Project Proposal: Chemists Online

Goals and Objectives

Goals

This is a collaborative project between universities and secondary schools in Hong Kong that aims at nurturing scientific literacy and questioning skills of secondary school students by providing them with exposure to university education through the use of appropriate e-learning facilities.

Objectives

i. To enhance students' scientific literacy.
ii. To develop questioning skills of senior secondary students.
iii. To increase the exposure of students to university education.
iv. To serve as an exemplar of school based assessment in chemistry in the NSS education.

Background

Students in the New Senior Secondary (NSS) System will enter universities after graduation from S6. Generally, they are less mature as compared with F.7 graduates in the present system. It would be beneficial for the up-coming NSS students to have chance to experience university life and culture before admission to universities.

In the NSS system, the final public assessment, HKDSE, includes SBA (School Based Assessment) as one of the elements in the assessment. Chemistry, physics and biology include a domain named non-practical assignment as one of the components in their SBA. This brings opportunities for collaborations between schools and universities that will definitely benefit the personal growth of students in the NSS system.

Most students in Hong Kong, including those at senior levels do not ask questions in classes or during discussion sessions. That is quite different from students of other countries, including Mainland China. This attitude greatly handicaps our students in advanced studies or career development. Many teachers attribute this phenomenon to both cultural and psychological perspectives. Teaching students question generating skills could help to solve the problem and should be vital for the personal development of students. Furthermore, asking questions through internet also help remove the blockade in the psychological perspective. A simple model for generating questions, '6W+IF+keywords', will be employed in this project (*Appendix A*).

Students' interest in science could be stimulated through attending seminars delivered by experts in that discipline. As multi-user web-conference technology advances, the conduction of on-line seminars followed by a question-and-answer session becomes feasible. Present technologies not only support good picture quality and online real time verbal communication, they also support lectures with demonstration of science experiments. We can, therefore, make use of the advancement in IT to increase the coverage of audiences from schools at different locations in Hong Kong. This project provides the opportunities for students to attend seminars delivered by experts in universities through internet or in face to face situations.

Two trials were conducted in the past two years; one was on Green Chemistry and the other on IR spectroscopy (*Appendix B & C*). Students of one of the participated school went to the university to attend the face-to-face lecture, and all other participated schools attended the lecture through the online mode. Students asked questions after each lecture using the conferencing tool. With the help of a learning management system, online forums were established for students to raise more questions and continued discussion on the topic concerned, and answered questions designed by the organizer after the seminar. The trials revealed that this mode of delivery of lectures could arouse students' interest, nurture their questioning skills and bring universities and secondary schools students closer.

Nowadays, many universities organize talks and seminars and invite secondary school students to attend. It would be very meaningful to convert some of these existing valuable learning opportunities to an online mode to benefit more students and change these seminars into routine online learning activities in the NSS curriculum.

All the local secondary schools and tertiary institutions have already deployed some kind of Learning Management System (LMS) for supporting teaching and learning. These systems are of growing importance to educational institutions, allowing them to enhance students' learning experiences by supplementing their face-to-face classes with interesting online learning modules, providing better communication among students and instructors, and simplifying course management. An e-Learning Open Platform (eLOP) developed at HKUST based on Sakai will be deployed for this project (see *Appendix D*).

Capability of Applicant

The project is a collaboration between secondary schools and Universities. Lok Sin Tong Young Ko Hsiao Lin Secondary School will be responsible for coordinating the organization of chemistry seminars and demonstration lectures delivered by chemistry experts from the universities to the secondary schools. The principal of the school has over 10 years of experience in chemistry curriculum development, and was the chairman of the Joint Working Party (under CDCC and HKEAA) for the development of NSS Chemistry Curriculum. Throughout the years of service in curriculum development of chemistry, the applicant has established a close relationship with devoted chemistry professors in the universities in Hong Kong. The applicant's experience in curriculum development of school chemistry and connection with universities definitely help to lead a project on collaboration between schools and universities *(see appendix I)*.

The Hong Kong Virtual University (HKVU) team led by the Hong Kong University of Science & Technology is the main collaborator of the project. HKVU will be responsible for the platform and all the technological issues and day-to-day operations. HKVU (and formerly known as CyberU funded by QEF) is a project funded by UGC's Restructuring and Collaboration Fund with partner institutions including the Hong Kong University of Science and Technology, the University of Hong Kong, the City University of Hong Kong, Lingnan University, and the Hong Kong Institute of Education. The main objective of the HKVU project is to establish a networked environment to promote collaboration in teaching and learning among local tertiary institutions. In addition to offering a wide range of courses to students from all local tertiary institutions, HKVU has also offered programs to secondary school students with the following aims:

- to allow students to get a taste of university education;
- to explore their interest in different disciplines outside the secondary school curriculum;
- to help students in making more informed subject choices in university admission; and
- to enrich students' other learning experience in English medium.

Over the past 8 years, more than 1,800 students from over 100 schools have benefited from these programs.

The Project Director has solid experience in managing QEF projects and collaboration among tertiary institutions and secondary schools, and is the co-leader of this project.

Targets

S5 and S6 students are nominated by schools to enroll in the online seminar series. 240 students from active-participating schools (see below) are expected to directly benefit from full learning experience from the project. Another 800 students from passive schools (see below) are expected to indirectly benefit from reduced learning experience from the project.

Project Details

In the first stage of the project, six active participating schools and chemistry professors from six universities have agreed to participate in the project (*Appendices G & H*).

The project involves the project leader, project personnel, secondary schools teachers and academics from universities. Each party plays a different role in the project. A Management Committee will be set up to manage the project and making final decision on issues arisen.

Roles of Parties Involved

Management Committee

The committee should set the goals, plan the framework of the curriculum monitor the progress and evaluate the outcomes during years of implementation. The committee should also oversee the financing and personnel issues of the project.

The composition of the committee should include:

i. project leader,
ii. co-project leader,
iii. representative(s) from the project personnel,
iv. representative(s) from the universities,
v. representative(s) from school teachers,
vi. representative(s) from EDB (if possible).

Schools

The project can accommodate up to 8 schools that are called "active participating schools", and support up to 20 passive schools in the first year and 40 passive schools in the second year of the project.

(a) Active Participating Schools

These schools should enroll in the project and both the teachers and students involved should play an active role in the project. Schools have to present at least 30 students at S5 and S6 level to take part in the project. Students from these schools have the chance to participate two-way communication at real-time activities, and the chance to participate a face-to-face session in universities.

Chemistry teacher(s) of these schools should take the role of coordinator of the project in the school. The teacher(s) should be responsible for the following tasks:

i. management of the accounts of students in the LMS;
ii. participation in the staff development sessions offered by the project (training on the LMS and blended learning);
iii. attending meetings with university professors and academics to set framework of online seminars for at least 3 occasions during the project;
iv. collaboration with other teachers to design pedagogical activities to prepare students for the topic concerned before the online seminar;
v. discussing the questions generated among students;
vi. facilitating the discussion on the platform, if possible; and
vii. assessment of students work through the reflections written by students and the results from the online assessment in the LMS.

