EASE E·A·S·E East-Asian Association for Science Education

The Newsletter of
The East-Asian Association for Science Education
東亞科學教育學會通訊
http://theease.org

Vol.6, No.4
No. 0024
DEC. 31, 2013

National Changhua University of Education
No.1, Jin-De Road, Changhua City, Taiwan
+886-4-7232105
Fax: +886-4-7211178

A Farewell Message from the Third President

The 2nd, 1st, and 3rd Presidents of EASE: Prof. Song, Prof. Ogawa, and Prof. Lien (left to right)

As we bid farewell to 2013, I and a few of the Executive Members (EM) will soon be relieved from the 2013-14 term of office as per the regulations of the EASE Constitution. For me, this is a transformation of roles as I return as a member and continue to put in my efforts in the development of science education in East Asia.

In these few weeks, I have re-read many EASE documents and past correspondences. I have also reminisced about the 2011 EASE conference in Gwangju, Korea and all of the people I've met, such as the 1st President Prof. Ogawa, 2nd President Prof. Song, many EASE pioneers and friends, as well as events that occurred. What left a deep impression and touched me greatly is everyone's hard work and contribution in promoting regional, East-Asian, or international science education. I give my deepest thanks to everyone who has given me guidance, support, and reminder.

In 2012, the EASE headquarters transferred operations to the National Changhua University of Education in Taiwan. The Executive Director Prof. Meichun Wen and her colleagues as well as Prof. Young-shin Park at Chosun University, Korea, gave critical supports to the development of EASE. During 2012 EASE Summer School, EM Prof. Enshan LIU and other EMs from Mainland China established a new research network for young scholars with the support of Beijing Normal University. The 2013 EASE Conference was a huge success with the support of Hong Kong EMs and Hong Kong Institute of Education, which establishes a new milestone for science education exchange in East-Asia. Soon, the 2014 EASE Winter School that has been in planning for quite some time will begin in two weeks at Ewha Women's University in January 2014 under the guidance of Prof. Sung-Won Kim and Korean EMs. The EASE Newsletter has also obtained ISSN No. and greatly improved the elements of research under the hard work of Chief Editor Prof. Sung-Tao LEE, the Regional Editors, and Headquarters members. We have also seen substantial results from a collaborative research, relating to science teacher education in Asia, co-organized by EM Prof. Chen-Yung LIN with the support from National Academy for Educational Research in Taiwan. We held an EASE Symposium in ESERA Conference. EM Prof. Hsiao-Lin TUAN, Taiwan and EM Prof. Manabu Sumida, Japan, and others have played important roles in other science education societies and strengthened inter-association relationship. The EASE Executive Board has also approved the EASE Book Project Calling and a plan of new EASE Book is underway. All in all, the hard work that everyone has put in is immeasurable.

I rather enjoy reading the articles of Prof. Chen Chih Fan (1925-2012). He is a scientist who was educated in China Mainland and the U.S. and he taught in U.S., Hong Kong and Taiwan. He was also renowned for writing essays. Some of his works have been included in grade school textbooks. One of the articles is titled "Thank Heavens" He mentioned that in our culture, we often thank the heavens because we receive so much from others but give so little in comparison. The people we must thank are innumerable; therefore, we thank the heavens. This, right now, is my sentiments.

As EASE steps into the 7th year, our new President Prof. Wang LEI and the new Executive Members will lead EASE on a new page. I deeply believe that under the guidance of President Wang, EASE will develop faster and better. I would also like to use this opportunity to gather our passions and to support the New President along with the academic events of EASE. I believe that, with our joint efforts, the New President and New EMs and Headquarters Members will bring EASE to a new pinnacle!

Best Wishes and Happy New Year!

Chi-jui LIEN
at National Taipei Univ. of Education

Message from the new EASE President

Dear my colleagues and my friends of EASE,

Hello, everyone!

I joined in EASE and served as the executive member in 2009. I have participated the biennial EASE conference three times (2009 at Taipei, 2011 at Gwangju, and 2013 at Hong Kong). I hold EASE Summer School jointly with Professor Enshan Liu in 2012……Along the way, I have witnessed and personally experienced EASE being grown to become an influential academic community, which has a broad impact not only in East Asia but also around the world, just in a few years. On the one hand, EASE Summer/Winter School and biennial conference have become the valued and expected events for researchers and graduate students of science education in East Asia. On the other hand, EASE is forming very good mechanisms for cross-regional international academic exchanges and cooperation in the field of science education research. Along the way, I have witnessed and personally experienced the foresight and insight of the EASE's founders, the super leadership of the EASE Chairs and the enthusiastic dedication of all the executive members.

While the next conference will be hold in Beijing in 2015, I will serve as the next Chair, courtesy of everyone's trust and election. I am greatly honored and excited, but also feel a lot of pressure and great responsibility. I will work with you all together, try my best to inherit the excellent tradition of EASE, support executive members from different regions to play their full role, make innovation based on the existing work, so as to push forward the work of EASE and the development of science education in East Asia.

Science education is a good cause, it can not only help our students well adapt to modern life and the future work, but also develop science and technology talents who will create the better life of humanity in the future. It is really worth to be devoted to by science educators all over the world.

Mainland China has numerous science teachers and science education researchers, who have also made excellent research achievements. Therefore, because the reform and opening of Mainland China was late, coupled with language restriction, the academic exchanges and cooperation of scholars between Mainland China and other regions are relatively fewer. I will do my best to push researchers in Mainland China to strengthen exchanges and cooperation with scholars in East Asia and around the world, so that the Mainland China can play a greater role in international science education.

Finally, I wish EASE and science education in East Asia would be more and more flourishing. I wish our new and old friends known from the EASE platform would keep close connection. May our friendship be everlasting!

Lei Wang
Beijing Normal University

Hong Kong Students' Beliefs about School-Based Assessment of Laboratory Skills

Professor Sin-Pui Derek CHEUNG, Department of Curriculum and Instruction
The Chinese University of Hong Kong, Hong Kong

Laboratory work is an important component of school science. However, over the past four decades there has been considerable debate about how assessment of students' laboratory skills should be conducted as part of the public examination. In September 2009, the secondary schooling in Hong Kong was shortened from 7 to 6 years and a new chemistry curriculum (CDC-HKEAA, 2007) for Secondary 4 - 6 students (approximately 16-18 years of age) was implemented in schools. Secondary 6 students are required to take the new Hong Kong Diploma of Secondary Education Examination. The chemistry examination consists of two parts: theory papers (80%) and school-based assessment (SBA) of laboratory practical work (20%). Actually, the subject 'Chemistry' has had the most extensive experience with SBA because its school-based assessment scheme, formerly called the Teacher Assessment Scheme (TAS), was introduced for the Hong Kong Advanced Level Chemistry Examination in 1978 as an alternative to the traditional external practical examination (Cheung & Yip 2004). The ideas of TAS were originally imported from the UK, but it gradually evolved to meet the special needs of the education system in Hong Kong. The TAS was later extended to the Advanced Level Biology (Yung, 2001) and Physics examinations in 1995 and 2002, respectively.

