優質教育基金
Quality Education Fund

M:FR/E

Final Report of Project	**Project No. : 2007/0471**

Part A

Project Title: Development of Learning and Teaching Resources in 'Astronomy and Space Science' Elective Module in New Senior Secondary Physics Curriculum

Name of Organization/School: Munsang College (Hong Kong Island)

Project Period: From 9/2008 to 8/2010

Part B

*Please read the **Guidelines to Completion of Final Report of Quality Education Fund Projects** before completing this part of the report.*

Please use separate A4-size sheets to provide an overall report with regard to the following aspects:

1. Attainment of objectives
2. Project impact on learning effectiveness, professional development and school development
3. Cost-effectiveness – a self-evaluation against clear indicators and measures
4. Deliverables and modes of dissemination; responses to dissemination
5. Activity list
6. Difficulties encountered and solutions adopted

** Final Report of Project prior to the 8th call should be signed by the supervisor of the school/the head of the organization or the one who signed the Quality Education Fund Agreement for allocation of grant on behalf of the organization.*

** Final Report of Project under the 8th and subsequent calls should be submitted via "Electronic Project Management System" (EPMS). Once submitted, these reports are regarded as already endorsed by the supervisor of the school/the head of the organization or the one who signed the Quality Education Fund Agreement for allocation of grant on behalf of the organization.*

This form/guidelines can be downloaded from the QEF webpage at http://qef.org.hk.

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1. Attainment of Objectives

Objective statement	Activities related to the objective	Extent of attainment of the objective	Evidence or indicators of having achieved the objective	Reasons for not being able to achieve the objective, if applicable
Experiment with six investigative studies that can be used in NSS physics.	Activity 1	Fully achieved	At least 30 student researchers were recruited.	
	Activities 2-12	Fully achieved	All student researchers passed all tests.	
	Activities 14 & 27	Fully achieved	Evaluation meetings were carried out with minutes recording the main conclusions.	
	Activities 13, 15-20, 25, 26	Fully achieved	1 PowerPoint presentation and 1 report were produced for each investigative study.	
Students develop generic skills through investigative studies	Activities 13, 15-20, 25, 26	Fully achieved	Students improved the following skills: problem-solving skills, communication skills, data processing skills, use of information technology, the ability to collaborate effectively with peers, and self-directed learning skills.	
	Activity 25	Fully achieved	Over 80% of the audience rated the presentation skills of the student researchers as good.	
	Activity 28	Fully achieved	80% of the student researchers agreed that sidewalk astronomy improved their communication skills.	
Students and the public are given more opportunities to gain a deeper appreciation about the wonders of the universe.	Activities 21-24,31	75% achieved	The following activities will be held in school: 1. At least 1 lunar observation activity 2. At least 3 solar observation activities	Due to unstable weather, the lunar observation activity could only be held after the project period, on 17/9/2010.
	Activities 21-24	Fully achieved	80% of the students joining the school astronomy activities agreed that the guided observations deepened their appreciation of the views in telescopes.	
	Activity 25	Fully achieved	Over 80% of the audience agreed that they gained knowledge and interest in astronomy.	
	Activity 28, 29	Fully achieved	At least 2 sidewalk astronomy sessions were organized.	Only one sidewalk astronomy session could be arranged within the project period due to unstable weather. The

				other session had already been completed shortly after the project ended, on 11/9/2010.
	Activity 30	Fully achieved	Website was set up by 8/2010.	

2. Project Impact on

(a) broadening students'/teachers' horizons

The investigative studies allowed the students to make first-hand scientific measurements on celestial objects and find out important facts about them, rather than merely be visually amazed by the telescopic views of the celestial objects. Outreach activities in school in solar observation allowed all students and teachers in school to see the sun as they had never seen before. They were stunned by a sun that is dynamic, violent, and beautiful. According to the favorable evaluation results, members of the school have gained a deeper appreciation about the wonders of the universe, as well as gaining knowledge and interest in astronomy.

(b) increasing students'/teachers' sense of achievement

Student researchers used simple equipment and techniques to make important measurements about the universe and taking good quality astronomy pictures, including repeating some historical experiments like measuring the rotational rate of the sun and finding the distance between the moon and the earth. When they were allowed to share their knowledge in front of their peers, teachers and the public, they gained a sense of achievement further.

Not all teachers participating in the project had a strong background in astronomy initially and it was natural to feel frustrated at the beginning. Through guiding the students in unusual investigative studies, the teachers found out first hand that that it was really possible to learn with the students and be successful facilitators in the process.

(c) fostering students' development in their potential and specific abilities

The six investigative studies in the project cover a wide range of skills that can suit students of different abilities and interests, such as use of various instruments and software, data-search on the web and oral presentations. For example, those interested in instrumentation undertook projects that involved more long-term observation and helped more in setting up the instruments, while those interested in data-processing and reading can help at a later stage of the investigations after the data had been collected. Those interested in communicating with others took more important roles in sharing their knowledge with their peers and the public during outreach programmes.