Students from these schools should attend not less than 6-8 seminars in two academic years. They should:

i. ask questions during the seminar, if possible;
ii. generate at least one question in the LMS;
iii. complete the task assigned in the LMS, if any; and
iv. write reflections or extensions for the topic concerned;
v. participate in at least 6 online seminars in S5 and S6 (in case students cannot meet this requirement, they may make up the number by using the self-access mode of learning);
vi. participate in optional seminars in science disciplines at their discretion.

(b) Passive Schools

The project can accommodate S5 and S6 students from up to 40 passive schools in the second year of the project. The number of students presented cannot exceed 30.

The teachers of these schools have to make arrangement to receive the broadcast during the seminar, and register to allow students to access the LMS to view the seminar archives. Though students of these schools cannot ask voice questions during the online seminars, they can participate in the online discussion forum within the LMS during or after the seminars. Teachers of these schools need to participate in the training session on the LMS, and they will also be invited to attend other seminars and meeting with university professors and academics.

Students in these schools take a more independent way of learning in the project, they can attend the seminar broadcast, or view the archive on the LMS, participate in the discussion forum, etc. Students should register this service through their schools.

Universities

Local tertiary institutions will participate in this project through the platform developed by the Hong Kong Virtual University (HKVU) project. HKVU is a collaborative project funded by UGC's Restructuring and Collaboration Fund with partner institutions including the Hong Kong University of Science and Technology, the University of Hong Kong, the City University of Hong Kong, Lingnan University, and the Hong Kong Institute of Education.

Two types of learning activities will be developed for this project:

- Online chemistry seminars (as primary activities) – Online science seminars are delivered to secondary schools using high quality live broadcasting and video conferencing technologies. Students will be exposed to advanced experiments using state-of-the-art university facilities. Students from active-participating schools may have opportunities to participate in these experiments in person (during face-to-face session), while students participating in these activities online will interact with the university instructors through video conferencing.
- Online science lecture series (as secondary activities) – Local tertiary institutions often invite distinguished speakers in different disciplines from around the world to conduct seminars in Hong Kong. For example, the Institute for Advanced Study (IAS) at HKUST invited to deliver the inaugural seminar on "The Origin of the Universe" in 2006 and shared his insights on how the Chinese culture interacts with the nation's economic base and modernization in 2008. Through this project, such seminars will be delivered to secondary schools using a real-time live broadcasting system and students will be given the opportunity to raise questions to these distinguished speakers.

These activities would in general be referred to as online seminars. University staff, with the support from teachers, should be responsible for the design, development and delivery of online chemistry seminars for secondary students participating in this project. For online science lecture series, HKVU will arrange 4 such online science lectures in an academic year to cultivate students' interest in science.

University staff should also be responsible for arranging activities for students who attend the learning activities in the university. Activities such as tours to laboratories or other universities facilities may help students to have more exposure to university life. These activities can serve as meaningful 'other learning experiences (OLE)' in the NSS curriculum.

Arrangement of online seminars

Overview

For each online seminar, pre-seminar learning activities, visit arrangements and online assessment details and follow-up activities should be planned and ready well before the conduction of the online seminar by the management committee together with teachers from the active-participating schools.

Technical staff must ensure all technical problems are solved before the commencement of the online seminar.

Each participating school should at least visit one of the universities participated once during the engagement in the project.

For each online seminar session, the system should be able to cater for 6 to 8 active participating schools (students of these schools can ask questions through the conferencing tool), and a number of passive schools (students of these schools cannot ask questions using the conferencing tool, but may be permitted to ask questions using the chat room provided) which are interested in the particular seminar deliver.

The seminars will be conducted after school at around 4:15pm, and last for about 1 hour and 15 minutes. The presentation will last for 30-40 minutes, and the questioning time will also be around 30-40 minutes.

The medium of instruction will be decided by the presenter, however, translation of some technical terms used in the presentation will be offered.

After the seminar, make the necessary arrangement for online assessment and forum on the LMS*, and coordinate with the university to give feedback to questions raised by students.

Proposing topics for the online seminar series

The management committee should determine the topics of the online seminars.

(a) The criteria in selecting areas of interest include:

- topics that are related to a certain area of the NSS curriculum;
- topics that can enlarge the scope of students and introduce some cutting-edge chemistry knowledge to the students;
- topics that can be presented in a way that can arouse the curiosity of students and provide them rooms for imagination;
- topics that can involve interesting experiments and demonstrations; and
- topics that relate to daily life experience.

(b) Proposed topics for the online seminars

The following are the exemplars of topics for the online seminars that can be arranged through the help of the chemistry experts participating in the project. Most of the topics are related to the subject content of the curriculum, and many of them are connected to the STSE (Science, Technology, Society and Environment) context. The experts in the university are very resourceful persons to suggest interesting topics for secondary students. The following list is a preliminary suggestion. Details of their relations to the curriculum can be found in *Appendix E*.

	Proposed area of interest	Related to
1	The VOC in air (Volatile Organic compounds)	Carbon compounds
2.	Nano-technology	Material chemistry
3.	Polymers chemistry	Organic Chemistry
4.	The interesting gas – CO_2	Acids and bases, environment
5.	Gastronomy	General Chemistry
6.	Drinking water	General Chemistry
7.	Fullerenes	Bonding and structure
8.	Cells and batteries	Redox Chemistry
9.	Forensic Science	Analytical Chemistry
10	Metals and Alloys	Material Chemistry
11.	Topics suggested by university professors	Various part of the curriculum

(c) Collaboration among professors and teachers' in the seminar programme

Teachers of active-participating schools will meet with the professor and university staff that will be responsible for delivering the talk to the students. Before the mee4ting, the professor may present a draft proposal of the seminar to the teachers. Teacher will then generate questions based on the topic chosen using

the 6W+1F+keywords model or otherwise, and the professor may response to some of the questions thus finalize the framework of the online seminar. With teachers' input, the online seminar programme should have the following characteristics:

- Pre-seminar activities should be designed so as to prepare students for the seminar.
    - Teachers will ask students to generate questions based on the title of the seminar.
    - Teachers will discuss whether bridging knowledge should be provided to students and how it is delivered to address the diversity of students.
    - University staff should also help arrange activities for students who attend the seminars in the university. Activities such as tours to laboratories or other universities facilities may help students to have more exposure to university life. These activities can serve as meaningful 'other learning experience (OLE)' in the NSS curriculum.
- Professors should design the seminar to address some of the questions from students and teachers, provide rooms for students to ask questions, include knowledge gap for further exploration, and introduce cutting edge development in chemistry. If possible, demonstrations or even experiments can be included.
- Logistics in question-answer questions during the online seminars, supported by the video conferencing tool employed.
- Post-seminar activities should be designed to help students.
    - Generate further questions based on the seminar content.
    - Discuss and organize questions to be posted on the platform.
    - Give a summary, or reflections of what they have learnt.
    - Answer questions from teachers or professors, if any.
- The management committee will post and organize questions raised by students on the platform, students, teachers and universities staff will give feedback to the questions. Useful links on the web will also be uploaded to the LMS for further explorations.
- Teachers can ask students to do writing assignment related to the seminar at their discretion.
- Project personnel should provide both clerical and technical support for the design of various activities.

(d) Time schedule for online seminars

The project is expected to commence in 2/2011. System preparation and piloting will be conducted during 3-4/2011. First stage of online seminar series in trial-run scale will be run during 4-12/2011. Second stage of online seminar series with more schools participating will be run during 3-11/2012.

