Quality Education Fund
The Dedicated Funding Programme for Publicly-funded Schools
Part B: Project Proposal

Project Title: School-based Junior Secondary STEM Education Programme	**Project Number: 2019/1012** (Revised)

Name of School: SKH Bishop Mok Sau Tseng Secondary School

Direct Beneficiaries

(a) Sector: ☐ Kindergarten ☐ Primary ☑ Secondary ☐ Special School *(Please put a tick in the appropriate box(es).)*

(b) Beneficiaries: (1) Students: 400 (S1-3) ; (2) Teachers: 15 ; (3) Parents: N/A ;
(4) Others: N/A

Project Period: 11/2021 to 08/2023

1. Project Needs

1.1	Project Aim(s)	The project aims at developing school-based junior secondary STEM education, arousing students' interest in STEM-related subjects, equipping them a solid background to apply STEM knowledge and skills to solve real-life problems creativity and collaboratively. Moreover, the project will enhance teachers' professional capacity in implementing STEM education through the teachers' development programmes.
1.2	Innovative element(s)	The project consists of school-based innovative element. Our school has been promoting STEM education since 2016 by organizing different learning activities for all students, and nurture students who are interested / have good performance in STEM learning activities to participate various competitions. To have a holistic approach, our school plans to further incorporate STEM education into daily learning and teaching. Students will be provided with opportunities for learning relevant knowledge and skills, such as mobile and robotic programming, AI, VR/AR production and 3D design and printing. Moreover, students will be allowed to gain more hands-on learning experience with relevant equipment. Thus, they will have more opportunities to apply what they have learnt and their learning experiences will be enriched.
1.3	Alignment with school-based / students' needs	One of the focus of the school's three-year development plan (2018-2021) is to develop STEM education. Our school plans to establish a well-organised curriculum based on the 3-tier model prepared by our STEM team. Students are provided opportunities to have hands-on learning experience and apply what they have learnt as well as to enhance teachers' professional capacity in implementing STEM education through teachers' development programmes.

2. Project Feasibility

2.1	Key concept (s) / rationale(s) of the project	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 are - Renewing the curricula of the Science, Technology and Mathematics 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 Technology, Mathematics and Science Education curricula. Learning activities, such as mobile and robotic programming, AI, VR/AR production, 3D design and printing, and interdisciplinary applications in STEM, will be organised for different grades of junior secondary level, with a view to enriching their learning experiences. The S3 students will be encouraged to apply the knowledge and skills they have learnt to solve some real-life problems. Our school also plans to organise some training activities for teachers to enhance their professional capacity in designing and implementing STEM learning activities, hence enhancing the learning and teaching effectiveness.
2.2	Applicant's readiness or ability/ experience/ conditions/ facilities for project implementation	With the mentoring of our teachers, many students have participated in different STEM activities and competitions in recent years. Our STEM-related subjects have reviewed and modified their curriculum to incorporate STEM learning activities, for instance, mobile and robotic programming, microcontroller and scientific investigation, 3D designs and AI. Students are interested in hands-on learning activities. Through these learning activities, students' creativity, collaboration skills and problem-solving skills can be enhanced. In order to further implement STEM education, our school plans to incorporate STEM education into junior secondary curriculum so as to provide valuable learning opportunities for all junior secondary students.
2.3	Principal's and teachers' involvement and their roles	A coordinating committee, which comprises the principal, vice-principals and panel chairpersons of STEM-related subjects, will be set up to coordinate and monitor this project. Teachers from STEM-related subjects will participate in teachers' development programmes. They will be involved in reviewing the existing school-based curricula, developing and trying out the newly developed STEM education programmes. Peer lesson observations as well as cross-curricula collaboration and evaluation meetings will be conducted. Moreover, dissemination activities will be organised to showcase students' learning outcomes.
2.4	Parents' involvement / participation	PTA will be informed of the school policy on implementing STEM education. Parents with a strong STEM background will be invited as a member of our advisory board.