In Hong Kong, chemistry is an elective subject in secondary schools. The SBA requires chemistry teachers to assess their students' practical skills when conducting chemistry laboratory experiments in schools. They need to make at least 8 school-based assessments in Secondary 5 and Secondary 6 (HKEAA, 2009). The laboratory work includes volumetric analysis, identification of cations and anions, and experiments suggested in the chemistry curriculum guide (CDC-HKEAA, 2007). A statistical moderation procedure is used to adjust SBA marks against the theory marks obtained from the external examination.

There is little doubt that a chemistry teacher watching over and working with a student throughout a two-year period is better able to assess the students' practical performance than is a single external practical examination. However, owing to large class size, time constraints and other barriers to the implementation of SBA, some chemistry teachers have complained about the need to conduct SBA in Secondary 5 and 6. Consequently, the Hong Kong Examinations and Assessment Authority has made some changes in the SBA scheme to alleviate teacher concerns. The changes include a reduction in the number of assessments required, and the use of investigative laboratory work as an optional assessment task. Do chemistry students in Hong Kong generally believe that these changes are good for them? Students' beliefs are critically important because they affect their interest in a school subject and classroom behaviors (Leder, Pehkonen & Törner, 2002). For example, if a chemistry student does not believe that SBA is valuable, he or she will not be willing to actively participate in the assessment and learning process; the effectiveness of the implementation of SBA in school will be adversely influenced. In the UK, coursework is preferred to examinations by most students, but the reliability of teacher assessment is still a major concern (Parkes & Maughan, 2009; Putwain, 2009).

Recently, I investigated Hong Kong chemistry students' beliefs about the new SBA scheme using a questionnaire. The convenience sample consisted of 93 Secondary 6 chemistry students from three schools. They were invited to rate the items on a 7-point scale (1 = strongly disagree, 7 = strongly agree). The results of my survey revealed that many students had reservations about the benefits of SBA (see Table 1). For example, a large number of students did not believe that SBA is a fair examination system (item 3). Although some students believed that SBA can accurately assess their practical skills (item 7), they did not want to increase the number or types of chemistry experiments to be assessed through SBA (item 10). These findings have important implications for implementing SBA in Hong Kong. School-based assessment of science students' practical skills has two important roles – as a complement to written papers in public examinations and as a catalyst for enriching the science curriculum in schools (Cheung & Yip, 2004). SBA can remove many disadvantages of a one-shot external examination and assess learning outcomes that are not examinable by means of written theory papers. One possible way to improve the implementation of SBA in Hong Kong is to reduce the number of assessments, but also enhance the quality of practical work by encouraging teachers to implement inquiry-based laboratory experiments (Cheung, 2011). A better integration of SBA and the normal chemistry teaching in school is also needed.

Table 1: Items measuring student beliefs about school-based assessment

	Item	Mean	SD
1.	SBA is a good system because teachers can provide students with frequent feedback on how to make improvement.	3.75	1.68
2.	I believe SBA is more accurate than an external practical exam to assess student performance.	3.86	1.69
3.	SBA is a fair examination system.	3.89	1.75
4.	I believe SBA experiments are useful because they can help me review chemistry concepts.	4.38	1.50
5.	SBA can help me to acquire a wider range of practical skills than external practical exams.	3.99	1.41
6.	I believe SBA is useful, because assessment can be spread over a period of two years and does not rely on one exam.	3.92	1.70
7.	SBA can accurately assess students' practical skills.	4.31	1.53
8.	SBA can increase my interest in studying chemistry.	3.63	1.66
9.	Chemistry teachers are the best persons to assess their own students' performance in practical work.	4.81	1.43
10.	SBA should increase the number or types of chemistry experiments to be assessed.	3.82	1.69

References:

1. Cheung, D. (2011). Teacher beliefs about implementing guided-inquiry laboratory experiments for secondary school chemistry. *Journal of Chemical Education*, *88*(11), 1462-1468.
2. Cheung, D. & Yip, D.Y. (2004). How science teachers' concerns about school-based assessment of practical work vary with time: The Hong Kong experience. *Research in Science & Technological Education*, *22*(2), 153-169.
3. Curriculum Development Council and the Hong Kong Examinations and Assessment Authority (CDC & HKEAA) (2007). *Chemistry curriculum and assessment guide (secondary 4 -6)*. Hong Kong: Government Logistics Department.
4. Hong Kong Examinations and Assessment Authority (HKEAA) (2009). *Chemistry and combined science (chemistry part): School-based assessment teachers' handbook*. Hong Kong: HKEAA.
5. Leder, G. C., Pehkonen, E. & Törner, G. (2002). *Beliefs: A hidden variable in mathematics education?* Dordrecht: Kluwer Academic Publishers.
6. Parkes, C. & Maughan, S. (2009). *Methods for ensuring reliability of teacher assessment*. National Foundation for Education Research.
7. Putwain, D. W. (2009). Assessment and examination stress in key stage 4. *British Educational Research Journal*, *35*(3), 391-411.
8. Yung, B. H. W. (2001). Three views of fairness in a school-based assessment scheme of practical work in biology. *International Journal of Science Education*, *23*(10), 985-1005.

"Everything comes to him who hustles while he waits."– Thomas Edison

Undergraduates' choices of Science, Technology, Engineering and Mathematics (STEM) education in Mainland China's universities

Prof. Yau-Yuen YEUNG, Department of Science and Environmental Studies
The Hong Kong Institute of Education, Hong Kong

As pointed out by many science educators (Osborne, Simon and Collins, 2003), there is a decreasing trend in the numbers of students pursuing further study in science or science-related areas in many Western/developed countries and the main reason is due to their attitudes toward science are becoming increasingly negative. In particular, the US national report to the president (PCAST, 2010) stated that "many of the most proficient students… have been gravitating away from science and engineering toward other professions." However, EU countries (EU, 2004) anticipated a severe shortage in the manpower in new scientific and engineering positions because the EU R&D expenditure was increased to 3% of GDP by 2010 and there were around 700,000 new vacancies available. On the other hand, mainland China's current state of booming economy has led to the large increase in both the number and percentage of high school students (especially female students) being admitted into universities. As already identified in many European Union countries and USA, there is a common concern among educators and academics that requires a rigorous study on factors influencing recruitment, retention and gender equity in Science, Technology, Engineering and Mathematics (STEM) higher education.

