Quality Education Fund

The Dedicated Funding Programme for Publicly-funded Schools

Part B: Project Proposal

Project Title:	Project Number:
School-based Junior Secondary STEM Education Programme	2018/1051 (Revised)

Name of School: St. Francis Xavier's College

Direct Beneficiaries

(a) Sector: Kindergarten Primary Secondary Secondary

(b) Beneficiaries: (1) Students: <u>380 (S1-S3)</u>; (2) Teachers: <u>12</u>

Project Period: <u>08 / 2020</u> to <u>12 / 2021</u>

1. Project Needs

1.1	Project Aim(s)	The project aims at developing school-based junior secondary STEM education, arousing students' interest in learning STEM-related subjects and enhancing their creativity, collaboration and problem-solving skills. 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 organising STEM interest workshops as post-examination activities since 2016 in order to nurture the students in STEM learning activities. Our school plans to further promote STEM education through incorporating STEM education into daily learning and teaching. Students will be provided with opportunities for learning relevant knowledge and skills. Moreover, students will be allowed to gain more hands-on learning experience through the establishment of the "Computer Room cum STEM Room" 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 promote STEM education through cross-curriculum collaboration, to arrange professional development programmes for teachers, provide STEM programmes to our junior form students and establish a new Computer Room cum STEM Room. Our school has been organizing various STEM workshops for junior form students every year, including drone interest workshops for more than 10 students in F.1-F.3 and STEM hands-on workshops as post-examination activities for the whole F.1 and F.2. It is evident that our students showed great interests and creativity in these workshops, as they are able to design and make products by applying their STEM knowledge. Moreover, students were attracted to the latest technology, such as drone. Apart from this, our students were often divided into groups when working on tasks, which also enhances their communication and collaboration skills. These also help gain our students' interests and the needs to develop their STEM attributes as well as generic skills, our school are planning to design learning activities and workshops which will be incorporated both within and out of the curriculum. In order to facilitate the conduction of the learning activities and workshops, a room with appropriate setting is needed. It should contain storage spaces for equipment, working desks for hands-on tasks, and flexible tables and chairs for group discussions or works.
		computer benches, which can hardly serve the above purposes. Therefore, our school is planning to refurbish the computer room to a "Computer Room cum STEM Room".

2. Project Feasibility

2.1	Key concept (s) /	The rationale of this project comes from the suggestions stated in the "Report on
	rationale(s) of the	Promotion of STEM Education - Unleashing Potential in Innovation" (December
	project	2016) released by the Education Bureau. The main points include:
		- 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 fill as is and as different should be and in the last
		We will review and modify the school-based junior secondary fectinology,
		diting 2 D design and printing drone programming will be organized for different
		grades of junior secondary level with a view to enriching their learning
		experiences. The 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	Our school has been developing STEM education programme since 2015. Our STEM
	or ability/ experience/	committee joined the school-based support service (SBSS) by EDB in developing
	conditions/ facilities	cross-curricula STEM learning activities for four years:
	for project	2015-16: Self-directed learning in Science
	implementation	2016-17: Self-directed learning in Science
		2017-18: STEM education
		2018-19: Professional Development School Scheme (STEM)
		Therefore our teachers in STFM committee possess rich experience in designing and
		organising relevant learning activities with student-centered pedagogy and are well
		prepared and ready for the implementation of the project.
		According to our previous experience, students are interested in hands-on learning
		activities which can arouse their motivation in learning and exploring. 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
		strengthen STEM education into junior secondary curriculum and establish a
		Computer Room cum STEM Room so as to provide valuable learning
		opportunities for all junior secondary students. The proposed learning activities will
22	Dringingl's and	A coordinating committee which commisses the principal wice principal ward
2.5	rincipal s and	A coordinating committee, which comprises the principal, vice-principal, panel chairpersons of STEM related subjects and chairman of Information Technology
	and their roles	Committee 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 /	Not applicable
2.5	participation	
2.5	Koles of	Not applicable
	conaborator(s)	