2.5 Implementation timeline

Implementation period *(MM/YYYY)*	Project activities
11/2021 – 03/2022	- Invite quotations for renovation of the Computer Room and procurements of relevant equipment and materials - Hire the project assistant
03/2022	- Review the existing STEM-related learning content - Conduct teacher training workshop, including STEM curriculum planning, learning activities, assessment and use of related equipment / teaching kits
04/2022 – 08/2022	- Develop school-based STEM education programme for junior secondary students - Design learning and teaching activities and lesson plans - Regular meetings for the discussion and sharing of the design activities and lesson plans
09/2022	- Review the lesson plans and conduct pre-lesson meetings
10/2022 – 05/2023	- Conduct learning activities for S1, 2 and 3 junior classes in the Computer Room - Conduct S3 Joint Science STEM project in the Science Laboratory during Jan – May 2022 - Conduct lesson observations and evaluate the progress of the project as well as the learning and teaching effectiveness. The learning and teaching activities will be refined if necessary - The Computer Room will be opened after school for students doing STEM project works and related competitions - Regularly interest workshops or courses will be held to enable students to learn the latest STEM skills
06/2023	- The coordinating committee and the teachers involved will evaluate the effectiveness of the project, refine the developed curriculum and learning and teaching activities - They will also discuss how to further develop the school-based STEM education programme and relevant learning activities in the coming school year
07/2023	- Organise STEM sharing session within school to showcase students' learning outcomes - Organise sharing seminars to share the project experience and project

2.6 Details of project activities

a. Student activity

Activity name	Content	Number of sessions and duration	Teachers' involvement and/or hired personnel	Expected learning outcomes
S1 Curriculum	1. 3D design and printing – use Tinkercad for 3D design and print to 3D printer 2. Introduction of AI & project – use AI4K12 and MS/Google AI examples to illustrate, students are required to use Google AI for image classification 3. Blockly programming & sensors – use Micro:bit to learn coding / blockly programming and use of sensors 4. Robotics programming – use ready-made kits to learn robotic car, sensors and programming, competition will be used to engage students to fine tune their programs	2 lessons, 40 min/session 2 lessons, 40 min/session 2 lessons, 40 min/session 2 lessons, 40 min/session	To be taught and guided by school teachers with relevant knowledge and experience	Students can understand the essential elements and skills in building a 3D model and how a 3D printer works. View AI from different perspectives and finally use MS/Google AI platform to feel how AI is used in image classification. Understand and use different inputs and sensors on Micro:bit and program it using blockly programming language. Learn and understand about coding, robot-making as well as moving controls and use of different sensors. They can apply the relevant knowledge and skills to complete the related learning tasks.
S2 [1] Curriculum	1. Mobile programming – learn App Inventor programming and how it works with different IOT sensors	5 lessons, 40 min/session	To be taught and guided by school teachers with relevant knowledge and experience	Student can understand and develop simple mobile apps with simple logic, connect to mobile with IOT sensors, send data to online platform such as ThingSpeak

[1] The total lesson time for junior Secondary Computer in our school should be above average in Hong Kong.
To learn the topics listed in K1, K2, K16 and E1, each S1 to S3 student needs to attend Computer Literacy lesson in alternating cycles by odd and even numbers. Each lesson is 70 minutes long.
In addition to the Computer Literacy curriculum, our school further arranges S2 students to attend Computer Programming lessons in every cycle, and each lesson is 70 minutes long.
Our designed activities are mainly using S2 Computer programming lessons for the new school-based STEM curriculum. This change will not affect much our Computer Literacy curriculum. Or even better, let our students exploring and learning more new topics in K8 and K9.