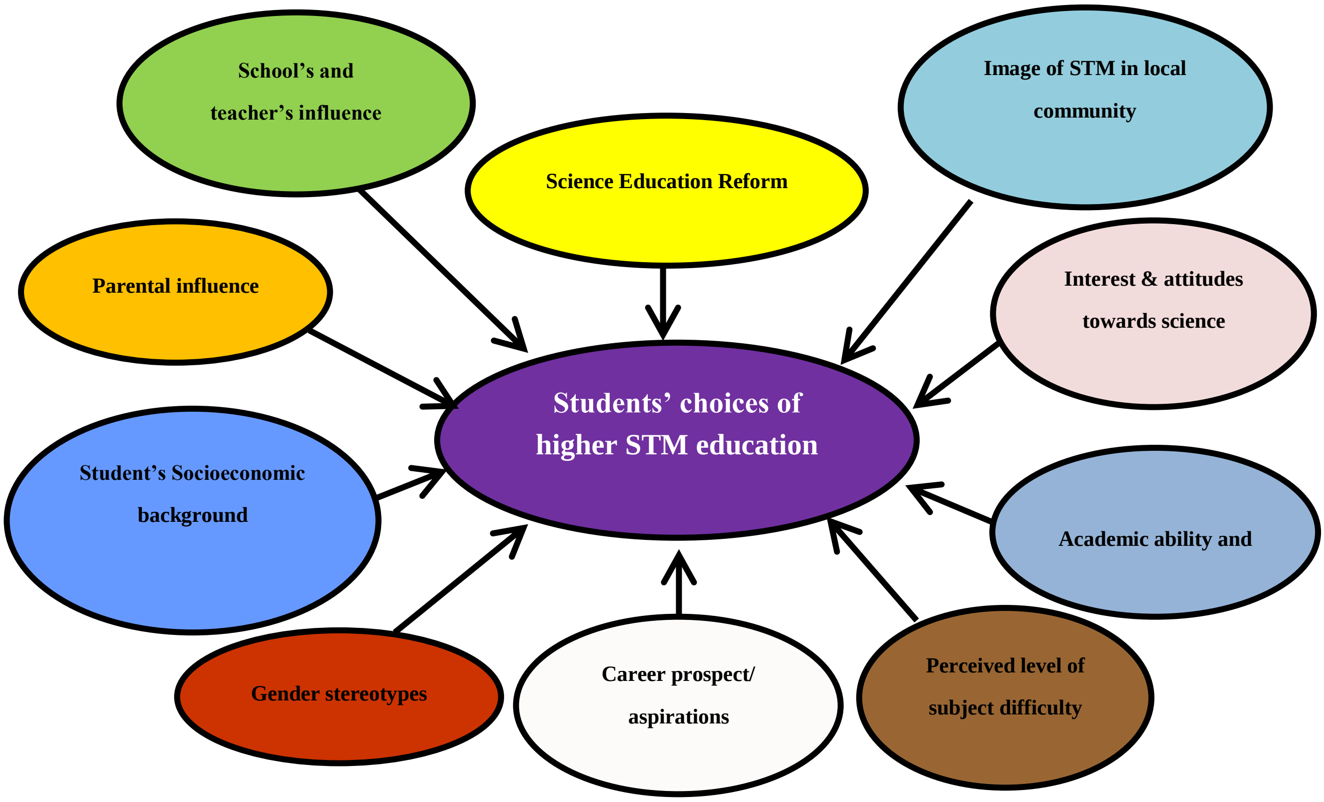


Figure 1: A schematic representation of the research framework of the IRIS study which outlines key factors affecting students' choices of higher education in STEM.

To investigate the abovementioned factors, a team of science educators from six partner institutions in five European countries (Norway, the UK, Slovenia, Italy and Denmark) initiated an international comparative research project called Interests & Recruitment in Science (IRIS, http://iris.fp-7.org) which was supported by the European Commission (7th Framework programme) and joined by more than 20 international associates (Australia, Colombia, Germany, Hong Kong, .. Malaysia, Mexico,.. Poland, USA etc.). The research framework is concisely outlined in Figure 1. From 2009-2012, around 7,000 STEM students have been surveyed but results are still being disseminated. Based on the international IRIS project, Yeung, Cheung and Sjøberg (2013) translated from the English IRIS questionnaire instrument (including 65 items in 17 questions) into Chinese and developed their own questions for interviewing students. To ensure higher return rate, they adopted paper and pencil mode (instead of the online survey) for administering the Chinese version of the IRIS questionnaire instrument to over 2,700 first year undergraduates in 3 large universities (with one comprehensive university, one focused on teacher training and one focused on science and technology) in Guangzhou of China (April – July 2012, see Figure 2). Those respondents are enrolled in 19 different majors as related to physics, chemistry, biology, food science, technology, computer and mathematics etc. Around 5% of the respondents were further interviewed to collect detailed information about their views or rationales on certain questionnaire items.

Figure 2:
Team of researchers and student helpers for administering the IRIS survey in Guangzhou.

The fundamental aim of the questionnaire survey is that research findings can provide research-based evidence to address the frequently asked questions regarding the relationship between young people's educational choices and their priorities, considerations, values and experiences on which young people base their educational choices. The IRIS instrument also includes questions on the relative importance of various kinds of school experiences and out-of-school experiences (as related to science and technology) on the students' choice of university programmes. The preliminary findings of their survey are summarized as follows:

- No significant difference in students' choices of undergraduate STEM programmes can be observed when gender is taken into consideration.
- Students' choices of undergraduate STEM programmes are quite uniform across the science and mathematics related subjects.
- Interest, good teachers and "fit in socially" are the most important factors underlying students' choices of undergraduate STEM programmes.
- "Interest of students in a subject, developing themselves, and using their talents & abilities" are rated more important than opportunities to earn a high income by students.

Those findings will have significant implications for the educational changes or reforms as those policy makers, curriculum designers in STEM, and heads of higher education institutions will be inspired to review, update, or re-design their educational policies, academic programmes in STEM as based on young people's choices and interest of study and career. They can help the local educators, education officers and teachers on how to provide well-informed guidance or advice on further study to their senior secondary students.

Acknowledgements
Financial support from the Hong Kong Institute of Education is gratefully acknowledge and thanks are also due to Cheng Yuxuan,Wu Xiao and Xiao Huafeng as well as their student helpers for their assistance in administering the IRIS survey in their respective universities in Guangzhou, China.

