Quality Education Fund
Application with Grant Sought Not Exceeding $150,000
Application Form --- Part II: Project Proposal

Project Title	Project Number
Facilitating Creative Science with New Technologies	2013/0448 (Revised)

Basic Information

Name of School / Organisation / Individual

Queen's College

Beneficiaries

(a) Sector: ☐ Pre-primary ☐ Primary ☑ Secondary ☐ Special *(Please tick)*

(b) Students: 144 (2014-15), 288 (2015-16) (in number)* and
4 S.1 classes(2014-15), 4 S.1 classes + 4 S.2 classes(2015-16) (class level/age)*

(c) Teachers: 4 (in number)*

(d) Parents: 0 (in number)*

(e) Participating Schools (excluding applicant school): 0 (in number and types)

(f) Others (please specify): _____

Proposal

(I) Project Needs

(a) Please state the aims of the project in clear and concise terms.

Our school is going to launch a curriculum reform in Junior Science. The Integrated Science would be diverted into core science curriculum and creative science curriculum. In core science curriculum, the teaching schedule would be in same pace with syllabuses suggested by The Curriculum Development Council. The creative science curriculum would focus on training science appreciation, skills in science, life skills and the introduction of science trend and new technology.

It is our mission to provide students with practical based science education aiming at excellence in applying learnt materials in daily life, with adequate life skills, catching up with future challenges, future trends, future technology and future mindset, whereby they can achieve self-fulfillment and development in science throughout their lives.

- To nurture in students a love of science;
- To develop students' minds and inculcate in them a strong sense of observation, spirit in science study, discipline in laboratory and catch up with the real world

science technology development;

- To produce in our students a high level of science skills development in preparation for further scientific study;
- To provide students with a balanced range of scientific activities in order to open their eyesight on the new science trend and to make them aware of the importance of scientific development;
- To cultivate students' creative talents and appreciation of aesthetics in science;

All the above can be achieved in the Creative Science programme which provides them opportunities to make use of their creativities in practical daily life issues.

(b)

(i) What are the areas of the needs and priorities of the school?

☑ Enhance learning and teaching to facilitate students' knowledge on subjects / learning areas / generic skills development

(ii) Please give background information to justify the demonstrated needs as mentioned in (b)(i).

☑ School development plan: To cohere with the school's major concern – Enhancing learning and teaching effectiveness. To promote e-learning which is one of the key areas in enhancing learning and teaching effectiveness. This programme can echo with the school's development plan by promoting teaching and learning of science technology in junior secondary level.

☑ Literature review summary:
Invention is essential for human
Invention and creativity
Chinese education being criticized of lacking creativity enhancement
Its important to go upstream

☑ Assessments on students' performance:
Students participated in the World Class Arena Autumn 2013 has scored lower than average in Problem-solving test but higher than average in Mathematics test. The evaluation of the test suggested students who scored relative low marks mainly because they lack variety of ways to tackle a problem which also shows a lack of creativity in dealing with problems and real-life difficulties. In light of this, it is necessary for the school to enhance learning and teaching to facilitate students in 2 of the 9 generic skills – Problem-solving and creativity.

(c) Please elaborate the innovative ideas or new practices to enhance, adapt, complement and/or supplement the existing practices of the school.

Using new technologies to solve problems of everyday life: The programme involves the operation of different technologies, eg. Use of data logger in measurement, robotic programming, sensors, 3D design and 3D printing, which facilitate students creating and inventing new items for practical use. This also ensures students of this generation getting in pace with the rapid development of technology. This part involves developing IT skills.

Building the new outdoor laboratory: The building of the outdoor laboratory enables students to perform solar-related experiment. Students can learn more about solar energy and carry out investigation related to natural resources eg. sunlight. This widens the scope of Science and laboratory experience.

The invention of new items: It is an experimental-based and investigation-based programme which stimulates students to apply their knowledge learnt and new technology mastered to solve daily life problems. Before the invention, students have to first think critically the problems in real life situations. This enhances the generic skill – critical thinking. To have students think of different ways to cope with the problems also enhances generic skills – problem-solving and creativity.
Students in each class would be divided into 8 groups (4-5 students a group). They will carry out scientific investigation according to their observation and curiosity. In addition, seminars and workshops will be prepared for students such as talk on solar cells and courses offered by other organizations. Furthermore, a planned schedule on creative science will give students updated science technology and information which may give stimulation on their projects or invention. The scheme of work for creative science is attached in Annex 1.
Subject teachers will facilitate students' investigation through providing stimulation, opinions and support whenever necessary. They will also monitor the progress of students' work.