	2. Python programing - use Google Colab to learn Python 3. AI & IOT programming – use ready-made AI-IOT kits for image classification and testing their models 4. Introduction of microcontroller and sensors 5. VR production – use Cospaces Edu to build a 3D world and import 3D models exported from Tinkercad 6. Project (small scales) – choose one of the topics related to smart living / environment / mobility, choose sensors to set up a solution	3 lessons, 40 min/session 2 lessons, 40 min/session 2 lessons, 40 min/session 2 lessons, 40 min/session 2 lessons, 40 min/session		Understand the syntax, basic operations logic and data structure of Python, and use it to develop simple apps. Use of a ready-made kit to understand how AI works. Build their own model and application for image classification. Understand microcontroller and different sensors and used in their project. Understand VR development. Students can apply their knowledge and skills to complete the learning tasks. Their collaboration skills and problem-solving skills will be enhanced through the learning activities. They can also apply what they have learnt in solving real-life problems.
S3 Curriculum	1. AI/ML programming – use Python Google Colab to learn AI/ML for image classification 2. Science joint STEM project – use STEM to go through scientific investigation [2] 3. Technology project students use STEM to solve one of real-life problems / problems raised in external STEM competitions	3 lessons, 40 min/session 6 lessons, 40 min/session 2 lessons, 40 min/session	To be taught and guided by school teachers with relevant knowledge and experience	Understand basic concepts of how AI/ML works, and use Python to learn image classification of larger dataset. From the Science joint project, students understand how to define their problem statement, form hypotheses, choose equipment and devices for experiment, observations, organize and analyse data and draw conclusions. Students can apply their knowledge and skills to complete the learning tasks. Their collaboration skills

[2] This is our existing practice in S3 Science curriculum. With STEM integration, for instance, students can decide to use different sensors in measurements.

				and problem-solving skills will be enhanced through the learning activities.
STEM sharing session	This sharing session will be organised for the junior secondary students at the end of the school year. The sharing session will include students' sharing and booth displays which aim at summarising the project activities, consolidating students' learning experiences and showcasing their learning outcomes.	A half-day event	STEM-related subject teachers	This event can showcase students' learning outcomes, recognise their achievements and encourage them to explore further.

b. Teacher training

Activity name	Content	Number of sessions and duration	Hired personnel	Expected learning outcomes
Teacher training workshops [3]	Teacher training workshops will be organised for teachers of STEM-related subjects. The content includes: 1. Curriculum planning of STEM education 2. The design and assessment of STEM-related learning activities	2 sessions, 3 hours/session	The trainer for curriculum planning of STEM education, design and assessment of STEM-related activities is required to have an university degree, diploma in education or equivalent and at least 5 years of experience in curriculum planning and teaching.	Teachers can understand the curriculum planning of STEM education and the design and focus of the STEM learning activities. They also possess the skills of using the STEM-related equipment
	Teacher training workshops will be organised for teachers of STEM-related subjects. The content includes: 1. 3D design and printing 2. Use of microcontroller, IOT sensors and ready-made kits in STEM-related activities	2 sessions, 3 hours/session	The trainer for 3D design and printing, microcontroller, IOT sensors and ready-made kits in STEM-related activities is required to have a relevant qualification at least 1 year of experience in training.	

c. Equipment

	Details of equipment to be procured	Contribution to fulfilment of the project aim(s) and if applicable, the expected utilization rate
1	Smart TV x 2	The wall mounted Smart TVs are mainly for students doing group discussion, design and presentation preparation in the lesson and after school.

[3] Our teachers are experience teachers. We have organized different learning activities to students in the recent years, after EDB encouraged to incorporate STEM education in school curriculum.
Our teachers are willing to learn by themselves. In order to provide better STEM learning experience to students, our teachers have participated various workshops which were held by EDB, non-profit organizations and providers, for example AiTLE and HKACE. Even one of them have participated STEM related seminars or workshops more than 30 hours a year.
Furthermore, some of the activities listed below are already taught by our teachers in the existing curriculum. In fact, our teachers learned those knowledge by themselves.
S1: 3D design, AI introduction, Micro:bit blockly programmig
S2: Mobile programming, Python, AI
As we have confidence in conducting STEM-related learning activities, that why the training workshops are designed mainly in focus to support teachers in the preparation of the school-based STEM curriculum.