Time	Online Seminar	Participating students
3-4/2011	System preparation and purchasing. Staff recruitment and formation of management committee. Formulation of year plan for 2010-2011, and finalize topics of seminars. Teachers' professional development and online student preparatory courses on questioning. Preparation of the 1st online seminar.	
4/2011	Conduction of the 1st online seminar and preparation of the 2nd seminar. Implement post seminar activities.	S5 students F.6 students (if interested)
5/2011	Conduction of the 2nd online seminar and preparation of the 3rd seminar.	Same as above
6/2011	Conduction of the 3rd online seminar and preparation of the 4th seminar. * The 3rd online seminar is optional, subject to scheduling feasibility.	Same as above
9/2011	Conduction of the 4th online seminar and preparation of the 5th seminar.	S6 students
10/2011	Conduction of the 5th online seminar and preparation of the 6th seminar. End of year evaluation. Dissemination of the interim results to secondary school teachers and invite more schools to join the project. Formulate year plan for 2011-2012 and finalize topics of online seminar.	Same as above
11/2011	Conduction of the 6th online seminar and preparation of the 7th seminar.	Same as above
12/2011	Conduction of the 7th online seminar and preparation of the 8th seminar.	Same as above
3/2012	Conduction of the 8th online seminar and preparation of the 9th seminar. * The 8th online seminar is optional, subject to scheduling feasibility.	S5 students
4/2012	Conduction of the 9th online seminar and preparation of the 10th seminar.	S5 students
5/2012	Conduction of the 10th online seminar and preparation of the 11th seminar.	S5 students
6-8/2012	Conduction of the 11th online seminar and preparation of the 12th seminar. * The 11th online seminar is optional, subject to scheduling feasibility. End of year evaluation. Formulate year plan for 2012-2013 and finalize topics of online seminar.	S5 students
9/2012	Conduction of the 12th online seminar and preparation of the 13th seminar.	S6 students
10/2012	Conduction of the 13th online seminar and preparation of the 14th seminar. End of year evaluation. Formulate year plan for 2011-2012 and finalize topics of online seminar.	S6 students
11/2012	Conduction of the 14th online seminar and preparation of the 15th seminar.	S6 students
11/2012-2/2013	Conduction of project evaluation and completion of project report. Prepare deliverables and dissemination.	S6 students

Professional Development of Teachers Involved in the Project

Professional development of teachers includes 2 domains, the first domain is seminars and workshop, and the second domain is the discussion session among school teachers and professors in universities.

The seminars and workshops

- A three-hour training on the use of the Learning Management System provided by HKVU, the eLOP system.
- A three-hour sharing session on how blended learning can be used in these online seminars.
- A three-hour workshop on question generation based on the 6W+IF+keywords model.

The discussion sessions

Besides these training sessions, meeting with university professors and chemistry teachers in the preparation of online seminars enrich teachers' chemical knowledge in different aspects of chemistry, improve their skills on pedagogy related to blended learning, and skills in using questions to enhance students' understanding. Peer learning among professors, teachers, project leaders, and perhaps some advisors (if present) help teachers to raise their professional standard. Teachers of each active participating school are required to participate in any 3 of discussion sections in the preparation of online seminars.

Questioning and Learning

It is a common consensus that questions is a very useful strategy for learning. Alison King, a professor of Education Psychology at California State University, pointed out that appropriate guided questioning enhances learning and knowledge construction. King used a method known as ***guided cooperative questioning*** (*Appendix F*). The method involves students using a set of thought-provoking questions stems such as "What are the strengths and weaknesses of...?" "What would happen if...?" and "Why is... important" to generate their own specific questions on the materials being studied. Then in small groups they pose their questions to each other and answer each other's questions. King conducted a series of studies on this strategy in small group discussion context. In the studies, student used this strategy for learning material presented in teacher-led lessons and lectures. Results of those studies showed that students using guided cooperative questioning performed better on comprehension of the material than did comparison students who simply discussed the material. Findings also indicated that the effectiveness of the guided questioning strategy can be attributed to the format of the guiding questions. Some format of questions helped the learners to generate specific kinds of questions that prompted them to think about and discuss the materials in a specific ways such as comparing and contrasting, inferring cause and effect, noting strengths and weaknesses, evaluating ideas, explaining and justifying. This could account for strategy users' improved comprehension of the material and their enhanced ability to recall the knowledge.

With the inspiration from King, and the two books mentioned in the *Appendix F*, we wish to apply the strategy used by King in our project. In our context, we put forward a framework (6W+IF+keywords) to help students to generate questions in the science context and related analytical, critical and creative thinking. We start with the simple '6W' question tag' first, and them using 'IF' and other appropriate keywords related to science context to form the structure of questions. Besides sharing the questions during the seminar sessions, questions are also shared on the platform to enhance peer interactions promote better understanding. This model will be introduced to the students at the very beginning of the seminar course, and assessment of students questioning skills can be continuously monitored (after an online seminar, and year-end assessment) during the course. We believe it takes long time for students to be good questioners and thinkers.

The following shows some examples how thinking and questioning are integrated using 6W+IF+keywords'. (For details, please refer to *Appendix A*)

	Targets	Purposes	Examples of related questions
(1)	Finding missing information	Identifying something you need to know for better understanding which is not given	What is the meaning of the term/symbol/..? Why? (What is the reason?)
(2)	Determining part/whole relations	Identifying factors or components of the whole system	What are the factors involved? Is A a factor/component?
(3)	Comparing and contrasting	Clarifying the relations with other ideas	What is the difference/similarity between A and B?
(4)	Uncovering assumptions	Evaluating the basis for assessing the reasonableness of arguments put forward	What is the assumption behind?
(5)	Determining reliability of sources	Reliability of experimental results, evidence produced, etc.	Are the results accurate?
(6)	Assessing assumptions, applicability,.	Assessing the validity of assumptions, applicability of principles in the specified context,	Is the assumption in this case *valid*? Can the principle/theory be *applicable* ...?
(7)	Making connection and extensions	Making connection and extensions to other areas such as other disciplines, applications, impacts and significance	What is the impact to A(other areas)? What are the applications in .A(other areas)?
(8)	using method to generate new ideas	Use method such as SCAMPER	What happen if A is substituted by B?

Key Features of the Project

Questioning

Questioning skill is one of the key studying skills especially for advanced learners. Questioning in fact help students develop their skills in higher order thinking, including analytical thinking, critical thinking and creative thinking. In this project, we have to explore whether '6W+IF+keywords' provide an effective structure or scaffold for question generation through peer learning among teachers with input from some advisors and research article. In advanced studies, such as in science seminars, the information is rich and complex. We attempt to improve their understanding and sharpen their thinking skills through strategy offered. We hope this could help advanced learners in coping with their studies in tertiary institutions.

Effect of a series of seminars

We realize that changes on students happen slowly, thus the effectiveness in nurturing questioning skills and science literacy through a series of planned seminars should be much higher in contrast to those one-off seminars occasionally held by local universities for the interested students. Furthermore, with the long enough duration and continual assessment, modules developed through this project can serve as an exemplar of school based assessment in chemistry in the NSS.