References:

1. Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. International Journal of Science Education, 25(9), 1049-1079.
2. EU. (2004). Europe needs more scientists! Brussels: European Commission, Directorate-General for Research, High Level Group on Human Resources for Science & Technology in Europe.
3. PCAST (2010). Prepare and inspire K-12 education in science, technology, engineering, and math (STEM) for America's future. Retrieved 21 September, 2010 from http://science.nsta.org/nstaexpress/PCASTSTEMEdReport.pdf.
4. Yeung, Y.Y., Cheung, K.L. and Sjøberg, S. (2013). "University students' choices of science and mathematics related programmes in Mainland China." Oralpresentation in East-Asian Association for Science Education 2013 International Conference, 4-6 July 2013, Hong Kong

Sharing of the experience of an undergraduate internship programme at the Space Museum

Dr. Wing-Kei HO, Department of Science and Environmental Studies
The Hong Kong Institute of Education, Hong Kong

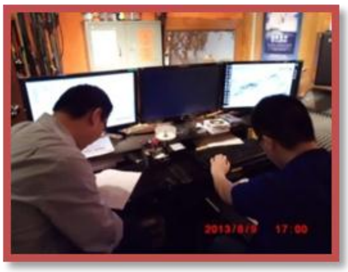
Experiential learning is an important aspect of university life. Undertaking an internship is one of the modes of experiential learning. In the summer of 2013, an internship programme was organized for the students of the Science & Web Technology Programme (Bachelor of Science Education) by our institute.

The aim of this internship programme is to provide students with an opportunity to learn through working in a real-life workplace environment in related private companies, non-governmental organizations (NGOs) or public organizations, e.g. the Hong Kong Science Museum and Space Museum. The Internship offers students the opportunity to both enhance their information technology competency and serve the community in e-learning, publishing, educational, and other related fields. Through this invaluable internship experience, students can integrate and apply the knowledge of science education and web technology they have studied in a real-life workplace environment. Participating in this internship enables students to develop effective communication and problem solving skills through interacting and collaborating with colleagues as well as cultivating a responsible working attitude. All of these experiences can help them better prepare for their future careers.

One of our internship partners is the Hong Kong Space Museum, which is the first local planetarium for the promotion of astronomy and space science. Their vision is to provide world-class museum facilities and services and make the Museum a regional astronomy and space science education center. During the 8-week internship, Boris Tse, one of our SWT programme students, designed a website for an Omnimax film, "Titans of the Ice Age", which was shown in September, 2013, providing some interesting scientific knowledge related to the show to the public.

"Everything on the webpage including the contents and the layout is designed by me, I had the autonomy to decide what I wanted to include on the webpage as long as it was related to the show," said Boris. "Besides the webpage, I have the opportunity to participate in the production process of the show, for instance, advertising, subtitling and sound recording".

"Opportunity often comes disguised in the form of misfortune, or temporary defeat." – Napoleon Hill




Picture 1 and 2:
Webpages designed by the intern for an Omnimax film, "Titans of the Ice Age"

Picture 3 and 4:
Experiencing the recording production

Another highlight of his internship was assisting in the Young Astronaut Training Camp (YATC). YATC aims to provide an opportunity for students to learn more about the remarkable achievements and developments of China's space technology and undergo Chinese astronaut training. Boris participated in the event as a helper on a 3-day training camp and the final audition/ selection of Young Astronaut. Apart from the abovementioned experience, he also assisted in some of the activities organized by the Space Museum such as the Digital Skies Student Partnership project, the setup of astronomic cardboard models and new exhibits for the exhibition unit.

Picture 5 and 6:
Assisting in the Digital Skies Student Partnership Project and Young Astronaut Training Camp



Picture 7 and 8:
Assembling astronomic cardboard models and new exhibits

"When I first knew that I needed to design a website, I found it a very challenging task because I knew nothing about webpage design. Despite the challenge I faced, I took it as a golden opportunity to push myself to master the required skills within a short period of time. I believe that we should face any difficulties with a positive attitude and take the initiatives to learn," Boris shared his experience of his internship. "Since the webpage will be linked to the official website of the museum and accessed by the public, all information must be accurate and error-free. I checked everything from photo captions to articles with great care."

Boris concluded, "I enjoyed the time working at Hong Kong Space Museum. I have learnt a lot from my colleagues and through active participation in the activities. I have gained a sense of satisfaction from designing my first website which would be part of the official webpage of the museum. I will keep abreast of the development of webpage design even after the internship. Last but not least, I hope the public could learn something from my webpage."(http://www.lcsd.gov.hk/CE/Museum/Space/Programs/Omnimax/TitansoftheIceAge/e_TitansoftheIceAge.htm).

In conclusion, the summer internship programme provided students with a good experiential learning experience. They were required to reflect on their internship experience with regard to issues related to science education and web technology. The participating students have gained hands-on experience of the challenges in the workplaces in both the public and private sectors. This will help them make decisions regarding their career path in the area of science education.

The roles of self-regulated learning in computer-based learning environment

Miss Chung-Man LAM, Department of Science and Environmental Studies
The Hong Kong Institute of Education, Hong Kong

I. Introduction

Currently, learning science in computer based learning environments (CBLEs) is a worldwide educational trend because of the feasibility and maturity of both the hardware and software support. However, the characteristics of CBLE, such as its freedom of navigation and sequencing of instruction, may actually interfere with learning. Therefore, it is necessary to promote learners' self regulated learning (SRL) skills in order to deal with the CBLEs. What is SRL and could it be taught or developed intrinsically? If it could be taught, what should be focused on when teaching SRL? Below is a discussion of these questions based on the findings from a review of the literature.

II. What is self regulated learning?

Zimmerman (2000) defines SRL as follows: “a student who is regulating his or her learning is able to set task-related, reasonable goals, take responsibility for his or her learning, and maintain motivation. It’s also assumed that self-regulated learners are able to use a variety of cognitive and metacognitive strategies. These students are able to vary their strategies to accomplish academic tasks. They are able to monitor their strategy use and modify their strategies if necessary.” SRL consists of three cyclical stages involving (i) goal setting, planning and forethought, (ii) monitoring, and (iii) self-reflection. These three stages are not independent but will interact and affect each other simultaneously. The above descriptions and phases are not strange to us, as human beings have the intrinsic ability to learn and interact with the environment to acquire the SRL skills stated.

III. Could SRL be taught or developed intrinsically?

Research has shown that SRL could be taught, but instruction should occur in a specific academic context, and teachers should provide “scaffolded assistance” when adopting strategies and regulating motivation (Schapiro& Livingston, 2000; Talbot, 1997). The most important factor is that teachers provide the opportunity for students to develop and strengthen their SRL skills. Empirical research done by Azevedo (2005) has shown that adaptive scaffolding could foster students to use self-regulated strategies resulting in deep learning of the complex science topics of the circulatory system and ecology using CBLE as a metacognitive tool. Azevedo (2005) examined the effectiveness of SRL and externally regulated learning (ERL) in promoting qualitative shifts to more sophisticated mental models in students. Two kinds of ERL settings were adopted, one was static scaffolding in which domain-specific sub-goals were listed to remind students, and the other was dynamic scaffolding in which human tutors monitored, evaluated and provided feedback regarding the students’ self-regulatory skills. Students were required to write down the mental models before and after using CBLE. Students who received static scaffolding would regulate their learning by using effective and ineffective monitoring strategies. On the other hand, students who obtained dynamic scaffolding would rely on the human tutors, and utilized a variety of self regulatory strategies such as activating prior knowledge, creating sub-goals, monitoring their cognitive system by using feeling of knowing (FOK), judging of learning (JOL), self questioning, summarizing, making inferences, drawing, elaboration, and help seeking from the tutor. Students in the control group showed fewer self-regulatory strategies. The results of a pre-post mental model comparison are summarized below (Table 1):

Table 1 : Comparison between pre and post mental models in different settings

Educational level / Setting	College student	Middle and high school students
Static scaffolding	More sophisticated mental models	Facilitate shifts in mental models to a certain extent
Dynamic scaffolding	Significant qualitative mental shifts	
No scaffolding	Little or no qualitative mental shifts	

From the above findings, we can see that SRL could not be well developed in self-learning activities unless timely scaffolding and feedback are provided dynamically.