2	3D printers x 2	Firstly they will be used for printing 3D models after the S1 3D design and printing lesson. Furthermore, students can print 3D parts for their designs when solving real-life problems / projects or competitions participated.
3	Laptop x 35	We need a flexible venue for students working collaboratively in different STEM projects, however the existing desktop computers in our computer room cannot provide this flexibility. Apart from the issue of immobility, webcams are also needed for most AI topics and projects, such as object detection and recognition. Furthermore, students can use the portable laptops in doing their STEM projects outside the classroom. Therefore laptop computers are vital and suit our needs to let our project carry out fluently and successfully.
4	Microcontroller and sensors kit x 40	They are mainly used in learning the following designed topics mentioned in paragraph 2.7: • S2 Introduction of microcontroller and sensors • S2 Project (small scales) • S3 Science joint STEM project • S3 Technology project Besides, they would be used in different participated competitions.
5	Robotic kit x 20	They will be used in learning the topic S1 – Robotics programming.
6	AI-IOT kit x 40	They will be used in learning the topic S2 – AI & IOT programming.

d. Construction works

	Details of the construction works proposed	Contribution to fulfilment of the project aim(s) and if applicable, the expected utilization rate
1	(a) Relocate light and power sockets (b) Refurbish the floor and the wall (c) Install graffiti walls (d) Purchase of furniture	The proposed work will help well optimise the utilisation of space in the current Computer Room[4]. The new settings will facilitate group discussions among students and display of students' work. The central area of the room will be used for learning, practising, assembling, group discussion and idea creation. The corners of the room will have smart TV and graffiti wall for group projects discussion, 3D printing and VR/AR and new STEM related equipment demonstration.

[4] To prevent any interruption, the construction works will be carried out in the summer holidays. After the works completed, this Computer Room will be open for students doing STEM project works and related competitions after school. However this arrangement will not affect other students using computers, because we still have computers in MMLC (44 sets), Computer Room 2 (20 sets) and TLC (20 sets) for them to use.

e. Features of the school-based curriculum to be developed, if applicable

Our school plans to develop the school-based STEM education programme for junior secondary students by reviewing the learning sequence and content of STEM-related subjects, adding four learning modules (robotics programming, AI and IOT, VR production, 3D design and printing) for S1-S3.

We will adopt the Approach 1 stated in the Appendix 3 of the "Report on Promotion of STEM Education - Unleashing Potential in Innovation" (December 2016). That is "Learning activities based on topics of a KLA for students to integrate relevant learning elements from other KLAs". Technology Education will become the core engine of our school-based STEM curriculum. Various learning elements of Technology Education, as mentioned above, will be taught in different grades of junior secondary level. For the KLA of Mathematics and Science Education, they will review and modify their curriculum, design activities to make use of the STEM knowledge students learnt at each level.

To echo the aims of this project, first of all, though our designed activities, we intend to arouse our students' interest in STEM-related subjects, equipping them a solid background to apply STEM knowledge and skills. Our objective is to achieve that they are not only taught to imagine, they should expose, touch and manipulate those technologies with their hands. They will be involved to think and design too. Just an example for the illustration, our learning activity will let students print their 3D models after their design and make in Tinkercad. We want them to experience it. If they have not tried to use 3D printer before, how they can know and even imagine using 3D printing to solve their daily problems.

Similarity we use the same approach to arrange our students learning Robotics programming, Mobile programming, iOT, AI and VR. We are not only let them know and understand those technologies, but also let them experience in STEM. We believe that "Tell me, and I'll forget. Show me, and I may remember. But involve me, and I'll understand."

Furthermore, by using project based learning approach, we intend to equip our students to apply the acquired STEM knowledge and skills to solve their real-life problems creatively and collaboratively. Students will be required to do projects tasks with increasing in scale and difficultly.