Establish long-term collaborations between schools sections and universities

As the NSS era started in last September, tertiary education becomes one year closer to all secondary students. Hong Kong needs a platform that provides long-term collaboration between secondary schools and universities experts in addition to the existing platform for collaboration across schools in Hong Kong. This university-school platform can provide modular courses of various disciplines jointly organized by schools and universities, so that secondary school students can have a taste of university education, and these courses also prepare students the skills as well as attitudes for tertiary education. This project aims to start establishing this platform which serves as good interfacing between secondary and tertiary education of Hong Kong in the NSS era.

Technical Details

Chemists Online is based on integrating video conferencing and video streaming technologies to provide senior secondary students with university level chemistry learning experience.

Background Work

A hybrid model of Remote Classroom was piloted in the Learning Community for Talented Students (LCTS) program offered by the Hong Kong Virtual University (HKVU) in spring 2009. This model allows an instructor conducting a face-to-face tutorial or lab session in a classroom setting to be delivered to multiple locations. A high-performance video-capture-capable computer is set up at this classroom to capture the tutorial/lab session. A real-time video-cast of the class is delivered to other students in other remote classrooms located in different districts. While students in the local classroom can interact normally with the instructor face-to-face, students in remote classrooms can view the presentations on the screen using an overhead projector and participate in discussions through an online chatroom. The instructor can respond to questions raised in the chatroom through the video conferencing system.

This setup has the benefit that students can participate in synchronous learning in a nearby classroom without having to spend time traveling to a distant centralized classroom. Hence, classes can be scheduled on weekdays soon after school.

Proposed Technologies for Chemists Online

Based on the aforementioned hybrid model of Remote Classroom, chemistry experts can conduct science experiments in university laboratories. The process of performing the experiment is then video casted to participating schools in different districts using real-time video streaming servers. Through an online chatroom, students can raise questions or give comments about the current context of the experiment. The chemist can interact with the students via chatroom or online video.

By extending this model using web conferencing technologies, some schools will be assigned as active participating schools. Students from these schools can participate in two-way web conferencing with the chemist in the laboratory. Both video and audio signals can be carried over this web conferencing channel in real-time. Students at these schools will be provided with a web-presence experience through watching the experiment and interacting with the chemist in real-time.

It is crucial in the demonstration of chemical experiments that all measurements and changes need to be clearly observed. Therefore, video with high quality is required in capturing the details of the experiments. This results in a high consumption of network bandwidth. In order to allow more schools to join the lab session concurrently, we plan to deploy multiple streaming servers forming a cascading network at different regions in Hong Kong. Apart from the root streaming server deployed at the university, cascaded streaming servers can be set up at different districts in Kowloon, the New Territories, and Hong Kong Island. This kind of streaming network can effectively reduce bandwidth requirements from multiple simultaneous high-bandwidth connections. In terms of scalability, such network can further be dynamically configured with additional servers when more clients are to be supported.

Outcomes of the Project

- Students are expected to gain improvement in thinking ability and questioning skills.
- Students Performance may be used in school based assessment in chemistry in the NSS education.
- Teachers will obtain professional training in using a LMS, helping students generate questions, using blended learning more effectively, and assisting online seminars.
- Additional deliverables also include
  - Online and recorded seminars hosted on a LMS
  - A master copy (on DVD) of each recorded seminar
  - Modules on question asking

Budget

Staff Cost

1 Assistant Program Manager @$18,000+5%MPF per month for 24 months $453,600
Help to manage the day-to-day operation of the project.
Liaise with schools and universities and project committee members.
Prepare post-activity reports.

1 Project Assistant @$13,000+5%MPF per month for 24 months $327,600
Provide assistance to instructors in the design and delivery of online labs and discussions.
Provide clerical support for office administration and project logistics.
Subject knowledge of chemistry is required to manage labs.

1 Technician @$9000+5%MPF per month for 24 months $226,800
Provide technical support to assist schools in setting up and maintaining the network system for the delivery of online labs.
Troubleshoot problems and propose technical solutions to various networking and A/V configurations in different school and university environments.

½ Program Assistant @$8000+5%MPF per month for 24 months $100,800
Provide clerical support for student registration, maintenance of student records, scheduling of labs and tutorials.

Staff cost total: $1,108,800

Equipment

4 Web and video severs (for distributed networking setup)	$100K
3 PCs for project staff	$18K
2 laptops for project staff and on-site video capture	$17K
Educational software packages	$80K
Misc. hardware, parts and consumables (including audio/video equipment), etc	$50K

Equipment total: $265,000

General Expenses

Allowance to guest speakers $40,000
10 speakers x 5 hours x $800/hour.

Allowance to supply GM teachers (to attend staff development sessions) $53,136
8 active-participating schools x 1 teacher x 6 days x $1107/day.

Transportation (including round trips between schools to the lab venue), etc $40,000

Promotion and administration, miscellaneous and so on $15,088

General expenses total: $148,224

Services

Development and production cost for 5 online lab modules per year for 2 years. $350K
Production of video, course website, and multimedia courseware presentations at $35K for each module.

Services total: $350,000

Contingency $22,976

Budget total requested from QEF: $1,895,000

Additional contribution from HKVU

HKVU will provide support for the following items:

1 Assistant Computer Engineer Responsible for the development and customization of the Learning Management System (LMS).	$400K
½ Program Assistant Provide clerical support for student registration, maintenance of student records, scheduling of labs and tutorials.	$150K
Total contribution from HKVU:	$550K

Staff Duties

Assistant Program Manager

- Help to manage the day-to-day operation of the project.
- Liaise with schools and universities and project committee members.
- Arrange laboratory visits and campus tours.
- Prepare post-activity reports.
- Oversee system development and integration.
- In accordance with the staffing structure of HKUST, the person may hired as Executive Officer II (EOII) or Teaching Associate or equivalent ranks.

Project Assistant

- Subject knowledge in chemistry/science is preferred.
- Provide assistance to instructors in the design and delivery of online labs and discussions.
- Monitor online and offline Q&A and discussions.
- Compile and prepare discussion topics and FAQ for instructors.
- Provide assistance to instructors in student evaluation.
- Provide clerical support for office administration and project logistics.
- In accordance with the staffing structure of HKUST, the person may be hired as Instructional Assistant or equivalent ranks.

Technician

- Knowledge in IT, networking is required.
- Knowledge in video production is preferred.
- Provide technical support to assist schools in setting up and maintaining the network system for the delivery of online labs.
- Troubleshoot problems and propose technical solutions to various networking and A/V configurations in different school and university environments.
- In accordance with the staffing structure of HKUST, the person may be hired as Technical Assistant or equivalent ranks.

Assistant Computer Engineer

- Knowledge in IT and software development is required.
- Knowledge in e-learning technology is preferred.
- Responsible for the development and customization of the Learning Management System (LMS).
- In accordance with the staffing structure of HKUST, the person may be hired as System Programmer or equivalent ranks.

Program Assistant

- Provide clerical support for student registration, maintenance of student records, scheduling of labs and tutorials.
- Provide other office and logistics support.
- Handle simple enquiries.