IV. What should be focused on when teaching SRL?

Another study (Greene et al., 2009) revealed that monitoring is a crucial SRL process that helps students construct an understanding of complex science topics using CLBEs. In the study, 219 high school and middle school participants were asked to self-study three articles on the circulatory system in CBLE for 40 minutes and write down their mental models both before and after. The researchers identified 35 micro-level self-regulatory behaviors and categorized them into 5 macro-level processes which were planning, monitoring activities, strategy use, handling task difficulties and demands, and interest. The results revealed that student educational level, mental model pretest score and frequency of using monitoring activities were the significant predictors of the likelihood of exhibiting a more complicated mental model in the posttest. If the educational level was controlled, students who applied monitoring activities more frequently would have a higher probability of an elevated mental model score in the posttest, regardless of their prior knowledge. If prior knowledge was taken into account, students with low pretest scores who frequently displayed monitoring behaviors exceeded those students with high pretest scores but who didn’t show any monitoring behaviors. This reflected that monitoring is a key element that should be emphasized in teaching SRL. The micro-level processes include judgment of learning, feeling of knowing, self-questioning, content evaluation, identifying the adequacy of information, monitoring progress toward goals, and monitoring use of strategies. Monitoring activities results in finding the discrepancies between goals and achievement; hence, revising the goal, and changing strategies or plans occurs.

V. Conclusion

All in all, “learning to learn” is a crucial issue around the globe as learning science does not only happen in the classroom or school context; it is independent of time and space since the occurrence of CBLEs. SRL, perceived as a vital skill, should be taken into account when using CBLEs. Though monitoring is the key component in SRL, the way that students acquire the SRL skills is still doubtful. Thus, studies on the interrelationship between educational software features and specific SRL behaviors, and the pattern of SRL behaviors in learning science could be carried out in order to fill the gap between the theory and implementation.

References:

1. Azevedo, R., Cromley, J. G., Winters, F. I., Moos, D. C., & Greene, J. A. (2005). Adaptive human scaffolding facilitates adolescents' self-regulated learning with hypermedia. Instructional Science: An International Journal of Learning and Cognition, 33(5-6), 381-412. O’Regan, M. Grätzel Nature 1991, 353, 737−740.
2. Greene, J. A., & Azevedo, R. (2009). A macro-level analysis of SRL processes and their relations to the acquisition of a sophisticated mental model of a complex system. Contemporary Educational Psychology, 34(1), 18-29. P. Du, R. Eisenberg Energy Environ. Sci. 2012, 5, 6012–6021.
3. Schapiro, S.R., & Livingston, J.A. (2000). Dynamic self-regulation : The driving force behind academic achievement. Innovative Higher Education, 25, 23-35.
4. Talbot, G. (1997). Can self-regulated learning be taught to college students? Quebec, Canada. (ERIC Document Reproduction Service No. ED 409 289)
5. Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), Handbook of self-regulation (pp.13-39). San Diego, CA: Academic.

Generation of Cognitive Conflict in Learning Biological Classification of Lepidopterans

Dr. Kwok-Ho TSOI, Department of Science and Environmental Studies,
The Hong Kong Institute of Education, Hong Kong

'Which is a moth? Which is a butterfly?'

Figure 1

The false tiger moth *Dysphania militaris* with big and beautiful wings.

Figure 2

Butterflies with dull or small wings. A. Spotted angle, Caprona alida or C. agama. B. Telicota sp. (V. Yiu, Personal communication)

'Insects with big and beautiful wings are butterflies.'
This was the answer given by a primary school girl. Is it also your choice?

Biological classification is the foundation for developing effective conservation programmes for wildlife. However various degrees of difficulties are commonly faced by children when performing animal identification. Teachers may also have a poor understanding of biodiversity and animal classification, particularly for invertebrates (Jambrina et al., 2010). This unsatisfactory performance is believed to be associated with insufficient background knowledge of invertebrate biodiversity (Yen et al., 2007). A study revealed that a group of student teachers scored an average of 49.7% in differentiating lepidopterans (insects characterized with minute scales over membranous wings, i.e. moths and butterflies) (Tsoi, 2013). Most student teachers used the same traits of wing coloration and size as the young girl did for the classification.

Butterflies are considered as nature's jewel. Many species can be easily identified by non-entomologists. These animals are thus commonly used as teaching models for children learning biological concepts, e.g. ecosystems or life cycles. However the global population of many butterfly species is declining and some of them are likely to become extinct in the coming decades. Butterfly conservation has thus become a global concern. Yet the general public is still confused about what a butterfly actually is, and any efforts spent on the conservation of these pollinators would thus be attenuated.

An alternative conception that butterflies have brightly colorful wings but moths have rather dull coloration is widespread among the general public (Yiu and Yong, 2002). It is realized that most nocturnal moths are dully colored. Yet there are many exceptional examples showing that diurnal moths are bright, while in contrast many butterflies and skippers are dull (Britton, 2011). In terms of their wing size, many species of the families Hesperiidae (skippers) have small wings. Therefore examination of the wing color and size are not reliable means of identifying these two animals. One of the diagnostic criteria that can be relatively accessible to children is their antennal structure. Butterfly antennae have a clubbed or hooked end (Figure 3), whereas moths have varied forms of antennae (Britton, 2011). Moths may have filamentous, pectinate or plumose antennae (Figure 4). However, it is not surprising that there are still exceptional cases. Some moths (e.g. the family Castniidae) have club-ended antennae, whereas moth-like butterflies (family Hedylidae) have unclubbed antennae (Scoble and Aiello, 1990). It is fortunate that these exceptional species make up a rather small proportion of all lepidopterans and thus the antennal structure is still regarded as the simple and major guiding principle, particularly applicable when children are distinguishing these two animals (Britton, 2011).