Assessment: Assessment will be in the form of project of which the topic is more flexible than summative and formative assessment of the usual Science lessons. Students can choose their own topic and demonstrate in various forms, such as essay format, product format or even handing in semi-products as assessment product. This new type of assessment breaks the boundary of students' performance and gives opportunity and space for them to develop their creativity. Teachers will act as a facilitator to give comments.

The programme involves new technology to be introduced to junior form students and the new assessment format also allows students to think out of the box.

(II) Project Feasibility

(a) Please describe the design of the project, including:

(i) Approach/Design/Activity

The programme adopts new technologies-in-education strategy and uses an outdoor laboratory to facilitate students' Science learning by widening their horizon and encouraging them to think out of the box.

Currently, we have 5 Integrated Science lessons in S.1 and 4 Integrated Science lessons in S.2. After the programme is implemented, 1 lesson will be allocated to implementing the Creative Science lesson. The S.1 programme will involve learning of new technology namely Robotic Tech 1 and sensors which is interesting and easier to handle. Students are required to finish a long-term (one-year) project by making use of the new technology learnt in practical use as the assessment.

For S.2 programme, students will further leant more advanced technology, namely Robotic Tech 2 and 3D design and printing techniques. Combining what they have learnt in these two years, students will be able to create more sophisticated products or theories (if the product is unable to be built) for practical use.

(ii) Key Implementation Details

Project period: **12/2014** (month/year) to **11/2016** (month/year)

Month / Year	**Content / Activity / Event**	**Target Beneficiary/ Participants**
Year 2014 – 2015		
12/2014 – 1/2015	Robotic Tech 1 – transportation of objects/ setting of computer programme	S.1 – 144 students
1-2/2015	Daffodil experiment – investigation of sunlight exposure's impact on Daffodils	S.1 – 144 students
2-4/ 2015	Sensor – light and sound sensor	S.1 – 144 students
5-7/2015	Scientific Investigation – The invention of new items	S.1 – 144 students
Year 2015 - 2016		
9-11/2015	Robotic Tech 1 – transportation of objects/ setting of computer programme	S.1 – 144 students
12/2015 – 1/2016	Daffodil experiment – investigation of sunlight exposure's impact on Daffodils	S.1 – 144 students
1-4/2016	Sensor – light and sound sensor	S.1 – 144 students
9-11/2015	Robotic Tech 2 – programme robots to finish specific task (moving to specific place, turning, picking up of objects…)	S.2 – 144 students
1-4/2016	3D design and printing – designing a 3D product with the help of computer and print their products	S.2 – 144 students
5-7/2016	Scientific Investigation – The invention of new items	S.2 – 144 students
8-11/2016	Evaluation	S.2 – 144 students

(b) Please explain the extent of teachers' and/or principal's involvement and their roles in the project.

(i) Number of teachers involved and degree of input (time, types, etc.):
4-8 teachers will be involved and are expected to spend 3-4 hours per cycle for lesson preparation.

(ii) Roles of teachers in the project: (*Please tick the appropriate box(es).)*

☐ Leader ☐ Co-ordinator

☑ Developer ☐ Service recipient

☐ Others (please specify) _____

(c) Please provide the budget of the project and justify the major items involved.
Grant Sought: HK$ 140 000

Budget item	Expenditure Detail		Justification
	Item	**Amount ($)**	
i) Equipment	School Package (Including 10 sets, 10 Transformers, 1 licence and 1 Activity Pack	$47,056	- to facilitate simpler and easy-to-build robots with software. - sensors and parts for building robots are included. - is relatively easier to handle compared with other sets available in the market. It can serve as a foundation to stimulate students' motivation and creativity. - to have enough equipment for a class
	Add-on equipment set	$4,280 x 2 = 8,560	
	Notebook (10)	$ 4,500 x 10 = $45,000	- to facilitate programme used in data logger system in laboratory. - to facilitate robotic programming and sensors. - portable notebook would facilitate students doing measurement and writing programme at the indoor / outdoor laboratory.
	3D printer and printing materials	$20,000	- to facilitate 3D design and printing
	Setting up of outdoor laboratory (Lab desk and chairs/ Lab utensils/ cabinets)	$14,384	- to set up the outdoor laboratory
ii) General expenses	Audit Fee	$5,000	--
	Total Grant Sought ($):	140,000	

(d) **Asset Usage Plan**

Category	Item / Description	No. of Units	Total Cost ($)	Proposed Plan for Deployment
Computer hardware	Notebooks	10	45,000	For use by school – IS department (Creative Science)
Others	School Package	1	47,056	

Others	Add-on equipment set	2	8,560	
	3D printer	1	20,000	

(III) Expected Project Outcomes

(i) Please describe how to evaluate the effectiveness of the project;

☑ Observation:
To see if students have a change in attitude towards learning Science, since one major aim of the programme is to nurture students a love of science.
To observe if students build an ability to handle technology and to make practical use out of them.