The Asset Usage Plan upon project completion

Category	Item / Description	No. of Units	Total Cost	Proposed Plan for Deployment (Note)
audio and video equipment	HD video camera with HDMI output and remote control and tripod with head	1	10,000	Remain in project office to sustain further production and continual services.
	Wireless microphone system set for video camera	2	5,000	Same as above
	Continuous fluorescent light and light stand	1	3,000	Same as above
	Travelling trolley case	1	1,000	Same as above
computer hardware	High performance main video server	1	35,000	Remain in project office to sustain continual services.
	Middle-tier video server	3	45,000	Same as above
	Noise reduction enclosure server rack-mount cabinet	1	20,000	Same as above
	PC set	3	18,000	Same as above
	Notebook	2	17,000	Same as above
	Uninterruptible power supply system (for total 4500VA)	1	15,000	Same as above
	High performance high definition video capture card	1	5,000	Same as above
	External hard disk for extended storage of video materials	1	1,000	Same as above
	Networked storage for backup	1	4,500	Same as above
	Network-enabled multifunction office color laser printer and fax	1	4,500	Same as above
computer software	MS Windows Server 2008 R2	4	5,800	Remain installation on corresponding machines for project sustainability.
	Adobe Flash Media Interactive Server	4	63,200	Same as above
	Camtasia (Screen capturing and video production software)	1	1,600	Same as above
	Adobe CS5 Master Premium	1	6,000	Same as above

Note: for use by school / organization / in other projects (please provide details of the department / centre to which the asset will be deployed and the planned usage of the asset in activities upon project completion).

Evaluation

Evaluation of the project will be conducted on each of the Chemistry seminars. The focus of the evaluation will be on the effectiveness of learning and teaching delivered by the Learning Management System and the quality of questions raised by the students. Areas for improvement will also be identified through the evaluation. Two end-of-year evaluations will be conducted in 9/2011 and 9/2012.

Performance indicators

Feedback from students and teachers from active participating schools and university professors is an indicator for the project overall. Number of students registered as participating users from schools other than the active participating schools measures the scalability of the project. Comments from experts in chemistry education provide a qualitative indicator of the effectiveness of chemistry education through the proposed technology model.

Outcome measurements

Primarily measures will be collected in the form of questionnaires and interviews.

Additional Assessment on Effectiveness of Learning

During the two-year cycle, post-seminar and year-end assessment exercises will be conducted to measure the questioning ability of students. A context will be presented to the students while the number of questions raised by them will be tallied and these questions will be classified by level of engagement to information to provide both quantitative and qualitative assessments.

Sustainability and Expandability of the Project

Seminars recorded are valuable components which can be re-used to supplement future re-run of the programme. Besides, recorded video modules can be re-packaged to create a shorter learning series where live video broadcast is replaced by recorded videos. The re-packaging of materials will be hosted on HKVU's LMES and require only minimal modification and human cost to re-use the materials many times. The questions generated by students can be compiled as a reference material to aid students in understanding questioning and thinking. Such reference materials can be re-used in future run of the chemists online learning series and can also be used to for independent study of questioning and thinking skills.

We also expect to expand the project further by:

- Inviting more schools and universities to enroll to the project.
- Extending the scope of content from chemistry to other disciplines.
- Building a community for university experts, teachers and students participated in the project to facilitate the exchange of ideas, and to bring schools and universities closer in the new system.

As there are a lot of interesting public lectures held from time to time in various universities in Hong Kong, we can also adapt these lectures (with minimal modification if necessary, such as adding introduction or comments) and put them in the Learning Management System for our project provided that there is no infringement of the Copyright Ordinance.

We will also consider developing a system to assess questions generated from students. This would help students to improve their skills of generating questions.

Different stages for further development

The project is expected to be launched from the academic year 2010/2011 to 2012/2013 to cater for the S5 and S6 students of the NSS system. The first two years of implementation serves as a trial stage of the project.

If the project works successfully for the first two years, the second stage will be launched in the academic years 2013/2014 and 2014/2015 to cater for S5 and S6 students of the NSS system if additional funding from QEF can be sought. Starting from 2014, 'non-practical assignment' will not be included in the SBA of NSS chemistry. Assignments from these online seminars can serve as one of the component, the non-practical assignment, in the SBA. Schools enrolled in this project can choose to submit the marks from online seminars of students to HKEAA as the SBA mark for the domain of 'non-practical assignment'. Furthermore, project organizers can also take this opportunity to fine-tune the difficulty level and design suitable pedagogical activities for students.

After 2014/15, organizer should consider whether it is possible to anchor this project to appropriate institutions, such as Hong Kong Virtual University, for long-term operation. Considerations should be given to extend the subject area from chemistry to other science disciplines to cater for the needs of the NSS students interested in other disciplines.

Promotion

Throughout the project period, especially at the early stage of the project, information sessions and training sessions will be organized starting from active-participating schools. Sharing sessions will be organized in the later stage to share experience learnt from the project

Report Submission Schedule

遞交報告時間表

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

本人/本校/本機構承諾準時按以下日期遞交合規格的報告：

Project Management 計劃管理		Financial Management 財政管理	
Type of Report and covering period 報告類別及涵蓋時間	Report due day 報告到期日	Type of Report and covering period 報告類別及涵蓋時間	Report due day 報告到期日
Progress Report 計劃進度報告 1/3/2011 - 31/8/2011	30/9/2011	Interim Financial Report 中期財政報告 1/3/2011 - 31/8/2011	30/9/2011
Progress Report 計劃進度報告 1/9/2011 - 29/2/2012	31/3/2012	Interim Financial Report 中期財政報告 1/9/2011 - 29/2/2012	31/3/2012
Progress Report 計劃進度報告 1/3/2012 - 31/8/2012	30/9/2012	Interim Financial Report 中期財政報告 1/3/2012 - 31/8/2012	30/9/2012
Final Report 計劃總結報告 1/3/2011 - 28/2/2013	31/5/2013	Final Financial Report 財政總結報告 1/9/2012 - 28/2/2013	31/5/2013

Appendix A: Materials Used in Teaching Questioning Skills

A Structure of Asking Questions

Reasons to ask questions

Asking questions may help deepen your understanding of the messages or ideas received and help generate new ideas and knowledge through

(a) clarifying the complex ideas (related to analytical thinking)
(b) accessing the reasonableness of ideas (related to critical thinking)
(c) making connections and extensions to other disciplines or areas (creative thinking)
(d) synthesizing new ideas and knowledge (related to analytical, critical and creative thinking)

Targets for generating questions

1. To clarify ideas, which are the foundation for higher order thinking, the methods include

(a)	Finding missing information	Identifying something you need to know for better understanding
(b)	Classification or grouping	Grouping similar ideas together for analyzing
(c)	Determining part/whole relations	Identifying factors or components of the whole system
(d)	Sequencing	Putting ideas into rationalized order for comprehension
(e)	Comparing and contrasting	Clarifying the relations with other ideas
(f)	Identifying generalization, evidence, examples, hypothesis, "reason and conclusion" pair	Identifying key points for critical thinking and assessing the reasonableness of arguments put forward
(g)	Uncovering assumptions	Evaluating the basis for assessing the reasonableness of arguments put forward

2. To access the reasonableness of ideas (critical thinking)
   (a) determining reliability of sources (experimental results, evidence, etc.),
   (b) evaluating arguments (reason-conclusion, evidence-conclusion, etc.),
   (c) accessing validity of assumptions, applicability of principles in the specified context, putting forward 'counter examples' if necessary.
3. To generate new ideas, concerns and knowledge, the methods include
   (a) making connection and extensions to other areas such as other disciplines, applications, impacts and significance
   (b) making prediction under hypothetical circumstances
   (c) making generalizations
   (d) using method to generate new ideas (e.g. SCAMPER)

Models to generate questions

There are many models to generate questions. We would like to choose one that most students have come across in secondary education, the **6W + IF + keywords** model.

