024

Key learning stages and key learning areas/subjects/learning elements	Content	Number of sessions
• ICT	• To enhance problem solving skills of F.2 students through making daily functional items by physical computing. • Making & coding with Micro:bit and Grove sensors • 1. Detect conductor by pins and closed Circuit Experience coding with Grove shield • 2. Home alarm system • Make a smart home alarm system by using ultrasonic ranger, speaker and simple password • 3. Hand-gesture controlled fan • Make a controllable fan with rotary angle sensor, gesture sensor and motor. • 4. Automatic light system • Make automatic light system by light sensors and conduct fair test with different light sensors. • 5. Automatic score recording for football games • Make automatic scoring system by Infra-red (IR) Distance Interrupter	• 6 sessions (35 mins for each) •

Number of school personnel and/or appointed project staff involved and respective duties:
- 2-3 F.2 ICT teachers

Expected outcomes:
- 1. F.2 students can understand the use of advanced sensors with breakout board of Micro:bit
- 2. F.2 students can produce maker project with breakout board and various sensors

Activity 8: Project learning 4: Be an AI Maker for AI applications for better health
Implementation Period:
01/2024 - 07/2024

Key learning stages and key learning areas/subjects/learning elements	Content	Number of sessions
• ICT	• To empower F.3 students as an advanced maker with AI technology:	• 14 sessions (35 mins for each)

	• 1. Explore where AI is used in daily life and experience AI • 2. The inedible apple • Make a smart object recognition device with Computer Vision • 3. Are you a boy or girl? • Make smart face detection system to recognize facial appearance, distinguish boy and girl • 4. Between tears and laughter • Make a smart system to detect and recognize facial expressions, identify people's inner feelings and outer feelings • 5. The key which cannot be replicated • Through face recognition experiment, analyze human's facial feature and determine the similarity of two faces • 6. Help protect the animals! • Train an AI classification model by Google Teachable Machine and make a smart system to detect specific type of animal • 7. Sit straight and protect your spine • Train an AI classification model by Google Teachable Machine and make a smart system to detect whether a human sit straight	

Number of school personnel and/or appointed project staff involved and respective duties:

- 2-3 F.3 ICT teachers

Expected outcomes:

- 1. F.3 students understand AI concepts and responsibility
- 2. F.3 students know how to train AI models with Microsoft Azure Cognitive Services and Google Teachable Machine
- 3. F.3 students can produce project of different them with AI technology

b. Teacher training (if applicable)

Activity 1: Workshop

Implementation Period:

05/2023 - 08/2023

Content:

- Teacher training on Advanced Micro:bit, use of Grove kits & use of una platform for interactive learning of programming in Micro:bit

Number of sessions:
- 2 sessions, 2 hours each

Teacher training conducted by school personnel/external instructor(s):
- Conducted by hired training instructor/speaker

Expected outcomes:
- Teachers can master the use of to make various project

Activity 2: Workshop
Implementation Period:
09/2023 - 12/2023

Content:
- Teacher training on AI maker

Number of sessions:
- 2 sessions, 2 hours each

Teacher training conducted by school personnel/external instructor(s):
- Conducted by hired training instructor/speaker

Expected outcomes:
- Teacher can master the use of Teachable Machine and necessary skills of AI technology

c. Other measures and activities (if applicable)

Use of Maker Room

The following activities will be conducted in Maker Room

Activity 2: Project learning 1: 3D modelling of repetitive pattern	35 mins x 8	F.1
Activity 3: Project learning 1: 3D modelling of repetitive pattern	35 mins x 2	F.1
Activity 4: Project learning 2: Rocket car	35 mins x 12	F.2
Activity 7: Project learning 3: Advanced Micro:bit making for smart campus	35 mins x 12 (6 sessions for each half class, 12 sessions in total)	F.2
Activity 8: Project learning 4: Be an AI Maker for AI applications for better health	35 mins x 14	F.3

35 mins per lesson, about 20 active cycles in one school year

Average use of Maker Room for student learning = 4.8 lessons / cycle

Other use of Maker Room

Teacher Training Workshop • Teacher training on Advanced Micro:bit, use of for interactive learning of programming in Micro:bit • Teacher training on AI maker	2 hours x 4