☑ Focused group interviews:
4 groups of 4-5 students will be interviewed after the programme to get feedback of the programme. Students will be interviewed about the benefits of the programme as well as how the programme can be improved. Amendment will be made accordingly.

☑ Pre- and post-activity surveys:
Pre and post-programme surveys will be given out to gain a general picture of how students' attitude change and to check the ability differences on handling the new technologies.

And (ii) Please state the project deliverables or outcomes.

☑ Learning and teaching materials for (i) programming, (ii) experiment and (iii) self-invention. Each set includes teaching schedule, teaching plans, lesson plans and teaching materials eg. worksheets and experiment notes.

☑ Resource package for (i) programming, (ii) experiment and (iii) self-invention. Each package including students' sample and PowerPoint on teaching

(IV) Report Submission Schedule

My school commit(s) to submit proper reports in strict accordance with the following schedule :

Project Management		**Financial Management**	
Type of Report and covering period	**Report due day**	**Type of Report and covering period**	**Report due day**
Progress Report 1/12/2014 - 30/11/2015	31/12/2015	Interim Financial Report 1/12/2014 - 30/11/2015	31/12/2015
Final Report 1/12/2014 - 30/11/2016	28/2/2017	Final Financial Report 1/12/2015 - 30/11/2016	28/2/2017

Annex 1

QUEEN'S COLLEGE S1 INTEGRATED SCIENCE 2014 -15 SCHEME OF WORK

Cycle	Date	*Core Topics – 4 lessons*	*Experiments/Assignments*	*Teaching Aids*	*Creative Science – 1 lesson*
1	SEPT 3 SEPT 11	Laboratory arrangement Laboratory regulation Laboratory safety		ETV: Laboratory safety	Life skills - Lighting a match - Light a candle
2	SEPT 12 SEPT 19	**Unit 1 Introducing Science** **Chapter 1 Beginning Science** - Branches of Science - Scientists - Scientific discoveries and inventions - Apparatus	Web search on the biography of famous scientists. **(e-learning)**	ETV: The scientific method	Basic laboratory skills (Be a Scientist) - Using the apparatus
3	SEPT 22 SEPT 29	- Uses of Bunsen burner - **Scientific investigation** - Limitations of Science			Basic laboratory skills (Be a Scientist) - Transferring solution and mixing solution - Observation
4	SEPT 30 OCT 9	Chapter 2 Working in the Science Laboratory Measurements - SI Units - Instruments - **Errors in measurements** - Measurement in length, volume, weight, time and temperature	2.5 Measuring length 2.6 Using a measuring cylinder to measure volume (I) 2.7 Using a measuring cylinder to measure volume (II) 2.8 Measuring weight 2.9 Measuring pulse rate 2.10 Measuring time 2.11 Measuring temperature		Talk on solar energy – deliver by QC old boy from HKU

Schedule 1 P. 1 1

5	OCT 10 OCT 17	Chapter 3 Conducting a scientific investigation - Controlled variables - Independent variables - Dependent variables - Fair tests		ETV: A fair test	Daily Scientific Investigation Strength of tissue paper (Worksheet provided)
6	OCT 20 OCT 27	**Unit 2 Studying Living Things** Chapter 4 Looking at Living Things - Living things vs non-living things - Seven characteristics of living things	4.1 Observing living and non-living things 4.2 Observing variations in humans	ETV: The living world	Making their own solar cell car and solar cell car race
7	OCT 28 NOV 5	Chapter 5 Sorting Things into Groups - Simple classification - Classification of animals and plants	Observation of animal specimens Observation of plant specimens	ETV: Grouping and classifying things	Introduction of new trend technology: eg. Data logger, 3D printers, Robot, light sensor, colour sensors and other sensors
8	NOV 6 NOV18	5.3 Making use of a key Chapter 6 Endangered Species -What are endangered species? - Causes and protection to endangered species.		ETV: Endangered species	Observation on the plants in school campus with the help of QR code.(e-learning)
9	NOV 19 NOV 28	**Unit 3 Cells & Human Reproduction** Chapter 7 Cells as the Basic Units of Living Things - Plant cells and animal cells - Cell division and growth	7.1 Looking at a microscope 7.2 Using a microscope 7.3 Observing ox eye cells with a microscope 7.4 Observing onion skin cells with a microscope	ETV: The world of the microscope	Development of microscope Hand lens → Double Hand lens → Simple microscope