	6W + IF	Main Targets	Key Words/Possible Extensions
Why	1) help deepen understanding 2) clarifying ideas and help critical thinking	Asking for reasons/explanation for a conclusion, phenomenon, an action, idea, etc.	WHY? WHY NOT?

	6W + 1F	Main Targets	Key Words/Possible Extensions
What	1) help find missing information, classify, analyze, criticize , evaluate, connect to other areas 2) clarification of ideas, help critical thinking and creative thinking	Asking for clarification Asking for connection to other disciplines Asking for generating new ideas and situations Asking for reasonableness of ideas	WHAT? Assumptions, Applications, Advantage/Disadvantage, Accuracy, Apparatus,... Background of studies,... Compare and Contrast .. (similarity and difference) Connection to ..... Data, Disadvantage, ... Definition Decision Examples, Expectation, Evidence, Errors,.. Factor s(component) of system Functions of part of system, ... Generalization, Grouping into similar categories Hypothesis, Hazards, Impacts, Interpretations, Information of..... Justifications Logically reasoning, Limitations Meaning, Method of study New idea/view Observation Problem encountered Prediction, Questions, Results, Relations between... Reliability of sources Reasons for .... Solutions for problem Significance/Importance Substitution Theory behind... Understanding Validity, value Waste

	6W + IF	Main Targets	Key Words/Possible Extensions
How	1) help find missing information, especially related to method or procedure	Asking for the way to do a certain task or proceed (method or procedure)	HOW? Procedure, Instrument and equipment Experimental set up, conditions, Overcome difficulties encountered Tools or methods used
Who	1) help find missing information, especially related to people concerned	Asking for people involved/related	WHO?
Where	1) help find missing information, especially related to places concerned	Asking for places involved	WHERE?
When	1) help find missing information, especially related to time concerned	Asking for time concerned	WHEN?
If/if not	1) help creative thinking for new ideas, critical thinking for evaluating reasonableness of idea	Asking for prediction from hypothetical situations	IF/IF NOT/WHAT IF

Summary

1. 3 main targets for asking questions:
   - Help clarifying complex ideas
   - Help accessing the reasonableness of ideas
   - Help creating new ideas
2. Introducing the simple 6W + IF model
3. Extending 6W + IF model using useful KEYWORDS

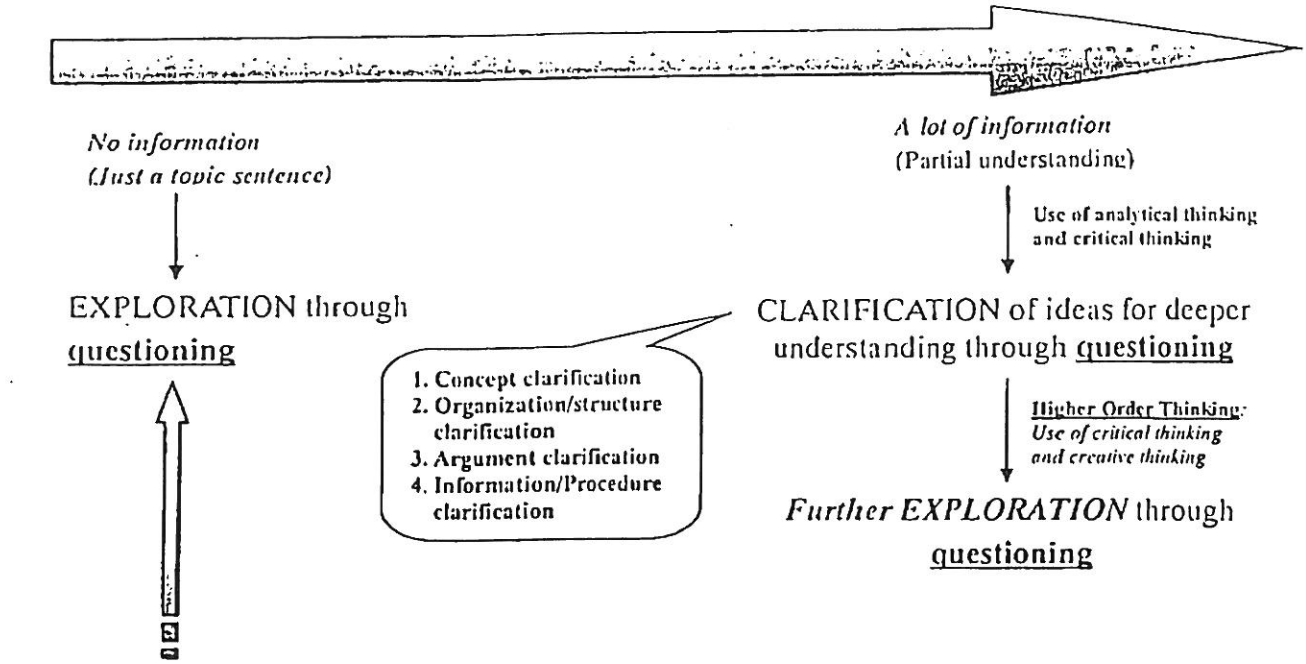
Additional Reference Book

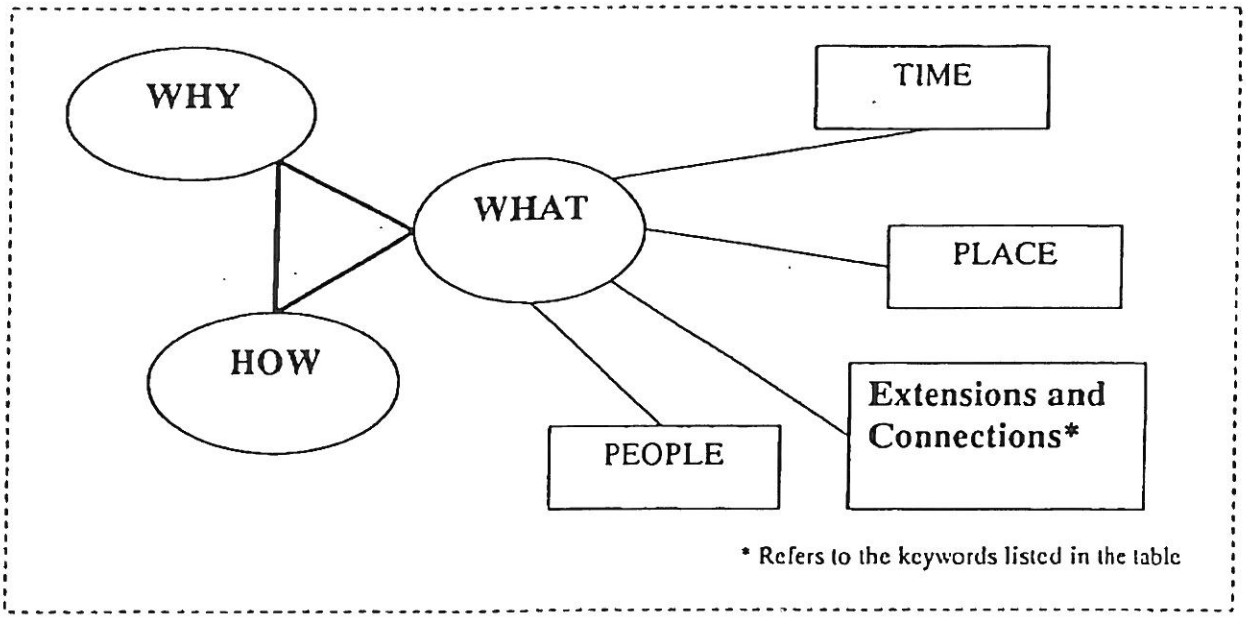
1. "Infusing the Teaching of Critical and Creative Thinking into Secondary Science. A Lesson Design Handbook."
   - **Author:** Robert J. Swartz, Stephen David Fischer, Sandra Parks
   - **Press Agent:** Critical Thinking Books and Software
   - **Year of Publishing:** 1998
2. "Asking the Right Questions, a Guide to Critical Thinking."
   - **Author:** M./ Neil Browne, Stuart M. Keeley (Bowling Green State University)
   - **Press Agent:** Prentice Hall, Upper Saddle River, New Jersey, 07458
   - **Year of Publishing:** 1998 (5th Edition)