The project for S1 – S3 are arranged in the following strategies (FIC), which is derived from the COVA learning model (*http://www.harapnuik.org/?page_id=6615*):

S1 – (F)ollow – given topic – e.g. design a smart phone holder
S2 – (I)mprove – a list of topics for students to choose
Project (small scales) – choose one of the topics related to smart living / environment / mobility, choose sensors to set up a solution
S3 – (C)reate – the problem is self-defined and initialized
Science joint STEM project – use STEM to go through scientific investigation
Technology project - students use STEM to solve one of real-life problems: students are required to raise a real-life problem and use STEM to design a solution

We also let our students participate different extended learning activities such as external STEM competitions. They will be provided with opportunities to apply what they have learnt to solve real-life problems and show their creativity and work collaboratively. Their learning will be consolidated and their collaboration and problem-solving skills will be strengthen.

2.7 Budget

Total Grant Sought: HK$ 998,000[5]

Budget Categories*	Breakdown for the budget items		Justifications
	Item	**Amount (HK$)**	
a. Staff	Project Assistant (18 months including MPF) ($14,500 x 18 x 1.05)	274,050	The candidate should have a university degree or equivalent. He/she will be responsible for: - arranging project activities and clerical work - arranging procurements - designing and compiling the learning and teaching resources - assisting in the implementation of the project activities and serving as a mentor for the extended learning activities for students
b. Service	Conduct teaching training workshops		
	1. Curriculum planning of STEM education, design of learning assessment ($780 x 6)	4,680	Conducting teacher development workshops to facilitate them in designing and promoting school-based STEM education.
	2. 3D design and printing ($500 x 3)	1,500	Conducting 3D printing training programme for teachers in order to equip them with relevant knowledge and skills
	3. Use of microcontroller, IOT sensors and ready-made kits in STEM-related activities ($500 x 3)	1,500	Conducting microcontroller and IOT sensors and ready-made kits programme for teachers in order to equip them with relevant knowledge and skills
c. Equipment	Smart TV x 2	30,000	For learning and teaching activities
	3D printers x 2	40,000	For learning and teaching activities
	Laptop x 35	175,000	For learning and teaching activities
	Charging cart for laptops x 1	15,000	For charging of the laptops
	Microcontroller and sensors kit x 40	60,000	For learning and teaching activities
	Robotic kit x 20	44,000	For learning and teaching activities
	AI-IOT kit x 40	24,000	For learning and teaching activities
d. Works	Relocate light and power sockets	50,000	Relocate light and power sockets in order to have spacious area for conducting learning activities
	Refurbish the floor and the wall	70,000	Advise to refurbish the floor and the wall
	Install graffiti walls	35,000	Install graffiti wall in order to facilitate students' group discussion, designing layout plan and planning for assignment progress

[5] For the staff recruitment and procurement of goods and services, our school will carry out on an open, fair and competitive basis. Our school will follow the "Guiltiness on Procurement Procedures in Aided Schools" strictly.

	Purchase of furniture	100,000	To tailor make half-height cabinet, full-height cabinet and a set of cupboard for storing and showcasing students' work Student chairs, desks and workshop tables to facilitate students' learning activities and making product
e. General expenses	Miscellaneous	10,000	Including photocopying and materials for learning activities etc
	Consumables - 3D Printing Materials	20,000	For learning and teaching activities
	Audit fee	5,000	
f. Contingency	Contingency fee for Works	25,500	(d x 10%)
	Contingency fee	12,770	[(b+c+e) x 3%]
	Total Grant Sought (HK$):	998,000	

3. Expected Project Outcomes

3.1	Deliverables / outcomes	☑Learning and teaching materials ☐ Resource package ☐ e-deliverables**(please specify)* _____ ☑ Others *(please specify)* _____ - Learning and teaching resources, including mobile and robotic programming, IOT and Scientific investigation, 3D designs and AI for junior secondary students - Students' work
3.2	Positive impact on quality education/ the school's development	The project will help the school plan and develop STEM education systematically and nurture students to be learners in the 21st century, curriculum development and teachers' development programmes.