10	DEC 1 DEC 8	Chapter 8 Reproduction – the birth of new life 8.1 Asexual and sexual reproduction 8.2 Reproduction in Humans		ETV: Sex and reproduction	Measurement by using data logger, eg. Temperature and pressure
11	DEC 9 JAN 2	8.3 Heredity Chapter 9 Growing up 9.1 Puberty 9.3 Family planning 9.4 Issues related to human reproduction		ETV: Puberty	Scientific investigation(Outside laboratory) eg. Growing of Chinese Narsissus(水仙花) in different conditions
12	JAN 5 JAN 22	**Revision**			
12-14		**Half-yearly Examination**			
14		**Discussion of Exam paper**			

Cycle	Date	*Core Topics – 4 lessons*	*Experiments/Assignments*	*Teaching Aids*	*Creative Science – 1 lesson*
14-15	JAN 26 FEB 4	**Unit 4 Using Energy** Chapter 10 Forms of energy and energy changes	10.1 Energy conversions 10.2 Energy conversions in motors and generators		Scientific investigation(Outside laboratory) eg. Growing of Chinese Narsissus(水仙花) in different conditions
16	FEB 5 FEB 12	Chapter 11 Our energy sources	11.1 How is electricity generated? 11.2 Using wind to generate electricity 11.3 Using flowing water to generate electricity	ETV: Energy sources in everyday life	Introduction to robotic programmes:
17	FEB 13 MAR 4	Chapter 12 Issues related to the use of energy			Application in Robot

18	MAR 5 MAR 12	**Unit 5 Water and Us** Chapter 13 Making water clean 13.1 The need for clean water 13.2 Removing impurities from water A. Impurities in natural water B. Methods for removing impuritie	13.1 What impurities are present in natural water? 13.2 Using sedimentation to purify water 13.3 Using filtration to purify water		Introduction of sensors: light sensor, colour sensor and sound sensor.
19	MAR 16 MAR 23	13.2 Removing impurities from water B. Methods for removing impurities 13.3 The water treatment process	13.4 Effect of chlorine on micro-organisms in water 13.5 Evaporate filtered water to dryness 13.6 Using distillation to purify muddy pond water	ETV: Drinking water treatment	Introduction to sensors used in robotic programmes:
20	MAR 24 MAR 31	Chapter 14 The Water Cycle Chapter 15 Water shortage and Pollution (Optional)	14.1 Making "rain"	ETV: Water pollution	Application in the use of sensor
21	APR 1 APR 17	Chapter 16 Water as a wonderful solvent	16.1 Dissolving substances in water 16.2 Growing crystal	ETV: Solutions and solvents	Scientific Investigation – self design (Decide topics)
22	APR 21 APR 28	**Unit 6 Unlocking the mysteries of matter** Chapter 17 Matter and its properties	17.1 What are the properties of liquids and gases? 17.2 Finding the melting point of ice and boiling point of water		Scientific Investigation – self design (Collection of data)
23	APR 29 MAY 7	Chapter 18 The building blocks of matter	18.1 Where does the liquid go? 18.2 Mixing gases 18.3 Perfume in a balloon 18.4 Mixing liquids 18.5 Brownian motion	ETV: The particle model of matter	Scientific Investigation – self design (Collection of data, analysis of data)

24	MAY 8 MAY15	Chapter 19 Explaining the properties of matter 19.1 Explaining the properties of gases	19.1 Measuring gas pressure 19.2 How large is the air pressure?		Project presentation (Peer learning -- Sharing findings)
25	MAY 18 MAY 27	19.2 Explaining what happens when matter is heated and cooled	19.3 Heating a solid, a liquid and a gas 19.4 What happens when a bimetallic strip is heated?		Project presentation (Peer learning -- Sharing findings)
26	MAY 28 JUN 4	19.2 Explaining some phenomena related to density	19.5 Finding the densities of objects 19.6 Exploring floating and sinking 19.7 Why can a ship float on water? 19.8 Why can hot air balloon rise in air?	ETV: The particle model of matter	Presentation and Evaluation (Consolidation of knowledge)
27	JUN 5 JUN 9	**Revision**			**Evaluation**
27	JUN 10 JUN24	**Half-yearly Examination**			
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- Each class would have a double lesson for designing and carrying out their own laboratory research (LWL lesson).
- Each class would have one opportunity to participate in bought course from Science Park.