It is worth exploring an effective way to promote the conceptual change in those who have such alternative conceptions of this issue. Direct presentation of all different features of the butterfly and moth to the learners is the simplest teaching approach, yet the learning effectiveness of such direct instruction in biological classification is doubtful (Kattmann, 2001). According to the principle of constructivism (Posner et al., 1982), learners holding alternative conceptions may generate cognitive conflict once they find discrepancies between the observed results and their expected ideas. Their existing schema will be modified and the reconstruction of a new conception is facilitated through experiential learning actions and reflections during the process of concept accommodation. The generation of cognitive conflict is thus believed to be an effective teaching strategy under the constructivist theory of learning (Lee et al., 2003) . Referring to the theoretical frameworks of the integration of scientific thinking processes into science classes, and the facilitation of collaborative learning through grouped discussion (So, 2011), an inquiry-based learning activity is designed for generating the cognitive conflict of the learners during the learning process. The teaching plan is summarized in Table 1.

The inquiry-based activity motivates the student teachers to participate in the assessments. A series of sequential learning processes including knowledge assimilation, generation of cognitive conflict, reflection, self-exploration, evidence collection, testing hypothetical traits, and the reconstruction of a new concept through the independent or grouped works are experienced. 'Conflict' was clearly observed in Tsoi's study (2013) in which some students were agitated and argued about those issues for which most students got the wrong answer. The constructivist approach associated with the generation of cognitive conflict has played an essential role in facilitating the active learning process of the student teachers. Its effectiveness in promoting conceptual change was revealed by a 30% increment in the average score on the second round of lepidopteran identification (on different specimens) arranged for one week after the study (Tsoi, 2013). A recent test on a small number of participants showed an encouraging result that all these students acquired 100% accuracy on a new batch of lepidopterans a year after the study, revealing that the approach is effective in terms of promoting long-term conceptual change in the participants (personal observation). A further study will be performed on a larger sampling size to confirm these long-term effects.

Table 1: An inquiry-based learning activity - Identification of lepidopterans

	Step	Actions	Discussion	Special remarks	Objectives
1	Orientation	Setting up a scenario	×	Game introduction	To motive students' learning interest
2	Assessments	Identification of lepidopterans displayed in a series of pictures (uncertain identity)	×	Writing reasons if any	To facilitate knowledge assimilation using existing schemas (presented in written reasons)
3	Stimulation	Release of results	×	Scoring the correct answers	To trigger the generation of cognitive conflict
4	Self exploration	Comparison of a series of identified lepidopteran pairs (one butterfly; one moth)	✓ (encouraging the discussion of possible diagnostic traits)	- Encouraging students to make trials on proposing hypothetical traits - Collection of these hypothetical traits by the teacher	To facilitate reflection
5	Testing the hypothetical traits	Re-presentation of the first half set of the lepidopterans' pictures (confirmed identity)	✓	- Guidance or hints but not the answer is given by the teacher - Evidence collection	- To test the hypothesis - To reject or accept the hypothetical traits based on the evidence - To facilitate the reconstruction of a new concept
6	Practice	Re-presentation of the second half set of the lepidopterans' pictures (confirmed identity)	✓	Positive reinforcement is given	- To apply the newly constructed concept - To practice the newly acquired skill
7	Conclusion	Listing the features and confirmation with the classification keys	✓	Encouraging questioning and feedback	To consolidate the newly constructed concept

This cognitive conflict approach and associated constructivist framework can be incorporated into children's learning experiences of biological classification issues, e.g. dolphins and fish, or spiders and insects. Apart from undergraduates, the approach has also been attempted with secondary school students (Figure 5) and the response was generally inspiring and positive. This approach thus has potential implications for science education for children.

Figure 3a

Figure 3b
Clubbed or hooked end of the antennae in butterflies.

Figure 4a

Figure 4b
Filamentous and plumose antennae in moths

Figure 5
A role play for learning the classification of lepidopterans in a secondary school.

References:

1. Britton D (2011) What are the differences between butterflies and moths? Retrieved from http://australianmuseum.net.au/What-are-the-differences-between-butterflies-and-moths.
2. Jambrina UC, Vacas JM and Sanchez-Barbudo M (2010) Student teachers' conceptions about animals and particularly about spiders. *Electronic Journal of Research in Educational Psychology*: 8(2): 787-814.
3. Kattmann U (2001) Aquatics, flyers, creepers and terrestrials – Students' conceptions of animal classification. *Journal of Biological Education.* 35(3): 141-147.
4. Lee G, Kwon J, Park SS, Kim JW, Kwon HG and Park HK (2003) Development of an instrument for measuring cognitive conflict in secondary-level science classes. *Journal of Research in Science Teaching*. 40(6): 585-603.
5. Posner GJ, Strike KA, Hewson PW and Gertzog WA (1982) Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education*. 66(2): 211-227.
6. Scoble MJ and Aiello A (1990) Moth-like butterflies (Hedylidae: Lepidoptra): a summary, with comments on the egg. *Journal of Natural History*. 24: 159-164.
7. So WMW (2011). Small group inquiry science learning: Developing science thinking and science processes. In Cheng MHM and So WMW (Eds.). *Science Education in International Contexts*. Sense Publishers, The Netherlands, pp 101-112.
8. Tsoi KH (2013) 'All flying insects with big, beautiful wings are butterflies!' A study in challenging this misconception. *School Science Review*. 95(350): 99-104.
9. Yen CF, Yao TW and Mintzes JJ (2007). Taiwanese students' alternative conceptions of animal biodiversity. *International Journal of Science Education*. 29(4): 535-553.
10. Yiu V and Yong JJ (2002). *Butterfly Watching in Hong Kong*. Wan Li, Hong Kong.

"The harder you fall, the higher you bounce."– American Proverb

Knowledge of composting as a way of food waste management and the willingness to pay for it: perceptions of secondary school teachers


Dr. Wenjing DENG and Prof. Wing Mui Winnie SO,

Centre for Education for Environmental Sustainability, Department of Science and Environmental Studies

The Hong Kong Institute of Education, Hong Kong

1. Introduction

Food waste (FW) is putrescible organic waste. In Hong Kong, food waste is mainly disposed of in landfills, which generates greenhouse gases and leachate, seriously contaminating the environment. In Hong Kong, the daily disposal of FW is 3,700 tons (EPD, 2012). Only 3% of the FW is recycled (Green Power, 2013). Therefore, FW management is one of the main environmental concerns.

In recent years, the government has implemented many plans regarding FW treatment. Besides, NGOs are also promoting FW recycling education. Greeners Action and Green Power carried out the Zero Food Waste in Campus Plan. In this project, the NGOs provided Food Waste Decomposers (FWDs) to the schools and encouraged the staff and students to utilize the compost generated to plant trees and grass. Finally, approximately 2,900 kg of FW were recycled (Greeners Action, 2013).