(d) training students to better meet social demands

The six investigative studies involve developing skills in reading, data-search on the web, communication, problem-solving, collaboration and the use of information technology. These are generic skills that are very important in the modern world.

(e) increasing training opportunities for teachers and enhancing their professional development

Guiding investigative studies is a new challenge to teachers in the NSS curriculum. Through undertaking this project, teachers gained invaluable experience in this important component. This included learning how much advice to give to the students, when to allow the students to think for themselves, and the common mistakes made by the students in presentations.

(f) improving learning atmosphere

Throughout the project, students made better use of their spare time in undertaking about the investigations and understanding the importance of planning ahead and solving problems together. This helped to enhance the learning atmosphere of the students involved. For solar projects, this also affected their peers to a certain extent, because many students liked to gather around during data-collection process and they also enjoyed observing the sun. Solar outreach activities also provided a more chance for the students to make better use of their lunch time as all members of the school could enjoy in learning about the current activity of the sun by observing.

(g) fostering team spirit and enhancing the overall image of the school

The team spirit of the physics department had been enhanced through the project through many formal and informal discussions about the investigations and sharing of ideas in tackling problems in guiding students. For the whole school, the solar observation outreach activities provided unique and enjoyable experience for all teachers and students in school, enhancing the sense of belonging among all members of the school. Public outreach programmes also helped to enhance the overall image of the school.

(h) inducing collaboration with other schools / professional organizations.

Informal collaborations had already taken place with other external organizations. For example, on 6-6-2009, some solar equipment has been used in teacher training session in Ho Koon Nature Education Cum Astronomical Centre. In September 2010, three sharing sessions had been organized for the public on solar astronomy. Both events were undertaken with the help of student researchers in the project.

3. Cost-effectiveness

(a) utilization of available resources

The main proportion of the fund is used for purchasing solar observation equipment. Although they are expensive, these are used very frequently for casual observation during lunch time whenever the weather is sunny. The only night-time observation equipment, the 12 inch Dobsonian telescope, is the most cost-effective design telescope and is very easy to use for students. It has no electronic part and is designed for heavy duty. It is now the main observational instrument for star-gazing activities in school. Overall, the equipment purchased have been used fully to ensure that a good cost-effectiveness is achieved.

(b) unit cost for the direct beneficiaries

The direct beneficiaries are all the teachers and students in our school, which is about 1150. The total expenditure of the project was $94,240. Therefore, the unit cost is about $82.

(c) sustainability of the learning programme and materials developed

All equipment purchased is non-consumables. Therefore, the project can be continued indefinitely without further funding. Furthermore, the equipment are designed to provide lifetime enjoyment with little maintenance problems. The materials developed, which can be downloaded from the project website, can be used for reference for teachers in Hong Kong.

(d) expenditure items which require no injection of resources when the project is replicated by other schools

All equipment must be purchased when the project is replicated by other schools.

(e) alternative approaches for equivalent benefits at less cost

For most purposes, telescopes and filter of smaller aperture will give almost the same results but with much less

cost. The difference will only become apparent when very high magnification photography and viewing are performed. Furthermore, the solar filter LS100F can be omitted if the school does not have a telescope for it to mount on. The main differences are that students will need to queue up for a longer period of time for viewing since there will only be one solar setup for viewing rather than two, and one can only do photography or viewing, but not doing both together, at the same time.

4. Deliverables and Modes of Dissemination

Table 3: Dissemination Value of Project Deliverables

Item description (e.g. type, title, quantity, etc.)	Evaluation of the quality and dissemination value of the item	Dissemination activities conducted (e.g. mode, date, etc.) and responses	Is it worthwhile and feasible for the item to be widely disseminated by the QEF? If yes, please suggest the mode(s) of dissemination.
Documents on how to carry out six investigative studies, the difficulties in guiding students and their potential solutions.	The website allowed easy download of all the relevant documents. Given the hardware, anyone can repeat the project.	Content was uploaded to the project website on 31/8/2010. The URL of the website is: http://www.imsc.edu.hk/pages/astronomy/investigations.htm	
Six written reports for the six investigative studies	The website allowed easy download of all the relevant documents. Response was positive in general in the Hong Kong Space Museum seminar series.	Content has been uploaded to the project website on 31/8/2010. Some contents were used in the 'Amateur Solar Observation and Photography' seminar series in Hong Kong Space Museum in September 2010. About 150 people attended the seminars.	
A project website	The website has a simple, user-friendly designed.	The website was uploaded on 31/8/2010.	