2.6 Implementation timeline

Implementation period	Project activities
(<i>MM</i> / <i>YYYY</i>)	
08/2020 - 09/2020	• Invite quotations for renovation of the "Computer Room cum STEM Room" and
	procurements of relevant equipment and materials
08/2020 - 12/2020	Conduct teacher training workshop (around 3 hours)
	Construction work of "Computer Room cum STEM Room"
	Design learning and teaching activities and lesson plans
01/2021 - 02/2021	Review the lesson plans and conduct pre-lesson meetings
03/2021	• Organise Drone programming workshops for primary students in the school open day (Mar 2021). Invite primary schools in the same district to join.
01/2021 - 04/2021	• Conduct the extended learning activities "Drone programming competition" for S1- S5 students
02/2021	• Conduct the learning activities "Design of simple geometric 3-D objects" for S1 students
03/2021	Conduct the learning activities "Video Editing" for S2 students.
	• Conduct the learning activities "Internet of Things (IoT) application" for S1 students.
	• Conduct the learning activities "Further exploration on 3-D objects" for S3 students
04/2021	Conduct the learning activities "Advance drone programming" for S2 students
	• Conduct the learning activities "Geometric construction using software" for S2 students
10/2021 - 12/2021	Conduct the extended learning activities "Drone interest class" for S1-S5 students
12/2021	• 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.

2.7 Details of project activitiesa. Student activity

a. Student activit	.y			
Activity name	Content	Number of	Teachers'	Expected learning
		sessions and	involvement	outcomes
		duration	and/or hired	
			personnel	
1. Learning	In response to the curriculum of	4 sessions in	To be taught by	Students learn about
Activities:	Computer Literacy on the topic	one school	school teachers	the skills needed for
	of video editing, learning	year, 40	with relevant	video production such
Video Editing	activities and a project for S2	minutes for	knowledge and	as shooting skills and
_	students are implemented.	each session	experience	video editing skills.
	Students will learn the shooting		_	Students are also
	skills on video taking which are			expected to unleash
	hands-on experiences. They will			their creativity, and
	also apply the computer			foster collaboration
	techniques on video editing and			and communication
	production individually, through			skills in the video
	the notebook computers in the			production project.
	Computer Room cum STEM			
	Room. Finally, they will be			
	divided into groups and			
	complete a project to produce a			
	video, that encourages their			
	creativity and collaboration. In			
	the preparation of the project,			
	students conduct group			
	discussion and tasks in a group			

	setting in the Computer Room cum STEM Room. Students will also try to compile a high- resolution video using high- performance desktop computers in the Computer Room cum STEM Room. Moreover, students can make use of a green screen installed in the Computer Room cum STEM Room during video shooting to create innovative effects.			
2. Learning Activities: Internet of Things (IoT) application	To strengthen the topic "programming" in the curriculum of Computer Literacy and enhance students' problem-solving skills and creativity, learning activities involving IoT are designed for S1 students. Students have to design and make the connections between different computing devices, and write a programme for the devices to achieve specific tasks.	6 sessions in one school year, 40 minutes for each session	To be taught by school teachers with relevant knowledge and experience	Students can learn about the concepts of IoT and programming of computing devices. Students also gain hands-on experience and problem solving skills of IoT application.
	Students have to write the programme using notebook computers and make the IoT application in the Computer Room cum STEM Room. Also, they will work in groups to facilitate group discussion.			
3. Cross- curriculum Learning Activities: Design of simple geometric 3-D	A cross-curriculum project will be launched for S1 students to strengthen the content in respective curricula. They have to apply the knowledge in Mathematics, Science and Computer Literacy to complete the tasks.	6 sessions in one school year, 40 minutes for each session	To be taught by school teachers with relevant knowledge and experience	Students can understand and apply the skills and knowledge in Mathematics, Science and Computer Literacy respectively in the project:
objects	Tasks: 1. To design a simple geometric 3-D object that have definite volume. (Math.) 2. To measure the volume of their designed objects (Sci.) 3. To print out the designed objects using 3-D printers (C.L.) Knowledge and skills involved: Mathematics: Mensuration of simple geometric objects and calculation of volume of a simple geometric 3-D object. Science: Measurement of volume of an irregular object			Mathematics: Calculation of volume of a simple geometric 3-D object. Science: Measurement of volume of an irregular object using basic apparatuses in science laboratory Computer Literacy: Use software and 3-D printer to make a 3-D object.

