



▲ From left to right: Ms LAW Ming-wai, Mr CHAN Pat-chun and Mr WONG Chi-fai, Thomas

Learning in and learning for the environment

Teachers presented with the Award

Mr CHAN Pat-chun

(Years of teaching : 16 years)

Mr WONG Chi-fai, Thomas

(Years of teaching : 23 years)

Ms LAW Ming-wai

(Years of teaching : 6 years)

School

**Queen Elizabeth School
Old Students' Association
Secondary School**

Subject taught

**Science (S1-3)
Biology (S4-6)**

Teaching Philosophy

"Our school-based Science curriculum is guided by the school motto 'Vos parate ut serviatis' (prepare yourselves that you may serve). We provide different learning opportunities to build up students' knowledge and skills in science. We take students into their community to learn in the environment, and learn for the environment."



Interview with the Teachers

Tin Shui Wai, where the school is located, is rich in natural resources. It is a good platform for science learning and teaching; ample opportunities are available for students to learn in the community.



▲ Students working in the Molecular Biology Laboratory

how to relate science to history as well as to our daily life," says Mr CHAN.

"In order to develop students' skills in biotechnology, we have been working very hard to equip our Molecular Biology Laboratory for the benefit of the students," Mr CHAN states. "In the past, we had to solicit help from the university to measure the concentration of heavy metals in environmental samples, but now, we are able to estimate it with the use of fluorescent bacteria,"

explains Ms LAW. "Now, with the equipment and facilities in our laboratory, we can design innovative experiments for students to carry out inquiry learning, and students are able to do their own experiments and collect data here."

Serving the community

Internalising the wisdom and knowledge of the past aside, learning from Nature is the most direct way to understand science and our world. Tin Shui Wai, where the school is situated, is the best location for students to learn from Nature.

"We took students to the Hong Kong Wetland Park, Yan Chau Tong and the oyster fields at Lau Fau Shan, for example," says Mr WONG. "Because science is related to a place's culture, economy and environment, by doing field studies, students are able to understand more about their living environment, the people around them and the history of walled villages. We hope that students will develop a sense of belonging to their community."

For a long time, the school has been designing programmes to engage students to learn and serve in

The enthusiasm of teachers is a great asset to inspire students' passion in learning. Coupled with a state-of-the-art laboratory that can provide various experiences in science learning, students, teachers and the community can all benefit. This is the situation at Queen Elizabeth School Old Students' Association Secondary School.

The team of awarded teachers believe that developing students' scientific literacy, so that they can make informed decisions in science-related issues, is as important as passing on knowledge and skills to help them excel in examinations.

The flexibility of subject combinations in the New Senior Secondary curriculum and the new Biology curriculum allow a more diverse learning and teaching experience. "For example, to make lessons on ecology more interesting, I would incorporate historical elements and biotechnology in the traditional oyster culture industry into my science teaching so that students would have a glimpse of



▲ Students act as eco-tour guides.

the community. When the Hong Kong Wetland Park was first opened, Mr WONG sought opportunities for his students to serve as eco-tour guides, so that they could gain a better understanding of Nature and develop good communication skills.

Boosting confidence, voicing concern

"Our students have been doing very well in local competitions like the Inter-school Bird Race," Mr WONG says proudly. Apart from local contests, Mr WONG has also been leading teams to participate in overseas conferences. "The experiences are valuable; students not only learnt to use English to discuss with foreign students, but also opportunities to develop their life skills."

Teachers, on the other hand, shared the honour when students won the competitions. "Of course we are pleased to see students winning awards. Even if they did not, gaining the confidence and enthusiasm in learning science is already the greatest reward. Most importantly, teacher-student relationships have

been strengthened through the experience," says Ms LAW.

Moreover, students have broadened their horizons and developed their awareness of social issues through various projects, such as the genetically modified (GM) papaya project. In the project, students found that papaya is the most common GM crop grown in local farms. The prevalence of GM papayas growing in the local environment would cause serious problems of genetic pollution. It would adversely affect the organic farming industry in Hong Kong. One of the students working on the project decided to voice his concerns at the Legislative Council about allowing the cultivation of GM papayas in Hong Kong to be legally exempted. "In a three-minute presentation, this student expressed his concerns supported with the data he collected in the project, which I believe is the greatest reward he has gained from the project," Mr CHAN explains.

Language — a big challenge

Although the school enjoys a lot of success in science learning and teaching, language is a big challenge. English is still a concern for many students, but the teachers are determined to help them master both Chinese and English.

"I remember an A-level student came back to school to thank me. She said she passed the university admission interview only because I had insisted teaching in English," Mr WONG says gladly.



▲ Students participating in the Hong Kong Science Project Competition



Teachers' Sharing

Scientific Literacy as an overarching goal of our school-based Science curriculum

Our team believes that effective teaching practices in science should embrace the goal of promoting scientific literacy among students so that they can make informed choices and decisions about science-related issues and problems that occur in daily life. Pertaining to scientific literacy we include two related but distinct senses:

- * "Being knowledgeable, learned and educated in science" — an understanding about the science contents and themes of science such as the nature of science and scientific inquiry
- * "Basic literacy ability" — the ability to read and construct meaning from scientific texts

Being knowledgeable, learned and educated in science

We would illustrate this sense of scientific literacy by our work done in the areas of Education for Sustainable Development, Biotechnology Education, Scientific Inquiry and the promotion of the application of science in real life context.

Education for Sustainable Development

One important characteristic of a scientific literate person is the capability to balance between the predicted positive and negative effects of science on the environment. Our curriculum particularly focuses on strengthening students' understanding of the natural environment and its interaction with science, both in local and global issues.



