

Chemists Online – Final Report

1. Attainment of Stated Objectives

1. To enhance students' scientific literacy
2. To develop questioning skills of senior secondary students
3. To increase the exposure of students to university education
4. To serve as an exemplar of school based assessment in chemistry in the NSS education

Table 1 - Attainment of Objectives

| Objective | 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 |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 1 | Three cohorts of enrollments each with a series of seminars. Each seminar is also bundled with online exercises with textual feedback. | Fully achieved | Exercises reflecting knowledge gained from the seminars were graded and counted towards certificates of completion. | |
| 2 | Keyword guided questioning tasks in exercises with feedback. | Fully achieved | Hundreds of questions per seminar were collected and compiled. Feedback was given. | |
| 3 | Live and real-time seminars for students, aided with personal response system. Laboratory tours were arranged. | Fully achieved | Students attended events on university campus. Real-time chatting and a Q&A system were implemented and used. Opinions polling with online and mobile personal response system was implemented. | |
| 4 | Nil | N/A | N/A | The non-practical assignment component of the school based assessment in NSS chemistry was suspended. |

1.1 Completion of Key Tasks of the Project

Table 2 - Completion of Project Key Tasks in Percentage at the end of the reporting period

| | Current accomplishment | Project goal | Percentage of completion |
|-----------------------------------------------|------------------------|--------------|--------------------------|
| Teachers professional training | 10.25 hours | 9 hours | 113.9% |
| Active participating schools recruited | 6 | 6 – 8 | 100% |
| Total schools recruited | 40 | Up to 40 | 100% |
| Students enrolled | 2556 | 1150 | 222.3% |
| Student attendance from participating schools | 434 (max attendance) | 240 | 180.8% |
| Chemists Online seminars organized | 18 | 12 | 150% |

2. Project Impact

The project was very successful. First of all, it widened the horizons and perspectives of students in their knowledge of chemistry. They developed a deeper understanding on the concepts in chemistry by asking questions and engaging discussion with fellow classmates and project staffs. They also realized how the concepts learnt in school can be applied to modern research. Furthermore, on our Facebook group platform, students could explore chemistry in daily life through articles posted by project staffs. They could apply what they learnt from the seminars in daily life. The Facebook group and the discussion board on the learning management system formed the online learning community. Secondly, the project provided students an opportunity to ask questions in person or online, so students became more confident to raise questions in public. In addition, analyzing the questions generated from students revealed that some students were capable to think 'out of the box' to ask novel questions. As most of the questions generated were related to clarification of meaning of chemistry concepts for better understanding of chemistry, the project staff responded to the needs of students by providing answers or links in the discussion forum in the LMS. The use of discussion forum benefited both the able and less able students to enrich their chemistry knowledge, and also served as a strategy to cater for the diversity of participants. Thirdly, since some seminar topics crossed between chemistry and biology or between chemistry and physics, students had chances to understand the inter-disciplinary nature of science and the role of chemistry as the central science. Fourthly, since the project was an interfacing program between secondary schools and universities, some students attended the seminars live at universities and they experienced the teaching style of different faculties. They also had chances to visit the laboratories and see different demonstrations with instruments which were not available in secondary schools. Besides, the learning online management system (LMS) was similar to the one used at the Hong Kong University of Science and Technology, students could experience the LMS at university ahead, which was quite different from that they used in secondary schools. Lastly, three teacher training workshops were arranged to introduce the 6W+IF questioning model and the science keyword questioning model to teachers. Therefore, both students and teachers could benefit some questioning skills from both models. (Further information of the project can be found at <http://elop.ust.hk/access/content/group/b697b7ba-e3dc-47eb-0062-e7a866f484d0/Teachers%20Training%20Workshop/QEF%20Interview%202013c-CK.pptx>)

3. Cost-effectiveness

Table 3 - Budget Checklist

| Budget Items | Approved Budget (a) | Actual Expense (b) | Change [(b)-(a)]/(a) +/- % |
|------------------|------------------------|-----------------------|----------------------------------|
| Staff Cost | 1,008,000.00 | 1,147,814.37 | +13.9% |
| General Expenses | 148,224.00 | 78,751.87 | -46.9% |
| Equipment | 265,000.00 | 224,684.54 | -15.2% |
| Service | 450,800.00 | 345,275.00 | -21.4% |
| Works | 0.00 | 0.00 | - |
| Contingency | 22,976.00 | 0.00 | -100% |

Unit cost of the direct beneficiaries

The sum granted by the QEF to sponsor the project was \$1,895,000 and direct beneficiaries were about 2500 (including students and teaching staff). Thus, the unit cost for each direct beneficiary can be calculated as about \$750. The project was considered to be very cost-effective in providing each student with a series of learning events in a cohort of study.