2.6 Budget

a. Service cost

Item	Service details	Unit cost	Quantity	Unit	Amount($)	Justification
Instructor* (Activity for staff)	Conducting teacher training workshops (4 hours)	780	4	Hour	3,120	
Instructor* (Activity for staff)	Conducting teacher training workshops AI maker (4 hours)	780	4	Hour	3,120	
Instructor* (Activity for students)	Conducting rocket car competition for all F.2 students with included materials and equipment 4 hours workshop 4 students per group car kit for each group: -1 rocket car foam block -2 axles -4 wheels -2 safety raw plugs -2 screw eyes *qualification of instructors: - STEM related course certificates / degree - at least 1 year of experience of organizing STEM activities	12,500	4	Hour	50,000	
				Sub-total on service cost :		**56,240**

b. Equipment cost

Item	Specifications	Unit cost	Quantity	Unit	Amount($)	Justification
3D printers	3D printers and printing filament	15,000	4	Unit	60,000	For F.1 teaching and learning activities
Hardware kits for advanced Micro:bit maker	Micro:bit and sensors	1,080	50	set	54,000	For F.2 teaching and learning activities

Hardware kits for AI maker	Rasperry Pi board, camera, and sensors	1,080	50	set	54,000	For F.3 teaching and learning activities
Subscription of interactive teaching & learning platform	Subscription of interactive teaching & learning platform (160 students accounts + teachers account) x 1 year	52,000	1	plan	52,096	For F.3 teaching and learning activities
Computer with monitor set	Teacher's desktop computer	6,000	1	Unit	6,000	For teaching
Smart TV with interactive pen & mirroring support	75" interactive smart TV	35,000	1	set	35,000	For teaching, interactive activities in lesson
wireless microphone system	2 wireless microphone	3,000	2	sets	6,000	For teaching & learning activities
Notebook		5,300	35	Unit	185,500	Portable notebook for pair programming, group discussion and other interactive learning activities
				Sub-total on equipment cost :		**452,596**

c. Works cost

Item	Works details	Amount($)	Justification
Demolition works	Remove existing furniture and fixtures	40,000	
Floor works	Revamp the floor to 3mm plastic floor	48,000	Provide durable floor for various STEAM activities
Paint / clean the wall	Prepare Graffiti wall & other walls of the room -work: -remove on wall furniture and nails $15000 -remove all old paintings $15000 -repaint the wall $30000 -installation of magnetic writable glasses (~7m x 2m)on one of the wall in maker room $30000	90,000	for students' collaboration and brainstorming ideas
Electrical works	Prepare 13A power sockets	12,000	Relocate power sockets for 3D printers, charging of notebooks and teacher's desktop computer

Ceiling works	Repaint the ceiling	40,000	Renew the ceiling to match with the theme of Maker Room
Furniture customization / installation	Install lighting -remove old lighting -install high-tech design lighting x 6	25,000	With high-tech design to highlight the theme of Maker Room (spotlights for teacher desk & graffiti wall, light with special shapes to match with modern design of the room)
Furniture customization / installation	Change the front and back door -door with wall for students to present their ideas with bricks	50,000	With high-tech design to highlight the theme of Maker Room
Furniture customization / installation	Blackout curtain	25,000	to facilitate movie shooting of presentation and demonstration
Furniture customization / installation	40 students' movable and stackable chairs and desk 2 teachers' high chairs and desk student chairs: $650 x 40 teachers' high chairs: $900 x 2 student movable desks: $18700 x 6	140,000	High mobility furniture to facilitate group work and pair programming
Furniture customization / installation	1 full height cabinet 3 half-waist cabinets	100,000	for displaying projects and storage
	Sub-total on works cost :		**570,000**

d. Contingency

Item	Amount($) (Round down to the nearest integer)
Works contingency	57,000
General contingency	15,264
Sub-total on contingency :	**72,264**

e. Audit fee

	Amount($)
Audit fee	15,000

Sub-total on audit fee :	**15,000**
Total amount of funding sought :	**1,166,100**

3. Expected Project Outcomes

3.1 Deliverables/positive impact on the school's development

Item: Lesson plans
- F.1 Maths, VA, T&L & F.1 ICT 3D modelling;
- F.2 I.S. Force & ICT Micro:bit basic level;
- F.3 ICT Micro:bit advanced level;
- F.3 A.I. maker

Item: Students' work
- F.1 3D model printouts;
- F.2: rocket car model;
- F.3: smart campus model & A.I. project

Item: Enhanced learning atmosphere
students' interest in STEAM will be aroused; students will be more confident in problem-solving;

Item: Development of students' positive values
students can develop positive attitude towards the use of A.I.