Quick Note

Question Word	Target	Possible Extensions
Why?	Explanation of 'action', 'think', 'say', 'that' (by theory, generalization, phenomenon, traditions, trends, etc.)	WHY-NOT
What?	Assumptions Purpose of work Definition Meaning of terms Results Observation Evidence Impact and Significance in a discipline Comparison (difference and similarity) Component or Factors Functions Advantage and Disadvantage Problems encounter Expectation or prediction Limitation Background (theoretical background) Applications Decision to make Connection to	WHAT—IF WHAT—IF NOT
How?	Method of study Procedure/stages/process Overcome practical difficulties Reliability and Accuracy Get rid of the hazards involved	WHY-HOW
When	Questions related to time	WHY-WHEN
Who	Questions related to people involved	WHY-WHO
Where	Questions related to places concerned	WHY-WHERE
If or If NOT	Under the hypothetical conditions/ situations, the PREDICTION	HOW- IF

Semantic View of Questioning





A Linking between Questioning and Thinking

Reasons to ask questions

Asking questions may help deepen your understanding of the messages or ideas received and help generate new ideas and knowledge through:

(a) clarifying the complex ideas (related to analytical thinking)

(b) accessing the reasonableness of ideas (related to critical thinking)

(c) making connections and extensions to other disciplines or areas (creative thinking)

(d) synthesizing new ideas and knowledge (related to analytical, critical and creative thinking)

Targets for generating questions

(1) To clarify ideas, which are the foundation for higher order thinking, the methods include

Targets		Purposes	Examples of related questions
(a)	Finding missing information	Identifying something you need to know for better understanding which is not given	What is the **meaning** of the term/symbol/..? Why? (What is the **reason**?)
(b)	Classification or grouping	Grouping similar ideas together for analyzing	What is the **relation** between .....
(c)	Determining part/whole relations	Identifying factors or components of the whole system	What are the **factors** involved? Is A a **factor/component?**
(d)	Sequencing	Putting ideas into rationalized order for comprehension	What is the **relation** between .....
(e)	Comparing and contrasting	Clarifying the relations with other ideas	What is the **difference** between A and B?
(f)	Identifying generalization, evidence, examples, hypothesis, "reason and conclusion" pair	Identifying key points for critical thinking	Is that the **reason**..? What are the **evidence** that show .....
(g)	Uncovering assumptions	Evaluating the basis for assessing the reasonableness of arguments put forward	What is the **assumption** behind?

(2) To access the reasonableness of ideas (critical thinking)

a. determining reliability of sources (experimental results, evidence, etc.)

b. evaluating arguments (reason-conclusion, evidence-conclusion, etc.)

c. accessing validity of assumptions, applicability of principles in the specified context

d. putting forward 'counter examples' if necessary

	Targets	Purposes	Examples of related questions
	Determining reliability of sources	Reliability of experimental results, evidence produced, etc.	Are the **results** *accurate*?
	Evaluating arguments	Evaluating reason-conclusion, evidence-conclusion	Is the **explanation** *valid*? Is the **reason** *justified*?
	Assessing assumptions, applicability,.	Assessing the validity of assumptions, applicability of principles in the specified context, putting forward 'counter examples' if necessary.	Is the **assumption** in this case *valid*? Can the **principle/theory** be *applicable* ...?

(3) To generate new ideas, concerns and knowledge, the methods include

a. making connection and extension to other areas such as other disciplines, applications, impacts and significance

b. making prediction under hypothetical circumstances

c. making generalizations

d. using method to generate new ideas (e.g. SCAMPER)

	Targets	Purposes	Examples of related questions
	Making connection and extensions	Making connection and extensions to other areas such as other disciplines, applications, impacts and significance	What is the **impact** to A.? What are the **applications** in A (other areas)?
	Making prediction under hypothetical circumstances	Based on the information given predict what happen in a new situation	If (so and so) then will (something happen)? If (hypothetic situation), then what will happen?
	Making generalizations	Based on the information given give a generalized comment	Can we **generalize** to .....?
	Using method to generate new ideas	Use method such as SCAMPER	What happen **if** A is substituted by B?

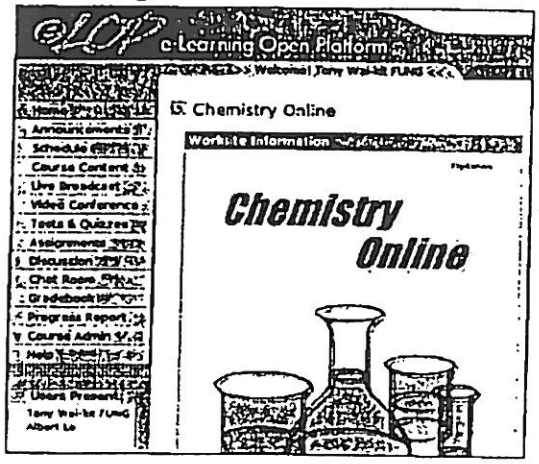
Appendix B: Sample System Screenshots during Pilot Run (Dec 2008)

High Definition Live Video of Chemistry Experiment

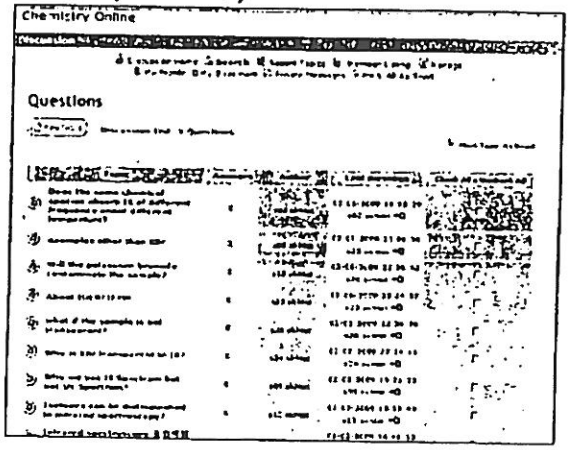
Video Conference between Participating Schools (prototype)