Sustainability of the learning programme and materials developed

All seminars with supporting materials required 5 DVDs to produce 1 set of self-learning package. 60 sets of self-learning packages were produced and they would be disseminated to the schools that participated in the Chemists Online project, QEF, and EDB. The project could be sustainable by utilizing materials in the DVDs with least additional efforts and resources. These DVDs contained the archive of seminar videos along with related quiz questions, which school teachers could selectively use for various teaching scenarios. The materials in the DVDs would also be used for another project, Chemists Online Self Study Scheme, which was collaborated by the Education Bureau and Hong Kong Virtual University. This Self-Study Scheme attracted more than 5000 students from secondary schools to join, the large enrollment reflects the online seminars and the pre-seminar materials produced meet the needs of chemistry students and teachers.

4. Dissemination of Deliverables and Good Practices

Despite of the online nature of the project, there are some good practices employed. Constant communication with regular email newsletter and Facebook posts helped maintaining contacts with individual participants. Materials were designed in a layered approach from core, supplementary and optional levels. This approach could cater for students learning at different paces and depths of engagement. Furthermore, as an interfacing programme between secondary and tertiary chemical education, the pre-seminar materials (with both English and Cantonese narrations) were carefully designed based on the NSS chemistry curriculum, so as to lay a foundation for the students to attend the seminar as well as to widen their scope in chemistry based on what they have learnt. Questions were also inserted in various parts of the seminar video archive to help students to grasp the main points of seminars. The design of pre-seminar

materials can serve as an exemplar for universities offering public lectures for secondary students. Interim progress reports were sent to individual students and their teacher on a regular basis, which helped students self-monitoring their own progress and maintaining their commitments to the project. Certificates of completion were issued to students to promote their incentives towards completing the project.

Table 4 - 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. |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Workshop Handout (10 pages) | Teachers found inspiring in picking up latest online learning skills. | Distributed to 7 teachers in the teacher training workshop; accessible to all teachers who joined the Chemists Online program online. | N/A |
| Electronic workshop Handout (65 pages) | Teachers found inspiring in picking up latest online learning skills and useful to know about student attitudes towards questioning. | Distributed to 9 teachers in the teacher training workshop; accessible to all teachers who joined the Chemists Online program online. | N/A |
| Workshop Handout (10 pages) | Teachers found inspiring in picking up latest online learning skills and questioning techniques. | Distributed to 12 teachers in the teacher training workshop; accessible to all teachers who joined the Chemists Online program online. | N/A |
| 60 sets DVD (1 set is equivalent to 5 DVDs) | Highly sustainable by reusing the contents in the DVDs for various teaching scenarios. | Distributed to 42 schools that participated in the Chemists Online project, QEF, and EDB. | Yes. QEF can share DVD contents (video and learning activities) with any interested parties. |

5. Activity List

Table 5 - Activity List

| Types of activities | Brief description | No. of participants |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Seminar | Date: 30 May 2011 Topic: Synthetic Polymers in Modern Life Venue: The Chinese University of Hong Kong Speaker: Prof. To NGAI | 212 students |
| Seminar | Date: 30 June 2011 Topic: A Journey to the Structural Determination of Organic Molecules: IR, MS and NMR Spectroscopy Venue: The Hong Kong Polytechnic University Speaker: Dr. Fuk Yee KWONG | 206 students |
| Seminar | Date: 12 August 2011 Topic: Gastronomy Venue: The Hong Kong University of Science and Technology Speaker: Dr. Lam Lung YEUNG | 147 students |
| Seminar | Date: 3 October 2011 Topic: Metals in Biological System Venue: City University of Hong Kong Speaker: Prof. Tai Chu LAU | 152 students |
| Seminar | Date: 1 November 2011 Topic: Conducting Polymers Venue: The University of Hong Kong Speaker: Prof. Wai Kin CHAN | 135 students |
| Seminar | Date: 28 November 2011 Topic: Nanomaterials for Environmental and Energy Applications Venue: The Chinese University of Hong Kong Speaker: Prof. Jimmy Yu | 114 students |
| Seminar | Date: 28 February 2012 Topic: Colour Chemistry Venue: City University of Hong Kong Speaker: Dr. Vincent KO | 517 students |
| Seminar | Date: 26 March 2012 Topic: Electrochemistry Venue: The Hong Kong Polytechnic University Speaker: Prof. Kwok Yin WONG | 493 students |
| Seminar | Date: 23 April 2012 Topic: Molecules for Liquid Crystal Displays Venue: The University of Hong Kong Speaker: Prof. Wai Kin CHAN | 467 students |