3.3 Evaluation

Please state the methodologies of evaluating project effectiveness and provide the success criteria.

The project will be evaluated through observation, questionnaire surveys, group interviews and students' performance in STEM-related subjects. The evaluation items are listed below:

1. The effectiveness of the school-based STEM education programme for junior secondary students (success criteria: 80% of the teachers and students agree that the project helps the school promote STEM education)
2. To arouse students' learning interest (success criteria: 80% of the teachers and students agree that the project helps arouse students' learning interest in STEM-related subjects)
3. To arouse students' creativity, collaboration and problem-solving skills (success criteria: 80% of the teachers and students agree that the project can help enhance students' creativity, collaboration and problem-solving skills)
4. To develop students' confidence using STEM in solving real-life problems (success criteria: 50% increase number of students joining external STEM competitions)
5. To arouse students' using STEM knowledge to go through scientific investigation (success criteria: 80% of the teachers agree that students' performance and learning behaviors in scientific investigation are better than previous years)

6. To enhance teachers' professional capacity (80% of the teachers agree that the project can help enhance their confidence in implementing STEM education)

3.4 Sustainability of the project

- By the end of the project, an evaluation meeting will be held for the committee members and the teachers involved. They will discuss how to further develop the school-based STEM education and design learning and teaching activities of different themes.
- The maintenance fee and the purchase of new equipment in future will be borne by the school. The school will continue to make good use of the facilities and equipment to conduct learning and teaching activities in order to enrich students' learning experience after the completion of the project.

3.5 Dissemination

- The school plans to organise a sharing seminar for the teachers of the district by the end of the project period so as to showcase students' learning outcomes, share the project experience and tips for implementing STEM learning activities.
- The deliverables will be uploaded to the school webpage and the Hong Kong Education City for teachers' reference.

4. Declaration

Our school:

1. will follow all the relevant safety guidelines and ensure participants' safety when conducting project activities;
2. will make effective use of the procured items for enhancing learning and teaching;
3. will constantly review the need of teacher training to ensure teachers' readiness to support the project;
4. will retain and reserve the renovated Computer Room for learning and teaching of existing computer subjects at both the junior (computer literacy) and senior secondary (ICT) levels, as the first priority;
5. will confirm the copyright of the deliverables/materials developed through this project should be vested with the QEF and note that any reproduction, adaption, distribution or provision of the deliverables to the public for commercial purposes by the service provider is strictly prohibited; and
6. understands that the subsidy of the Quality Education Fund is one-off, and our school will have to bear future expenses, including maintenance costs of equipment, daily operation costs and other possible expenses/consequences.

5. Asset Operation Plan

Category	Item	Quantity	Amount (HK$)	Proposed deployment plan
AV equipment	Smart TV	2	30,000	All AV equipment will be put inside the Computer room for learning and teaching STEM activities.
Computer hardware	3D printers	2	40,000	All computer equipment will be put inside the Computer room for learning and teaching STEM activities.
	Laptop	35	175,000	
	Charging cart for laptops	1	15,000	
	Microcontroller and sensors kit	40	60,000	
	Robotic kit	20	44,000	
	AI-IOT kit	40	24,000	
Furniture	Install graffiti walls	1	35,000	All furniture will be placed inside the Computer room for learning and teaching STEM activities.
	Purchase of furniture	1 lot	100,000	

6. 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 01/11/2021 - 30/04/2022	31/05/2022	Interim Financial Report 01/11/2021 - 30/04/2022	31/05/2022
Progress Report 01/05/2022 - 31/10/2022	30/11/2022	Interim Financial Report 01/05/2022 - 31/10/2022	30/11/2022
Progress Report 01/11/2022 - 30/04/2023	31/05/2023	Interim Financial Report 01/11/2022 - 30/04/2023	31/05/2023
Final Report 01/11/2021 - 31/08/2023	30/11/2023	Final Financial Report 01/05/2023 - 31/08/2023	30/11/2023