4. Learning Activities: Geometric construction using software	science laboratory Computer Literacy: Create a virtual simple geometric 3-D object in software of a notebook computer and print out using 3- D printer in Computer Room cum STEM Room. To reinforce the topic "simple geometry" in Mathematics curriculum, S2 students are asked to construct a shape in a software in a tablet. They have to apply properties of geometry in the task, such as constructing a regular polygon using the properties of geometry. To facilitate group discussion and the use of tablets, the tasks will be completed in Computer Room cum STEM Room	6 sessions in one school year, 40 minutes for each session	To be taught by school teachers with relevant knowledge and experience	Students can apply the properties of geometry in mathematics and construct a shape in a software in tablet.
 5. Cross- curriculum Learning Activities: Further exploration on 3-D objects 	To strengthen the topic "3-D geometry" in the Mathematics curriculum, S3 students are asked to complete a project on designing and making a hamburger box, with the minimum surface area that can carry a hamburger with definite shape and size. Firstly, students have to visualize their design using a simulation app in tablets. In the simulation, students learn and observe the orthogonal projection views as well as the nets of 3-D objects. Secondly, by using the net of the 3-D objects, they find out the surface area and minimize it. Finally, students have to make the hamburger box of their designs by their nets. Students are divided into groups in the project. The lessons will be conducted in Computer Room cum STEM Room to facilitate the group discussion and use of the tablets.	6 sessions in one school year, 40 minutes for each session	To be taught by school teachers with relevant knowledge and experience	Students learn to 1. create a net of 3-D object 2. calculate and carry out minimization of surface area of 3-D object 3. create visual 3-D object in a simulation app in tablet 4. observe orthogonal projection view of 3-D object
6. Learning Activities:Advance drone programming	To strengthen the topic "programming" and "3-D printing and design" in the curriculum of Computer Literacy and enhance students' problem solving skills and creativity, the learning activities of Drone controlling by using an apps using advance	S2: 6 sessions in one school year, 40 minutes for each session	To be conducted by school teachers with knowledge of using drone and its applications.	Students can apply Mathematical formula and computer coding to design a programme for a drone operation. Moreover, students apply their skills in 3- D printing for the extra structure in the drones.

	 programming are designed for S2 students. The content includes a) to study an advance computer programming language for Drone coding b) to set a programme for drones using Python to complete specific tasks c) to add extra structure to the drone using 3-D printer to stabilize and enhance the cruise performance The learning activity will be conducted in Computer Room cum STEM Room, as it allows flexible space for the operation of drone. Also, students are asked to use the tablet for the coding of tablets and 3-D printers in Computer Room cum STEM Room.			In addition, students practise their problem- solving skills and creativity in completing the tasks.
Extended learning activities: Drone interest class	A number of students are interested in drone operation and coding. In the drone interest class, students will learn to control and programme the drones to complete specific tasks. During the class, students will also develop their communication and collaboration skills. Each student will be given a drone and a tablet. The activities will be carried out in Computer Room cum STEM Room for the flexibility in space for drone operation and use of tablets there. Target beneficiaries: 12 students from S1-S5 Selection criteria: students' interests, programming ability.	The class will be implemented after school. 7 lessons in one school year, 2 hours per lesson	Related club teachers will serve as mentors. They will monitor students' learning progress and advise on their work.	Students can apply their programming knowledge and skills to operate the drones. Students are also expected to develop their communication and collaboration skills in the class.
Extended learning activities: Drone programming competition	A number of students are interested and experienced in drone operation and coding. 10 students will represent school to participate in at least 2 drone programming competitions. They will have to design and make the structure of drones to complete specific tasks. Each student will be given a drone and a tablet. Students will	In one school year: Training - 18 hours Preparation for competitions - 100 hours Competitions - 4 hours	Related club teachers will serve as mentors. They will monitor students' learning progress and advise on their work.	Students can apply Mathematical formula and computer coding to design a programme for a drone operation. Moreover, students apply their skills in 3- D printing for the extra structure in the drones. In addition, students practise their problem- solving skills and

	use the 3-D printers also to make			creativity in
	the extra structure of the drone.			completing the tasks.
	The activities will be carried out			
	in Computer Room cum STEM			
	Room for the flexibility in space			
	for drone operation, and use of			
	tablets and 3-D printers there.			
	_			
	Target beneficiaries: 20 students			
	from S1-S5			
	Selection criteria: students'			
	interests, programming ability			
Drone	Our students will conduct drone	3 sessions in	Related teachers	Student instructors can
programming	programming workshops for	one school	will serve as	consolidate their skills
workshops for	primary students.	year, 1 hour	mentors. They	of basic programming
primary		for each	will guide and	of drone and its
students	No. of our students involved: 10	session	train student	principles in the
	from S1-S5		instructors to	preparation and
			conduct the	conduction of the
	Our students will have to master		workshops	workshops.
	the basic programming of drone			
	and its principles during the			They are also expected
	preparation of workshops. Their			to enhance their
	skills on communication,			communication,
	collaboration and leadership will			collaboration and
	be strengthened.			leadership skills.