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|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Seminar | Date: 10 May 2012 Topic: Water Uptake of Atmospheric Particles: From the Millikan Oil Droplet Experiment to a Blue Sky Venue: The Hong Kon University of Science and Technology Speaker: Prof. Chak Keung CHAN | 449 students |
| Seminar | Date: 9 July 2012 Topic: Science and the Aftermath of Fukushima Nuclear Plant Accident Venue: Hong Kong Baptist University Speaker: Prof. Wing Hong CHAN | 369 students |
| Seminar | Date: 7 August 2012 Topic: Food Chemistry and Food Safety I Venue: The Hong Kong Polytechnic University Speaker: Dr. Ka Sing LEUNG | 317 students |
| Seminar | Date: 28 November 2012 Topic: Determination of Volatile Organic Compounds Venue: The Chinese University of Hong Kong Speaker: Mr. Tim WONG | 509 students |
| Seminar | Date: 11 December 2012 Topic: Drug Discovery and Organic Chemistry Venue: The Chinese University of Hong Kong Speaker: Dr. Kendrew MAK | 494 students |
| Seminar | Date: 4 February 2013 Topic: Food Chemistry and Food Safety II Venue: Sing Yin Secondary School Speaker: Dr. Ka Sing LEUNG | 477 students |
| Seminar | Date: 13 March 2013 Topic: Symmetry, Asymmetry & Our Chiral World - A Personal Recollection on the 2001 Nobel Prize in Chemistry Venue: Hong Kong Baptist University Speaker: Prof. Wai Ming LEE | 447 students |
| Seminar | Date: 30 April 2013 Topic: The Importance of Water in Food Chemistry Venue: City University of Hong Kong Speaker: Dr. Vincent KO | 415 students |
| Seminar | Date: 5 July 2013 Topic: Photodynamic Therapy - A Promising Strategy of Cancer Treatment Venue: The Chinese University of Hong Kong Speaker: Prof. Dennis K.P. CHAN | 189 students |

| | | |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Seminar | Date: 9 September 2013 Topic: Drug Discovery and Organic Chemistry (Cantonese) Venue: Lok Sin Tong Young Ko Hsiao Lin Secondary School Speaker: Dr. Kendrew MAK | 35 students |
| Teachers Training Workshop | Date: 13 May 2011 Venue: Lok Sin Tong Young Ko Hsiao Lin Secondary School | 7 Teachers |
| Teachers Training Workshop | Date: 21 Feb 2012 Venue: Lok Sin Tong Young Ko Hsiao Lin Secondary School | 9 Teachers |
| Teachers Training Workshop | Date: 17 Nov 2012 Venue: Lok Sin Tong Young Ko Hsiao Lin Secondary School | 12 Teachers |

Feedback from students

Voluntary post-program surveys were conducted among students participated in the project. Results indicated that students participated in this project have a strong positive willingness to recommend this project to their peers. Students expressed that the project broadened their scientific knowledge beyond DSE syllabus, although they still found themselves lacking training in thinking critically. Majority of students indicated the helpfulness of the questioning tasks introduced in the project. They also expressed a positive change in their confidence in asking a question and the effectiveness on development of questioning skills.

6. Difficulties Encountered and Solutions Adopted

6.1 Seminar Scheduling

The scheduling of seminars was varied from the proposed schedule because the schools expressed reluctant to attend seminars during their exam periods. Besides, double cohort from the 3-3-4 study track affected the availability of seminar venues. Therefore we surveyed exam periods of the participating schools and avoided scheduling seminars during such periods. Some seminars were also arranged during the summer sessions. To cater for the stringent venue availability in universities, we tested and set up remote seminar venue at selected secondary schools. Some seminars were arranged and broadcasted from the selected secondary school instead. Eventually, we produced more seminars than proposed.

6.2 Questioning Opportunity

The project was designed to attract questions from students during Q&A session of the seminars. However, questioning opportunity was therefore limited to only students who could attend the seminars real-time. Students who participated a seminar only online was unable to enjoy the Q&A session. We therefore introduced the addition of questioning tasks as part of post-seminar assessments. The questioning task was designed with a scientific keyword guided approach, which effectively helped students formulate questions. The number of questions collected from students per seminar was multi-folded.

6.3 Capacity of Simultaneous Online Chat Room Facility

The project was designed to support both face-to-face and remote online attendance. The real-time communication with students during a seminar was dependent on online chat room facility provided by the LMS. During the second cohort of intake of the project, the existing chat room facility reached its full

capacity. The chat room failed to support the scaled up number of enrollments and therefore the communication channel was severely affected. To solve this problem, we first created a Facebook group to enable large scale real-time online discussion on Facebook during seminars. In addition, HKVU designed and implemented a new thread-based chat-room tool which could support a large number of online participants and made communication management more effective.

6.4 Real-time Question Presentation

The seminars in this project were broadcasted real-time. We noticed that questions received from on-site students might not be well heard by other participants. The seminar speaker was required to repeat the questions. To ease this process, HKVU developed a question presenter tool to show student questions on a projector and recorded screens. The tool also provided an advantage to queue up questions which were collected from various online communication channels.

6.5 Capacity of Simultaneous Online Video Access

Early in the project, the simultaneous access to the seminar videos was limited to a small number of concurrent users due to bandwidth computation capacity. To scale up the concurrency, a larger bandwidth was requested and allocated from HKUST where the hosting of the video server resided. In addition, a cascade form of multiple video servers was configured which provided a larger computation power for larger concurrency.

6.6 Keeping Teachers Informed Progress of Their Students

Some teachers wished to have a better monitoring of the progress of their students. In order to support this, HKVU developed some report generating tools to produce progress reports regularly. Individual progress reports were issued to students so that they could self-adjust their own learning pace. An aggregate progress report was also sent to the teacher for their reference or follow-up actions.