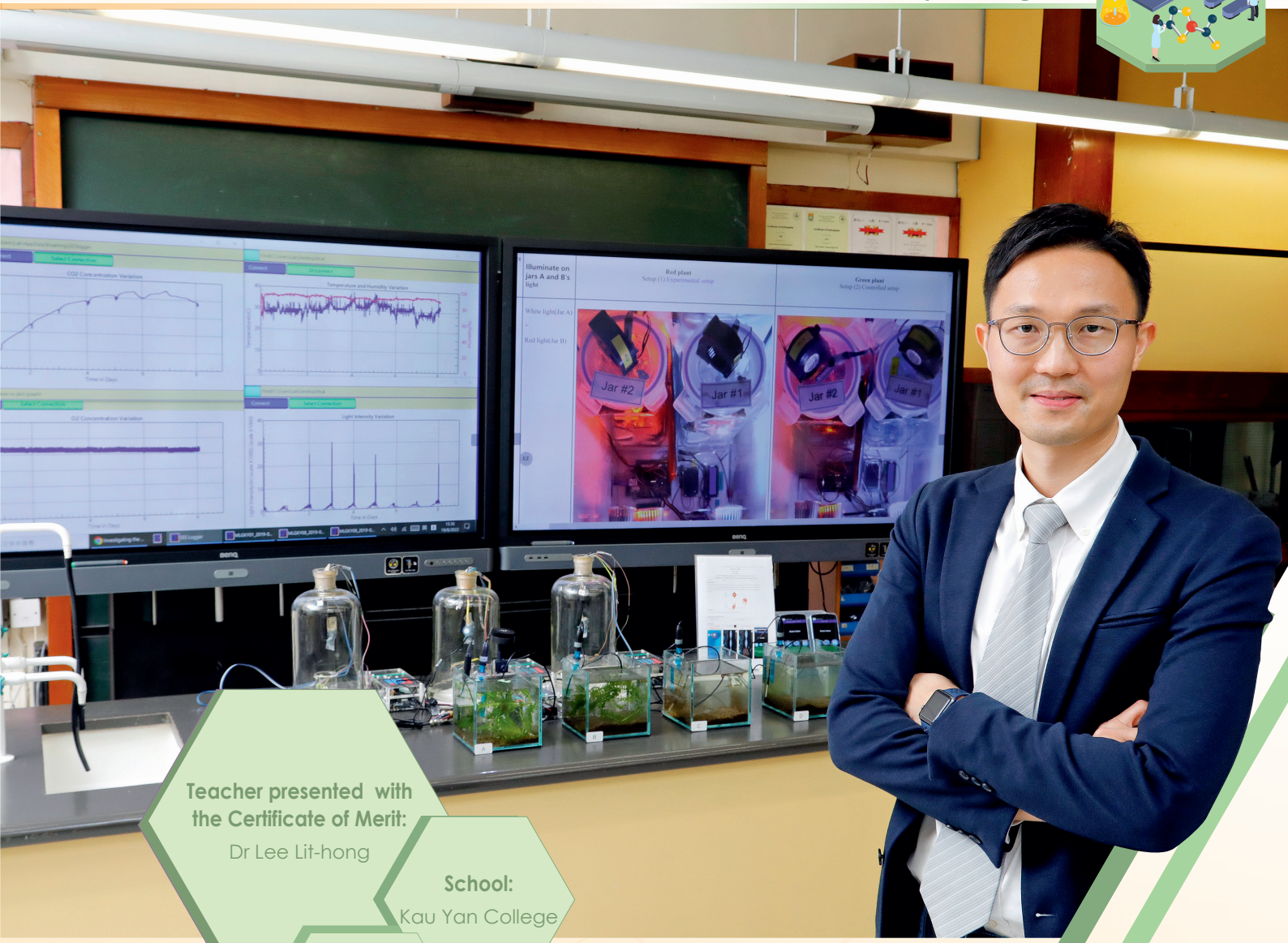
獲嘉許狀的教學實踐

Teaching practices presented with the Certificate of Merit

科學教育學習領域

Science Education Key Learning Area



Teacher presented with the Certificate of Merit:
Dr Lee Lit-hong

School:
Kau Yan College

Subjects taught:
Integrated Science (S1-3) and Biology (S4-6)

▲Dr. Lee wants to help students solve the problems encountered in their daily lives through the scientific approach.

Tech and innovation motivate students in science learning

Teaching philosophy:

Developing students' curiosity, engaging students to learn independently, and encouraging students to investigate scientifically through innovative and technology-enhanced strategies.

教師專訪 Interview with the teacher

▲The awarded teacher guiding students to revise their STEM product.

The unexpected encouragement from a science teacher over a mistake made in class planted the seed of Dr Lee Lit-hong's passion for the subject and teaching. "The teacher said it's fine to mix different colour solutions to observe the chemical reaction. She made me realise that there's room for creativity in scientific inquiry," Dr Lee recalled.