b. Teacher training

Activity	Content	Number of	Hired personnel	Expected learning
name		sessions	_	outcomes
		and		
		duration		
Teacher	Teacher training workshops on drone	1 session,	- To hire	Teachers can
training	will be organised for teachers of STEM-	3 hours	professional trainer	understand the
workshops	related subjects. The content includes:		for the drone	science behind of the
on drone	1. The science of drone and its		workshop who	design of drone and
(3 hours)	relevance to the junior science		should be an	manage to basically
	curriculum		employee of a drone	control the drone and
	2. The design and control mechanism of		company and has at	master the coding
	drone and its relevance to the Computer		least 2 years of	language of the
	Literacy curriculum		drone instructor	programme of the
	3. Controlling the drone		experience.	drone.
	4. Coding the drone			In terms of pedagogy,
	5. Discussions on the implementation of			teachers acquire ideas
	the drone activity in the curriculum			of how to facilitate
	5. Important points for lesson design			students' learning of
				STEM skills through
				the drone activity in
				the lesson design.
				Also, various panels
				would know how to
				use drone as a hand-
				on tool to enrich/
				motivate/ facilitate
				students' learning in
				their curricula.

с. Е	Equipment			
	Details of equipment to be procured	Contribution to fulfilment of the project aim(s) and if		
		applicable, the expected utilization rate		
1.	30 notebook computers	For drone and micro-computer programming learning		
2.	10 mini-3-D printers	For learning and teaching activities		
3.	1 "green screen"	For learning and teaching activities (video production)		
4.	2 desktop computers	For learning and teaching activities (video editing)		
5.	1 projector	For conducting lessons		
6.	Hands-on tools	For learning and teaching activities		
7.	30 tablet computers	For learning and teaching activities		
8.	30 mini-drones	For learning and teaching activities		

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	To change the Computer Room to "Computer Roo	m cum STEM Room".
	a) 電工程	In view of students' interests and the needs to develop their
	b) 天花工程	STEM attributes as well as generic skills, our school are
	c) 地台工程	planning to design learning activities and workshops which
	d) 牆身飾面工程	will be incorporated both within and out of the curriculum.
	e) 油漆工程	activities and workshops a room with appropriate setting is
	f) 傢俬	needed. It should contain storage spaces for equipment,
	g) 其他-窗簾等	working desks for hands-on tasks, and flexible tables and
	h) 電工程	chairs for group discussions or works or other activities.
	i) 天花工程	However, the current computer room in our school comprises of arrays of fixed computer benches, which can
		hardly serve the above purposes. Therefore, our school is
		planning to refurbish the computer room to a Computer
		Room cum STEM Room.
		The proposed work will help well optimise the utilisation of
		space in the current Computer Room. It will be converted
		into a "Computer Room cum STEM Room". The new
		settings will facilitate group discussions among students,
		hands-on tasks, use of electronic devices such as tablets and
		notebook computers and display of students' work.

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

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 (micro-computer programming, video editing, 3-D design and printing, drone programming) for S1-S2. They will be provided with opportunities to apply what they have learnt to solve the real-life problems and show their creativity. Their learning will be consolidated and their collaboration and problem-solving skills will be enhanced.

f. Other activities: Not applicable

2.8 Budget

Total Grant Sought: HK\$1,081,900

Dudget	Breakdown for the budget items			
Categories	Item	Amount (HK\$)	Justifications	
a. Staff	Not applicable			
b. Service	Teacher drone workshop (3 hours)	2,640	\$880 / hour	
c. Equipment	30 notebook computers	150,000	\$5,000@ for learning activities that requires a computing device for writing programme or other use each student is expected to use one notebook computer	
	10 mini-3D printers	20,000	\$2,000@ for learning activities involving 3-D printing	
	1 "green screen"	3,000	for learning activities "Video editing"	
	2 high performance desktop computers with screen	32,000	 \$16,000@ for learning activities involving high resolution (4K) video editing 4K video editing is CPU and GPU intensive task. Moreover, a 4K screen is also required. To edit a reasonable length of video, the Hard Drive should provide plenty of space and RAM size should be enough to run the video editing software. Requirement: CPU must be Intel Core i5 or equivalent Screen Resolution must be 4K or above Graphic Card must be Radeon Pro 560X or equivalent Hard Drive must be 512 GB or above RAM must be 16 GB or above 	
	3 projectors with screen	30,000	for students when carrying out hands- on tasks or group discussions or other activities, they can view to the projector screen easily in any position in the Computer Room cum STEM Room	
	Hands-on tools	10,000	for learning activities that require hands-on experience	
	30 tablet computers	105,000	\$3,500@ for learning activities that require tablet computers each student is expected to use one tablet computer	
	30 mini-drones	33,000	\$1,100@ for learning activities that require drone each student is expected to use one mini-drone	