In this case, it is obvious that purchasing a FWD can help decompose the FW into compost, which can better help the schools to reduce FW. However, there is no research investigating the FWD purchasing considerations in schools. Therefore, this study can fill this knowledge gap to help better establish FW recycling schemes in schools.

2. Methodology

This study evaluates the middle school teachers' willingness to pay for the decomposer by questionnaire survey with the contingent valuation method in three middle schools in Hong Kong. The questionnaire survey was conducted in November 2012. Every school received 50 questionnaires. A total of 121 valid questionnaires were retrieved, including 48 from School A (Hong Kong Island), 43 from School B (Kowloon), and 30 from School C (New Territory). The data collected were analyzed by SPSS.

3. Results and discussion

The questionnaire was designed to find out: teachers' knowledge of and views on Hong Kong's FW management, the present status of FW management in their schools, and their views and preferences regarding the school's FW management. Finally, factors affecting their attitudes towards FWD were investigated.

3.1 Teachers' knowledge of and views on Hong Kong's FW management

The survey shows that all teachers investigated knew that the FW in Hong Kong is disposed of in landfills, while 95.4% had heard of the decomposer, and 89.4% said they knew the functions of the decomposer. However, only 12.3% of them could distinguish the suitable types of waste that the FWD can decompose. Thus, their lack of knowledge of the FW classification details could be an obstacle for the future promotion of decomposers on campus.

Table 1 Teachers' attitudes towards FW management

Questions	Options	Total (n=121)	
		Freq.	%
Q1 What do you think of the problem of FW in Hong Kong?	No problem	1	0.8
	Small problem	4	3.4
	Acceptable	43	35.1
	Quite serious	36	29.6
	Very serious	29	23.9
	No idea	8	7.4
Q2 Do you agree that FW is useful?	Yes	108	90.1
	No	7	5.3
	No idea	6	4.7
Q3 If you have ever heard of the decomposer, what do you think about it?	Totally useless	2	1.4
	Poorly effective	22	17.9
	Acceptable	52	43.1
	Highly effective	13	10.8
	Totally successful	1	0.7
	No idea	31	26.1

More than half of the participants agreed that the FW issue in Hong Kong is serious (29.6% "quite serious" and 23.9% "very serious") (Table 1 Q1). Meanwhile, 90.1% believe that FW is useful (Table 1 Q2). Therefore, they may consider other practical factors if they object to use FWD. As only 11.5% of the staff members thought that the decomposer is "highly effective" or "totally successful" (Table 1 Q3), the decomposer's efficiency may affect their attitude towards having a decomposer on campus.

3.2 The present status of school's FW management and teachers' views

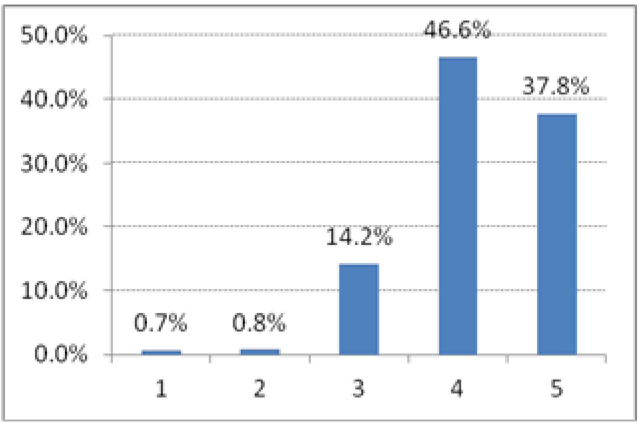
We found that the teachers frequently had leftovers (Table 2 Q4), and that none of the three schools had a FW classification procedure.
Most of the teachers thought that the FW problem in their school was worse than acceptable (Table 2 Q5). Hence, the majority realized the need to manage the FW at their schools, which should result in stronger support for buying a decomposer.

Table 2 Situation of FW management at school

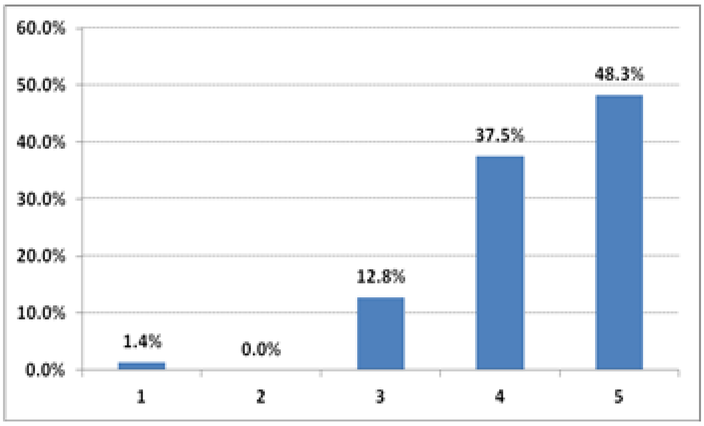
Questions	Options	Total (n=121) Freq.	%
Q4. Have you ever wasted any food at school?	Never	6	5.0
	Rarely	51	42.1
	Sometimes	52	43.0
	Always	12	9.9
Q5. What do you think of the problem of FW in your school?	None of both	94	77.7
	Very serious	31	25.6
	Quite serious	79	65.3
	Acceptable	11	9.1
	Small problems	0	0.0
	No problem	0	0.0

3.3 Teachers' preferences regarding school FW management

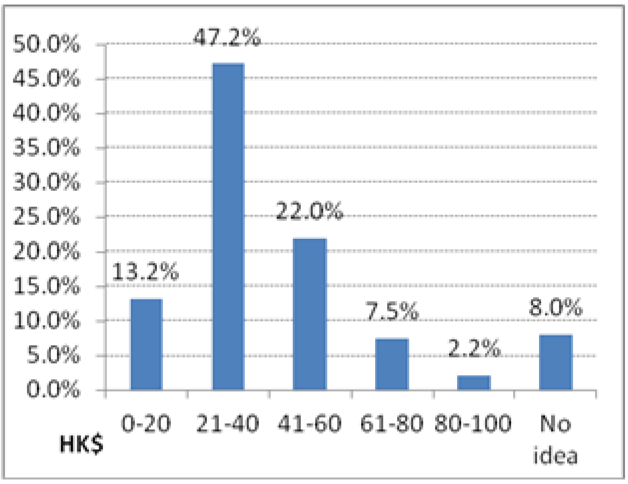
Our questionnaire also shows that only 23.9% of the staff would firmly support having a decomposer on campus, while the rest neither supported (38.1%) nor had any idea about it (38.0%). There are several main concerns when they were asked to choose one only. "No place for settlement" was the greatest concern for 26.9% of the participants, followed by the "Hygiene problem" (24.3%) and being "Too expensive" (23.5%). Besides, "Less contribution to environmental protection" (13.7%) and "No department in charge" (11.6%) were the greatest concerns for some of the teachers.