(a) Elements/experiences contributing to the success of the project

The dedication of the teachers and the students contributed to the success of the project. Although not all teachers involved in the investigations were knowledgeable in astronomy initially, they were determined to learn and willing to spend a lot of time to meet the student researchers for discussion. They also had high expectation on the students and were not afraid to demand them to achieve excellence. Such attitude made the students take the investigations seriously, and they were willing to challenge themselves in various unusual tasks. In particular, those participating in more long-term data collection investigations (e.g. Investigation studies 1 and 3) showed exceptional determination and perseverance.

(b) Feasibility of continuing the project should also be given.

The feasibility of the investigative studies for NSS physics curriculum has been proven in the project. Since all equipment purchased can be used indefinitely, these investigations can be repeated in the future to benefit many generations of students.

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5. Activity List

Types of activities *(e.g. seminar, performance, etc.)*	**Brief description** *(e.g. date, theme, venue, etc.)*	**No. of participants**			**Feedback from participants**
		teachers	students	others	
Astronomy seminars, workshops and star-gazing activities for recruiting student researchers (Activity 1)	10/10/2008, 17/10/2008. 24/10/2008, 31/10/2008, 7/11/2008 3:45pm-5pm Physics Laboratory 10/10/2008 6pm-9pm Roof		30 30 14 16 30 24		Students were interested in the activities and all agreed to participate in the investigative studies that followed.
Workshop on the use of astronomy software 'Registax'. (Activity 2)	14/11/2008 3:45pm-5pm Computer Room Room 505		29		N/A
Workshop on the use of 'Photoshop CS3' in photo-processing (Activity 3)	9/1/2009 3:45pm-5pm iMac Lab Room 313		30		N/A
Star-gazing night with practice on the use of instruments purchased in QEF. (Activity 4)	9/1/2009 6pm-9pm Roof		28		N/A
Workshop on the use of photo-stitching software 'iMerge' (Activity 5)	16/1/2009 3:45pm-5pm Computer Room Room 505		30		N/A
Star-gazing night with practice on the use of instruments purchased in QEF. (Activity 6)	16/1/2009 6pm-9pm School Roof		30		N/A
Workshop on the use of instruments purchased in QEF. (Activity 7)	23/2/2009 3:45pm-5pm Physics Laboratory		29		N/A
Test to evaluate students' ability to use the equipment purchased in QEF. (Activity 8)	27/2/2009 3:45pm-5pm Physics Laboratory		30		All students passed the test.

Workshop on the use of 'Photoshop CS3' in advanced photo-processing. (Activity 9)	13/3/2009 3:45pm-5pm iMac Lab Room 313		30		N/A
Workshop on the use of 'Photoshop CS3' in advanced photo-processing. (Activity 10)	18/4/2009 3:45pm-5pm iMac Lab Room 313		30		N/A
Talk on solar and moon observation (Activity 11)	25/4/2009 3:45pm-5pm Physics Laboratory Room 614		30		N/A
Test to evaluate students' ability in using 'Photoshop CS3' (Activity 12)	8/5/2009 3:45pm-5pm iMac Lab Room 313		30		All students passed the test.
Meetings between student researchers and supervising teachers (Activity 13)	9/2009 Various times and venues		30		Each student researcher was able to reflect on how to improve their communication skills.
Teacher evaluation meeting (Activity 14)	26/10/2009 1:40pm-2:05pm Staffroom B	3			The main conclusions were recorded in a minute.
1. Presentation of investigation plans 2. Interviews with student researchers to reflect on how to improve their communication skills. (Activity 15)	23/10/2009 3:50pm-5:30pm Room 614		33		Over 94% of the audience rated the presentation skills of the student researchers as good. Over 100% of the audience agreed that they gained knowledge and interest in astronomy.
Data collection for investigative study 1 (Activity 16)	25/10/2009-5/11/2009 Various times North Point and Sai Wan Ho		2		Data collected successfully
Data collection for investigative study 3 (Activity 17)	4/12/2009 – 5/12/2009 7pm-2am Shek O		2		Data collected successfully
Data collection for investigative study 2 (Activity 18)	28/10/2009 6:30pm-7:30pm North Point		5		Data collected successfully
Data collection for investigative study 6 (Activity 19)	27/10/2009 - 29/10-2009 Outside Room 612		5		Data collected successfully
Data collection for investigative study 4 (Activity 20)	12/5/2009, 15/5/2009, 23/11/2009, 29/10/2009, 8/7/2009, 12/1/2010, 18/1/2010 12:50pm-2:05pm Rooftop or outside Room 612		5		Data collected successfully