This little episode also inspired him to pursue teaching innovation. Dr Lee makes science lessons fun and 'cool': he has incorporated many interactive activities into junior science education, featuring diverse technologies and learning tools, and taken learning beyond the classroom. "My goal is to help students solve the problems encountered in their daily lives through the scientific approach. I also aim to nurture their science process skills by adopting the scientist's mindset," said Dr Lee.

Using data for evidence-based teaching

The challenge of online teaching amid the COVID-19 pandemic got Dr Lee's creative juices flowing. He helped set up a school-based remote laboratory for biology experiments on mealworms' gas exchange and other phenomena. Students' curiosity was ignited when they first saw the unconventional setup that included webcam, video live streaming, datalogger, and sensor. "The gas exchange experiment highlights the type of data neglected by many students," he said. "We do real-time data analyses and comparisons with multiple graphs. The experiment motivates students to take their learning to the next level, such as further investigations on how the various factors in mealworm's growth affect the gas exchange and their development into beetles."

This evidence-based teaching energises the students. They are encouraged to propose hypotheses and then verify them through data analysis. "This is how the use of a datalogger and sensor helps enhance students' science process skills," Dr Lee said, adding that the school fully supports his teaching, thanks to students' boosted motivation and enhanced learning experience. "The key to utilising technology in science teaching is to select the right and subject-specific technologies and use them with precision. Follow-up data analysis and interpretation are also vital."

▲Students using mobile datalogger and sensor to measure the distance travelled and speed of a moving trolly.

Dr Lee's innovative approach also led him to add the "Predict-Observe-Explain" (POE) learning cycle to the flipped classroom on an e-learning platform. They aimed at nurturing students' self-directed learning. "Students are asked to prepare for a lesson in advance. For instance, they have to film a short video on a scientific phenomenon and end it by asking other classmates to predict the outcome. Then students will do online observation and compile an explanation of what they have observed," he noted. "Students find it entertaining because their classmates are featured in the videos. In the explanations, most of their misconceptions are cleared."

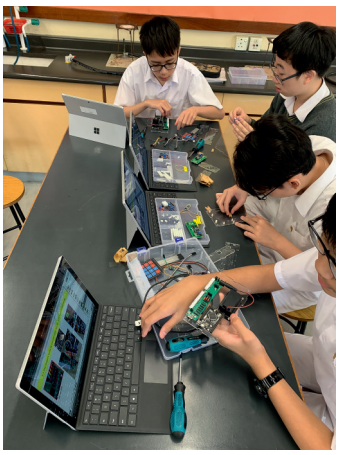
Science for daily lives

As part of Kau Yan College's drive to nurture students' respect for nature and the environment and enhance their environmental literacy, it established the school-based "e-Life@KYC", a cross-subject curriculum focused on the practical applications of science in our daily lives. With science as the platform, scientific investigation is connected with engineering design, mathematics, computer, technology, and home economics. The curriculum inspires students to solve real-life problems with scientific investigation, Dr Lee said "Some students made a dehumidifier with dried phyllanthus emblica leaves to replace the regular ones with polluting chemicals. Another group invented an eco-friendly microwavable heat bag using red beans instead of chemical substances. The heat bags were evaluated by the students' parents and distributed to some elderly later."

Time has been the biggest challenge in Dr Lee's 13 years of teaching and curriculum design. "I have sacrificed my personal time," he said. But seeing the significant transformation of some students makes it all worthwhile. Among them is a student he met in an S1 class. Initially, the student was quiet and passive. However, science helped break the ice and build a bond between them. This student later joined the territory-wide Fun Science Competition. He became so keen that he took the initiative in asking Dr Lee to help him custom-build an aqueduct in the lab for testing his artifact. "The student gradually opened up and became more willing to share his ideas," Dr Lee recalled. "The student now works as a clinical scientist in a hospital . Recently, he shared his inspiration in an online career talk with current biology students in the school. I was glad to see that he became so confident and was more than able to captivate the audience with his story with science."

Empowering science education with technology

Science is a discipline that shares a deep and extensive relationship with technology, and thereby, one cannot truly experience science without experiencing its technological dimension. It is my belief that a wise and purposeful use of technology not only can motivate students to learn, but also help students to understand science concepts and develop scientific literacy enthusiastically. Through innovative integration of technology within and outside the lesson, students can also understand our nature better and investigate like a scientist in a self-directed learning manner.



▲*Students assembling the Arduino mobile datalogger*

Visualising environmental data for conceptual understanding

With a view to helping student master science concepts, low-cost and student-assembled Arduino mobile dataloggers have been used during scientific investigations. The mobile dataloggers, connecting with sensors, are portable electronic devices used to collect data over time. The devices are able to capture thousand pieces of information in seconds as well as collect authentic data remotely when students are not around during prolonged measurements. They afford the collection and storage of environmental data automatically, reducing human error and eliminating the risk of a forgotten or missed reading. The stored data can also be accessed and auto-plotted in graphs for in-depth analysis by students at a later time. In practice, the dataloggers have been utilized in many scientific investigations across different topics in the school-based science (S1-2) curriculum. For instance, the dataloggers have been applied facilitate students in measuring the changes of dissolved oxygen (DO) and pH value of water (indicator of dissolved carbon dioxide in form of carbonic acid) in a series of ecospheres. As such, students could visualise and interpret the change and interrelation of different parameters with time by graphs more easily and the complex concept of gas exchange between different composition of animals and plants can be illustrated clearly.