▲ Students working on the solar-cooker project

We organised cross-curricular field studies and visits to provide authentic learning experiences for students. Apart from Science, Geography and Chinese Language are involved in the junior form cross-curricular visits in the coastal areas of Deep Bay (S1) and Tai Tong Nature Trail (S2). Senior form students from different subjects like Biology, Economics, Geography and Tourism and Hospitality Studies would have their Chinese white dolphin watch and Tai O visit. We trained students to serve as eco-tour guides who could also serve to educate a great number of their peers. We also organised international exchange tours and our students have participated in the Youth Conference of the Caretakers of the Environment International since 2000.

Biotechnology Education

We believe biotechnology will likely impact students' life and the community in the future. With this vision, our school decided to establish a Molecular Biology Laboratory in 2005. We tailored our Science curriculum to infuse different biotechnology topics into all levels so that all students in our school are provided with some biotechnology learning experiences. For example, our S1 students would have practical work on DNA extraction. S3 students would learn about genetically modified (GM) food so that they can make informed decisions on whether to support GM



▲ Discussing the experimental findings with students

food or not. The establishment of the laboratory also facilitated the implementation of biotechnology-related practical work and biotechnology-related inquiry activities, such as the detection of GM papayas by Polymerase Chain Reaction (PCR), the use of bio-indicator species, such as the green fluorescent protein-expressing bacteria *Daphnia*, and water- or air-borne microorganisms in environmental monitoring, at both junior and senior levels.

Scientific inquiry experience

In addition to acquiring scientific knowledge, students need to have an understanding of how science works. Our school-based curriculum is conceptually grounded in the framework of scientific inquiry ladder proposed by Bell et al. (2005): Confirmation; Structured inquiry; Guided inquiry; and Open inquiry. To scaffold students to advance through each level, students at different grade levels are given tasks of different complexities. With extensive experience of conducting scientific inquiry, our students reaped a number of prizes in school science competitions in Hong Kong in recent years.

Application of science in real life context

To achieve the goal of helping students to apply science in real life context, we deliberately provide students with learning opportunities to use scientific ideas, processes and reasoning. For example, our students applied their scientific knowledge of global warming, heat transfer, energy efficiency, etc. to analyse the effect of screen-building in Tin Wing Station near our school, and expressed their concerns to the MTR Corporation Limited and the government in 2012. We also organised our students to serve the

community as eco-tours guides in different regions in Hong Kong, like Lau Fau Shan, Nam Sang Wai, Lung Kwu Tan and Lai Chi Wo.

Basic literacy ability

This literacy component stresses the ability to read and construct meaning from scientific texts. The focus is to boost students' ability to read and write in English and their confidence in using English to learn science.

As academic language used in science differs from language used in everyday life, students face a great deal of linguistic challenges when learning science. We adopt the genre-based approach to teach academic science language. Students are guided to write science texts in English through the provision of sentence patterns in writing procedures, recording observations, writing discussions, drawing conclusions, describing features and causal relationships. We also introduce thinking tools (e.g. visual organisers) to assist students to organise and express their ideas in English.

Reflection

Through recent years of work on promoting learning Science in English, we have become more aware of the importance of strengthening the basic literacy ability of students in science lessons. More effort will be made to integrate literacy elements into the planning of our Science curriculum.

We will also continue our tradition and strive for further improvement by capitalising on our own strengths. For example, with the well-equipped Molecular Biology Laboratory, we will strategically incorporate more biotechnology teaching topics or issues related to traditional biotechnology in China (e.g. dyke pond fishing, oyster culture, etc.) into the school Science curriculum.

Conclusion

Reflecting on the work we have done has reinforced our professional vision and mission of the need to promote scientific literacy among students and has allowed us to identify our areas of strengths and weaknesses for future planning to realise our goals.



Assessment Summary

Enhancing students' scientific literacy and strengthening their environmental awareness

These three awarded teachers have shown great passion and professional innovation in their teaching and curriculum development. The team has worked out a holistic and systematic plan to promote scientific literacy, which includes students' robust understanding of scientific concepts and processes, and the application of science in real life context, with a vision that students would take sustainable actions in everyday life and make informed decisions based on scientific evidence.

It is a carefully planned programme across the six secondary years for the Science Education Key Learning Area. Abundant Nature experiences, such as bird watching and fieldtrips, are provided to develop students' values and attitudes in conserving, protecting and maintaining the quality of the environment. The curriculum materials developed by the team are original, local and authentic with a strong focus on scientific literacy and scientific inquiry. Current issues are chosen to arouse interest and in some of the topics, elements of national education are included as well.

The awarded teachers succeeded in strengthening student sensitivity and confidence in applying science to daily life. Contemporary socio-scientific issues were used to make science relevant

to the students and they were led to make informed judgement based on available data. The awarded teachers had also contributed a lot of time and effort in developing students' project skills. Through this, students developed the abilities to integrate science concepts and skills to construct new knowledge and to solve authentic problems. The high quality of their students' work was reflected in the awards gained in various territory-wide science project competitions. Students' spirit of exploration, as well as their independent, logical, critical and higher-order thinking skills had been carefully cultivated. In recent years, efforts were also made to integrate literacy elements into the planning of the Science curriculum to help students to learn Science in English.

The awarded teachers had participated actively in education-related researches. They helped in developing exemplary teaching materials and video clips of their lessons were uploaded on the web for sharing with teachers around the world. They also contributed to the community through training students to conduct eco-tours for teachers and the elderly, which also constituted an important means of developing a sense of care to people and the Nature among students.



▲ Sharing with other teachers



▲ An ecological cultural study tour to the tropical rainforest in Malaysia

Way of Obtaining Information of the Teaching Practice

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