Solar outreach programme – observation of sunspots (Activity 21)	13/1/2010 12:50pm-2:05pm Outside Room 612		38		92% of the participants had deepened their appreciation of the views in telescopes.
Solar outreach programme – observation of partial solar eclipse (Activity 22)	15/1/2010 3:30pm-4:50pm School playground		89		89% of the participants had deepened their appreciation of the views in telescopes..
Solar outreach programme – observation of sunspots and filaments (Activity 23)	10/3/2010 12:50pm-2:05pm Outside Room 612		43		88% of the participants had deepened their appreciation of the views in telescopes.
Solar outreach programme – observation of prominence (Activity 24)	18/3/2010 12:50pm-2:05pm Outside Room 612		36		83% of the participants had deepened their appreciation of the views in telescopes.
Presentation of results (Activity 25)	19/3/2010 3:50pm-5:30pm Room 614 20/4/2010 3:50pm-4:20pm Room 614	3	30		94% of the audience rated the presentation skills of the student researchers as good. 100% of the audience agreed that they have gained knowledge and interest in astronomy. Most student researchers had improved their generic skills in various areas: Problem-solving - 93% Communication - 97% Data processing - 83% Use of information technology - 83% Collaboration with peers - 80% Self-directed learning - 83%
Data-collection for investigative study 5 (Activity 26)	26/3/2010 9:30am-11:30am		3		Data collected successfully
Teacher evaluation meeting (Activity 27)	26/4/2010 1:40pm-2:05pm Staffroom B	3			The main conclusions were recorded in a minute.
Sidewalk astronomy – Observation of Venus occultation by moon with the public (Activity 28)	16/5/2010 6:30pm-8:30pm Gold Coast Tuen Mun		18	About 100 public members	83% of the student researchers agreed that sidewalk astronomy had improved their communication skills.
Sidewalk astronomy – solar observation and photography (Activity 29)	11/9/2010 3pm-4:30pm Hong Kong Space Museum		13	About 40 public members	100% of the student researchers agreed that sidewalk astronomy had improved their communication skills.

Development of the project website (Activity 30)	8/2010		3		Website uploaded on 31/8/2010
Lunar outreach programme – observation of the moon (Activity 31)	17/9/2010 6:30pm-9:30pm School Roof		30		93% of the participants had deepened their appreciation of the views in telescopes.

6. Difficulties Encountered and Solutions Adopted

1. Training of students began in 11/2008 rather than 1/2009.

   Since all 30 students who joined the astronomy society activities in October 2008 agreed to participate in this project, enough student researchers for this project had been recruited. Hence it was possible to start the training sessions earlier.

2. Dealing with absentees in training activities

   Training missed by absentee was either later provided by another student researcher who had taken the relevant training, or the absentee was asked to participate in another identical training session at a later time (e.g. Student could choose to participate in star-gazing either on 10/1/2009 or 16/1/2009.)

3. All equipment was purchased by 4/2009 rather than 12/2008.

4. Delay in carrying out the investigations

   Our project utilizes weekly Friday meetings to carry out most of the activities. However, due to the preparation of our school's 10th anniversary open days in 2009, three weekly meetings originally scheduled in March 2009 had to be cancelled. The open days was not planned by the school as the project proposal was submitted in May 2008. As a result, the training of students was delayed by a month, and could only be finished in late April rather than late March.

   After the evaluation of students' performance on 8 May 2009, it was clear that there was little time left for students to discuss their investigation plans before the final examinations. Hence some activities were rescheduled as follows:

Original Time	Rescheduled Time	Activity
4/2009	9/2009	Planning of investigations
5/2009	10/2009	Presentation of investigation plans
6/2009-1/2010	10/2009 – 2/2010	Carrying out investigations

5. Some outreach activities in schools began ahead of schedule.

   Since the organization of astronomy outreach activities depends on catching good weather, we had begun organizing such activities since January 2010 rather than March 2010 stated in the proposal.

6. The topic for investigative study 5 was changed.

   The investigation on sunspot development could not be performed. This was because the study requires good weather on a few consecutive days together with a sunspot with a good size on the sun. Such chance did not occur and so the investigation was changed into observation of the sun in multiple wavelengths, which only requires one day of good weather.

7. A lunar observation activity in school was organized after the project period.

   The weather from January to June 2010 had been unfavorable, therefore it was not possible to find a time when good weather coincided with a time when the moon could be observed after sunset. The school lunar observation activity could only be organized on 17/9/2010 after the project period.

8. One sidewalk astronomy activity was organized after the project period.

   It was difficult to plan a time for sidewalk astronomy in 2010 due to unstable weather before the end of the project period. A session on solar observation was arranged on 11/9/2010 after the project period, co-organized with Hong Kong Space Museum.

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Appendix: Budget Checklist

Budget Items *(Based on Schedule II of Agreement)*	**Approved Budget (a)**	**Actual Expense (b)**	**Change [(b)-(a)]/(a) +/- %**
Equipment	$94,400	$94,240	-0.17%