Item: Enhanced collaboration between subject panels
Maths, IS, ICT, VA, T&L

Item: Strengthened teachers' capabilities in curriculum design and teaching
- F.1 Maths: the use of coordination and transformation in daily life;
- F.2 IS: introduce force with practical exercise of rocket car;
- F.3 ICT: tailor ICT curriculum for Micro:bit advanced level and A.I. maker

3.2 Evaluation

Evaluation Method: Lesson/activity observation
Success criteria:
- 80% of teaching activities can be completed smoothly

Evaluation Method: Questionnaire
Success criteria:
- • 80% of teachers and students agree that the project will help schools to promote STEAM education
- • 80% of teachers and students agree that the program can help students learn STEAM related subjects
- • 80% of teachers and students agree that the program can help enhance students' relevant abilities
- • 80% of teachers believe that the program will help enhance their confidence in implementing STEM education

3.3 Sustainability of the project (only applicable to applications with total funding sought exceeding $200,000)

- The curriculum will continue to be implemented and enhanced after the completion of the project.
- The relevant facilities and equipment will be properly used for learning and teaching activities after the completion of the project.

3.4 Dissemination (only applicable to applications with total funding sought exceeding $200,000)

Item: Seminar/sharing session The school intends to hold a student achievement sharing meeting before the end of each school year, invite primary and secondary school teachers in the district to participate in the meeting, showcase students' learning outcomes, and share the content of the program and the experience of implementing STEAM activities.
Item: Others Upload student products to the school website for teachers' and stakeholders' reference.

When writing this proposal, did the school refer to the sample proposal/project(s) approved with funding support at the Quality Education Fund (QEF) website?

No

4. Declaration

1. The school confirms that teachers involved in the project will master not only the use of the tools, but also the pedagogies and lesson design to conduct relevant student activities.

2. The school confirms that we will ensure that the learning and teaching materials to be developed meet students' learning needs, levels, age and abilities. Moreover, the content and information will be correct, complete, objective and impartial.

3. The school confirms that all procurement of goods and services will be conducted on an open, fair and competitive basis with measures taken to avoid conflict of interests.

4. The school confirms that the copyrights of the deliverables/materials will be vested with the QEF. The service provider(s) will not reproduce, adapt, distribute or make available of the deliverables to the public.

5. The school confirms to observe all the rules and regulations on alteration to school premises (including structural alteration and conversion, change of room, etc.) and seek approval from the respective Regional Educating Office before project commencement.

6. The school understands that the expenditure items funded by the QEF is one-off. The school will bear the recurrent expenditure incurred, including maintenance costs, daily operating costs, etc. and the possible consequences that may arise.

7. The school will bear all possible consequence/ expenses caused by alteration/ improvement on works, including but not limited to the provision of relevant grants, repair works, etc., and understand that if the purpose of the special room is changed, the related funding may also be affected.

5. Asset Usage Plan

Categories	Item	Unit cost	Quantity	Unit	Amount($)	Proposed Plan for Deployment
computer hardware	Computer with monitor set	6,000	1	unit	6,000	For learning and teaching activities
	Smart TV with interactive pen & mirroring support	35,000	1	set	35,000	
	Notebook	5,300	35	unit	185,500	
Furniture	Student movable desks	18,700	6	unit	112,200	
Others	3D printers	15,000	4	unit	60,000	
	Hardware kits for advanced Micro:bit maker	1,080	50	set	54,000	
	Hardware kits for AI maker	1,080	50	set	54,000	
	wireless microphone system	3,000	2	set	6,000	

6. Reports Submission Schedule

The school commits to submit proper reports in strict accordance with the following schedule:

Project Management (Should be submitted via the "Electronic Project Management System" (EPMS))		**Financial Management** (Hard copy together with supporting documents should be submitted to the QEF Secretariat by mail or in person)	
Type of report and reporting period	**Report due on**	**Type of report and reporting period**	**Report due on**
Progress Report 01/04/2023 - 30/09/2023	31/10/2023	/	/
Progress Report 01/10/2023 - 31/03/2024	30/04/2024	Interim Financial Report 01/04/2023 - 31/03/2024	30/04/2024
Progress Report 01/04/2024 - 30/09/2024	31/10/2024	/	/
Final Report 01/04/2023 - 31/10/2024	31/01/2025	Final Financial Report 01/04/2024 - 31/10/2024	31/01/2025