Appendix C: Screenshots of Website on eLOP during Pilot Run

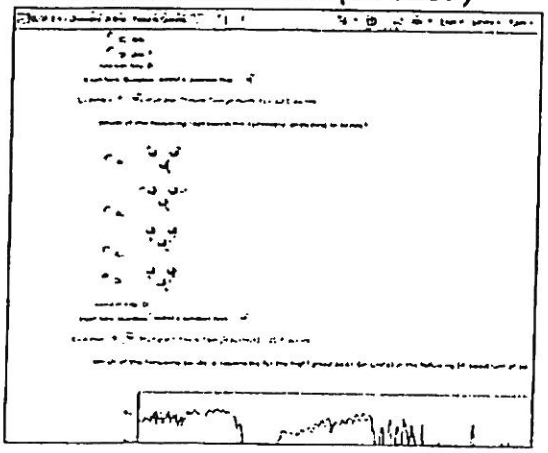
Front Page



Questions Raised by Students in Discussion Forum (on eLOP)



Post-event Online Quiz (on eLOP)



Appendix D: The LMS offered by HKVU

Learning Management System

All the local secondary schools and tertiary institutions have already deployed some kind of Learning Management Systems (LMS) for supporting teaching and learning. These systems are of growing importance to educational institutions, allowing them to enhance students' learning experiences by supplementing their face-to-face classes with interesting online learning modules, providing better communication among students and instructors, and simplifying course management. A robust and scalable e-Learning Open Platform (eLOP) will be developed for the project.

The implementation of eLOP is based on Sakai, which is an open-source courseware management standard. Since its inception in 2004, the user community of Sakai has grown significantly. Major academic institutions including Yale University, University of California - Berkeley, MIT, Stanford University, University of Michigan in the US, University of Cambridge in UK, University of Toronto and University of British Columbia in Canada and Australian National University in Australia are among the users which have deployed the Sakai-based learning management system.

The eLOP platform allows instant access to learning resources, communication and interaction with students and instructors anytime and anywhere. eLOP is designed as an enterprise level learning management system to provide support for:

- Class management
- Development of courseware using a modular approach which provides clear learning objectives and encourages self-managed proactive learning
- Multimedia rich course content
- The use of self-assessment and interactive tasks for enhancing learner's experience
- Tracking of students' progress through a SCORM compliant implementation
- Conducting course evaluation

Appendix E: Topics suggested for online chemistry seminars

	Proposed area of interest	Remarks
1	The VOC in air (Volatile Organic compounds)	Linked to the sections of Organic Chemistry (Topic V and XI) The seminar may relate to the impact of organic chemicals to the environment and human health, analysis of VOCs (analytical chemistry, Topic XV), etc. The seminar intends to bring real life significance of organic chemistry.
2.	Nano-technology	Link to sections related to bonding and structure (Topic II and VI,), Industrial chemistry (Topic XIII), and Materials Chemistry (XIV). The seminar intends to introduce the concept of nano-technology, their applications in real life, and trends of development. The seminar serves to give the development of a cutting edge of chemistry.
3.	Polymers chemistry	Link to sections related to Organic Chemistry (Topic V and XI) and Material Chemistry (Topic XIV). The seminar could focus on introducing stories of development of several types of polymers that illustrate how chemists produce new product to help solve problems and meet the needs of people.
4.	The interesting gas – CO_2	Link to sections related to Fossil Fuels and Carbon Compounds (Topic V), Acids and Bases (Topic IV). The seminar could focus on introducing CO_2 as one of the green house gases, how the acidic nature of CO_2 help the removal of the gas from power stations and from ordinary air so as to decrease the continuous rises of the gas in the atmosphere, and uses of different forms of CO_2.
5.	Gastronomy	Link to various sections of the chemistry curriculum, Acids and Bases (Topic IV). Rate of Reaction (Topic IX), Organic Chemistry (Topic V and XI), etc. The seminar could focus on how general chemistry affect our daily life.
6.	Drinking water	Link to Planet Earth (Topic I) and other sections in the syllabus. The seminar could focus on purification of water, e.g. how to obtain safe drinking water in rural area, such as Iraq.
7.	Fullerenes	Link to Microscopic World II (Topic VI). The seminar could focus on the peculiar bonding and structure of fullerenes, and their potential in commercially sectors.
8.	Cells and batteries	Link to Redox Reactions, Chemical Cells and Electrolysis (Topic VII). The stories of cell production, how cells are designed and produced to meet the need of people. The trend of future development.
9.	Forensic Science	Related to Acid and Bases (Topic IV), Redox Reactions (Topic VII), Analytical Chemistry (Topic XV). Introducing how chemistry is at work in forensic science. Inspiring students how simple chemistry or science could be of help to fight crimes.
10	Metals and Alloys	Related to Metals (Topic III) and Materials Chemistry (Topic XIV). The seminar could focus on how properties of metals be modified by adding suitable constituents, and aided by pictures from Scanning Electron Microscope, discussion of the future trend of development of alloys.

Appendix F: Reference from Alison King

1. "Guiding Knowledge Construction in the Classroom: Effects of Teaching Children How to Question and How to Explain."

   - Author: Alison King (Bowling Green State University)
   - Source: American Education Research Journal, Vol. 31, No.2 (Summer, 1994), pp. 338-368.

   A separate pdf file can be downloaded from HKVU website for reference. Please see *Appendix K*.

Appendix G: List of Active Participating Schools in the First Stage

- LOK SIN TONG YOUNG KO HSIAO LIN SECONDARY SCHOOL
- SKH TSANG SHIU TIM SECONDARY SCHOOL
- TWGHs MRS FUNG WONG FUNG TING COLLEGE
- LOK SIN TONG YU KAN HING SECONDARY SCHOOL
- TRUE LIGHT MIDDLE SCHOOL OF HONG KONG
- PUI CHING MIDDLE SCHOOL

Appendix H: Candidates of Invited Speakers/Chemistry Experts to Help Organize the Seminars

A good number of experts in chemistry area from most local tertiary institutions agreed to organize the seminars and serve as invited speakers for the seminars.

Appendix I: Resume of Project Leader

Relevant Experience and Qualification of the Head of Lok Sin Tong Young Ko Hsiao Lin Secondary School

Position Held/Services/Academic Qualification	Time
Principal of Lok Sin Tong Young Ko Hsiao Lin Secondary School	00-present
Chairperson of Curriculum Development Council Committee (EdB) for the Science KLA	05-09
Chairperson of the Join Working Party (under CDCC and HKEAA) for the development of NSS Chemistry Curriculum	02-08
Chairperson of the Join Working Party (under CDCC and HKEAA) for the development of 27007 AL Chemistry Syllabus	00-04
Member of Public Examination Broad of HKEAA	07-present
Doctor of Philosophy in Chemistry (City University of Hong Kong)	89-96

Appendix J: List of Advisors

Chemistry experts with strong academic background and experience in local examination structure will be invited to serve advisors of the project.

Appendix K: Additional Materials Online

Additional materials to support the proposal can be found at http://hkvu.ust.hk/cos/. Due to copyright issues, please key in "qefdemo" to access the content. The page contains a full-length high quality video recorded during pilot run, as well as the reference materials stated in *Appendix F*.

Appendix L: Letter of Intent from HKVU

A copy of the letter of intent signed by the project director of Hong Kong Virtual University to support this project is enclosed.