e. Contingency	Contingency fee for Works	40,700	(c x 10%)
	Audit fee	15,000	
	Miscellaneous	5,091	
e. General expenses	printers, drone	10,000	
a Canaral	囡康丄框 Consuming motorials for 2 D	20,000	for lighting adjustment purpose
	油漆工程	35,000	
	牆身飾面工程	100,000	 Install graffiti wall in order to facilitate students' group discussion, designing layout plan and planning for assignment progress other wall decorations
	地台工程	55,000	Relocate power and network lines under the floor stage in order to have spacious and flexible area for conducting learning activities
	天花工程	55,000	
	電工程	100,000	Relocate light and power sockets in order to have spacious area for conducting learning activities
	清拆	35,000	
	清垃圾	5,000	
c. Works	清潔	2,000	
	傢俬	200,000	 a half-height cabinet a full-height cabinet a set of cupboard for storing and showcasing students' work a long bench for hands-on works a storage frame for putting hands-on tools 35 sets of movable desk and chair
			To toilor malea

3. Expected Project Outcomes

3.1	Deliverables / outcomes	Learning and teaching materials Resource package
		⊠ Others
		- Learning and teaching resources, including micro-computer programming,
		video editing, 3-D design and printing, drone programming for junior
		secondary students
		- Students' work
3.2	Positive impact on quality	The project will help the school plan and develop STEM education systematically
	education/ the school's	and nurture students to be learners in the 21st century through the establishment of
	development	the "Computer Room cum STEM Room", curriculum development and teachers'
		development programmes.

3.3 Evaluation

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 involved teachers and students agree that the project helps the school promote STEM education)
- 2. To arouse students' learning interest (success criteria: 80% of the involved 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 involved

teachers and students agree that the project can help enhance students' creativity, collaboration and problemsolving skills)

4. To enhance teachers' professional capacity (80% of the involved 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 of the "Computer Room cum STEM Room" 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 in the school open day (Nov 2020) 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. Report Submission Deadline

Project Management		Financial Management		
Report type and covering period	Submission Date	Report type and covering period	Submission	
			Date	
Progress Report		Interim Financial Report		
01/08/2020 - 31/01/2021	28/02/2021	01/08/2020 - 31/01/2021	28/02/2021	
Progress Report		Interim Financial Report		
01/02/2021 - 31/07/2021	31/08/2021	01/02/2021 - 31/07/2021	31/08/2021	
Final Project Report		Final Financial Report		
01/08/2020 - 31/12/2021	31/03/2022	01/08/2021 - 31/12/2021	31/03/2022	

5. Asset Usage Plan

Category	Items	No. of Units	Total Cost	Deployment plan
	Notebook	30	\$150,000	Upon the project completion, we will continue to use the procured equipment to conduct student activities in the future.
	Mini-3D printer	10	\$20,000	
	Green screen	1	\$3,000	
	Desktop computer with monitor	2	\$32,000	
	Projector with screen	3	\$30,000	
	Hands-on tools	-	\$10,000	
	Tablet computer	30	\$105,000	
	Mini-drone	30	\$33,000	
Equipment	Furniture -a half-height cabinet -a full-height cabinet -a set of cupboard for storing and showcasing students' work -a long bench for hands-on works -a storage frame for putting hands- on tools -35 sets of movable desk and chair	-	\$200,000	

6. Declaration

- When purchasing service or equipment, the school will ensure that all procurement of goods and services is conducted on an open, fair and competitive basis with measures taken to avoid conflict of interests in the procurement process.
- In relation to the equipment to be purchased, the school will observe relevant safety guidelines and state the necessary measures to be taken to ensure the safety of students and school personnel.
- The school understands that the expenditure items funded by the QEF are one-off. The school will bear the recurrent expenditure, such as the material costs and consumables from 3D printing, etc. that may arise after the end of the project.
- In revamping the computer room into a Computer Room cum STEM Room, the school has already sought the acknowledgement from the respective Regional Education Office before commencement.
- The school will bear all possible consequences resulted from the related school premises alteration/improvement works, including but not limited to the provision of relevant grants, repair works, etc.