Enriching scientific inquiries with remote laboratories

Learning science should not be limited in the lesson. To provide more opportunities for students to carry out interesting and authentic scientific inquiries beyond the classroom, several innovative remote laboratories have been developed with the use of the dataloggers to engage students in manipulating various science process skills such as observing, inferring, identifying variables, stating hypotheses, and graphing and interpreting data in an online manner. Predict-observe-explain (POE) exercises are also embedded in both online investigations and self-developed videos to help clarify students' cientific misconceptions and nurture students' scientific minds.

Engaging students in scientific reasoning

Connecting science with daily life scenarios can not only enhance students' curiosity in science, but also create chance for them to learn scientific reasoning. To this end, innovative experiments such as the study of human visual, auditory, and haptic reaction times have been designed with the use of mobile devices. This kind of experiment allows students to make accurate measurement rapidly and facilitates them to explain daily life practices such as why it is more effective for using car horns to alert pedestrians or other drivers when driving. This also provides collaborative learning as students need to gather data from the others for reliable analysis.

Nurturing students' environmental literacy and positive values

To help students to develop positive values like empathy and respects for life and environment when learning science, numerous daily life related scientific investigations have been infused with engineering design activities so that students can manufacture different marketable products by using disposable materials and donate them to the community in need. Assessment as learning approach such as creating a 2-minute presentation video, writing up a user manual, and inviting peers and parents to rate the STEM products is also adopted to promote meaningful evaluation and ownership of learning.

►*Students receiving a self-directed learner prize in a science competition*

Connecting science to daily life - using Technology to enhance Scientific Investigation

▲*Students actively responding to the teacher's inquiring in the lesson*

Dr. Lee Lit-hong is a passionate and proficient Integrated Science and biology teacher. He adapted the junior science curriculum to make it student-centred, activities based and daily life related to enhance students' interest for learning science. A school based curriculum "e-Life@KYC" was developed to nurture students as lifelong learners in science for the benefit of personal development.

Dr. Lee demonstrated his good knowledge on the Science curriculum and PCK (Pedagogical Content Knowledge). He strived to nurture and develop scientific concepts and science process skills of students by using an inquiry approach for scientific investigations. He helped students develop scientific thinking and guided them in examining scientific theories and hypotheses through Predict-Observe-Explain (POE) learning cycle.

Dr. Lee developed a wide range of learning activities to boost students' learning motivation and strengthen their science process skills. He developed an e-learning platform for flipped classroom to enhance self-directed learning (SDL) of students. Interactive learning tools, such as Interactive Physics, MultiSim, PhET, Arduino and Science Journal were also implemented in science lessons to enrich students' diversified learning ability.

Dr. Lee had a leading role in school to implement technology and IT for junior science education, and developed resources based on dataloggers for junior science practical. He shows his passion in using technology and IT to facilitate students' learning science by conducting scientific investigations. As such, during the outbreak of Covid-19 pandemic, he developed a school-based remote laboratory to conduct biology experiments. Through integrating webcam, YouTube Live livestreaming, Arduino datalogger, and Google Drive cloud-storage, students were able to observe and conduct scientific investigations in an online platform. By using the setup, more advanced scientific investigations such as the effect of light intensity on the behaviours of mealworms, the relationship between gas exchange of aquatic plants and animals in an ecosphere, and the effect of pH on the growth of seedlings have been conducted remotely.

In the lesson observation, Dr. Lee conducted a lesson for an integrated science class. The topic was "Common Acids and Alkalis". The learning targets and learning objectives were stated clearly and concisely in the lesson plan. He adopted a POE approach in the lesson. By using a daily life example that a portable soda water maker to produce carbon dioxide to test the pH of the solution. The students were engaged in the demonstration and were able to describe the scientific phenomena. His sustained efforts in nurturing student's science thinking and process skills was appreciated, which was evident in student's high motivation in learning science. Then, He asked students to perform a serial dilution of a soft drink with different concentrations, followed by determining the pH values of the solutions via a universal indicator and a digital pH meter connected to a datalogger. As such, students were provided with opportunities to practice science process skills. The write-to-learn and notes taking habits of students were also observed in the lesson. It helped students learn the science content and it gave them practice communicating like real scientists.

Dr. Lee was keen on sharing his expertise in IT technology and unique teaching experiences by writing journal articles. He published journal articles on technology enhanced science education in several occasions. The nominee was readily to share exemplary teaching materials and practices with peers. He was invited as the guest speaker for various local seminars and workshops of universities to share his insights and experience in science education and STEM education.

Ways to Obtain Information on the Teaching Practice

Contact:
Dr LEE Lit-hong

Email:
leelithong@kyc.edu.hk

Website:
www.kyc.edu.hk

Tel: 2660 8308

Fax: 2662 0377