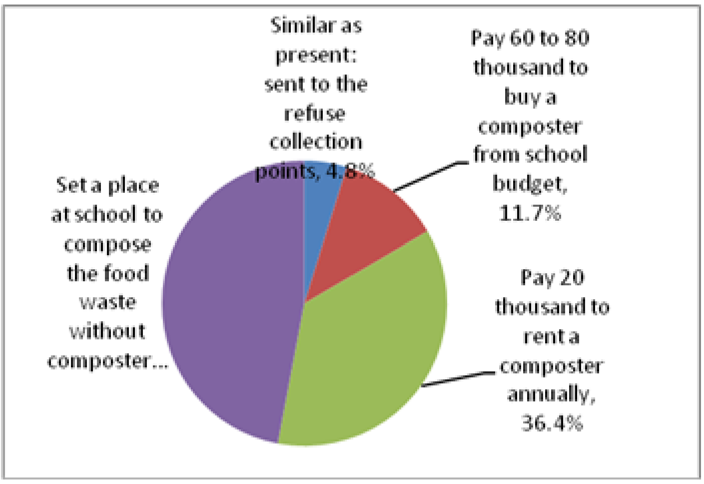
Money is needed for the operation of the decomposer. To what extent do you agree to the "user-pays" principle (i.e., everyone has to pay for their leftovers)? (1=totally disagree, 5=totally agree)



If ask for my opinion, I will support my school to buy the decomposer. (1=totally disagree, 5=totally agree)



If you had 100 dollars, how much would you be willing to pay AT MOST for the operational fee of a decomposer at school?



As one of the staff members, my preferred food waste management program would be

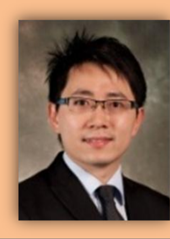
Most of the teachers supported buying decomposers and agreed to pay for their own leftovers (Figures 1 and 2). However, when asked how much they were willing to pay for FW management, 60.4% only agreed to spend $40 at most if they had $100 (Figure 3), while 47.0% preferred to set aside a place for composting at school without using a decomposer, which tends to be cheaper, compared with renting (36.4%) or buying a new one (11.7%) (Figure 4).

4. Conclusion

The staff agreed that paying for a decomposer is reasonable. However, the lack of knowledge of FW treatment leads to their unwillingness to pay for a decomposer in reality. Consequently, the possible factors hindering decomposer promotion at school could be: the cost of the decomposer, the staff's knowledge of decomposers and other practical issues. Therefore, more education and detailed planning for the FW management project are suggested and required for the popularization of decomposers.

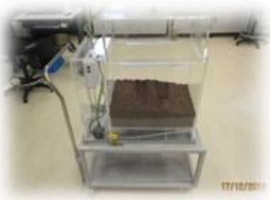
The Use of the Interactive Conceptual Approach for Maximizing the Enjoyment of Learning Green Technology

Dr. Yiu-Fai TSANG, Department of Science and Environmental Studies
The Hong Kong Institute of Education, Hong Kong



Most students are used to memorizing formulas and theories without fully understanding the principles behind them. This phenomenon is also common in learning Green Technology in both tertiary education institutions and secondary schools. It is a daunting challenge for the teacher to assess if the students really understand the topics taught or if they simply apply the equations they have memorised to get the right answers. This task is made even more difficult in large class-size situations.

This project proposes the development of a hardware kit consisting of components to enable students to build different green technology systems, thereby facilitating learning. Using this kit, students have to create their own models based on selected topics or theories. This approach enables the student to connect conceptual ideas to physical/ mechanical systems in a more direct and meaningful way. Through the model making process, students will find learning Green Technology enjoyable. This project also encourages and supports the teaching and learning of Green Technology in tertiary education institutions and secondary schools in Hong Kong.



Instead of requiring students to memorize formulas and theories without fully understanding the nature of Green Technology, the proposed interactive teaching approach can stimulate student thinking on the related topics. A considerable amount of effort is required to help students to develop the ability of conceptual understanding, without overwhelming them with a large amount of mathematics and theories. The teacher will explain the functions of each component of the toolkit. Through hands-on experience in building green technology systems with the hardware kit, students will create their own designs for experimentation. There will be opportunities for students to discuss their designs with teachers. This learning approach allows students to create innovative models for learning Green Technology. Lecturers/ instructors will also be able to recognise immediately any misunderstanding of the concepts taught through the models constructed by the students.

This project consists of four parts: (a) teaching kits, (b) seminars, (c) workshops, and (d) school visits.

a) Teaching kits involving different topics will be designed to facilitate students' learning and understanding of the fundamental concepts of Green Technology. The hardware components will be tailor-made based on the course contents and student needs in different educational institutions.

b) The seminars are designed for participants to exchange innovative ideas and current concerns related to Green Technology and Environmental Protection. Up-to-date information and experience (both local and global) will be shared by NGOs and tertiary education institutions.

c) Apart from lectures, several interactive workshops will be organized for teachers and students. The workshops will cover the basic concepts of Green Technology, introduce scientific ideas, and emphasize technological implementation. After the students have a good grasp of these concepts, a model-making project using the proposed hardware teaching kits will be arranged. The results will be used as an evaluation for the proposed teaching kits and for further enhancement.

d) School visits facilitate face-to-face discussions on the professional training and technical supports for lectures/ instructors and school teachers.

"Change is not merely necessary to life – it is life."– Alvin Toffler

A Knowledge Transfer Programme on Environmental Pollution investigation for In-service Teachers/ Technicians in Hong Kong Secondary Schools

Dr. Wai-Chin LI, Department of Science and Environmental Studies

The Hong Kong institute of Education, Hong Kong

A. Background

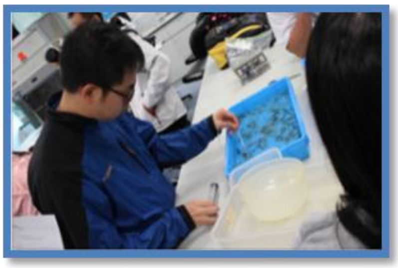
The development of environmental conservation and education in Asia lags far behind the Western World. It appears to the team that education in the environment in particular has been lacking, regardless of the fact that it represents one of the three important elements of environmental education (about, in, and for the environment). This is partly due to the fact that environmental studies is a multidisciplinary subject for which many in-service teachers have difficulties locating a set of appropriate teaching materials tailor-made for the local environment. Our programme will help fill this gap. Instead of adopting materials produced in foreign countries, teachers can make use of the local information in the resources pack provided in the programme to organize good quality educational activities for their students.

B. Mission

The whole program is designed for in-service teachers/technicians of Liberal Studies, Geography, Science or Environmental Education in secondary schools. The programme and resources pack cover both scientific and technological knowledge, consisting of teaching materials and guides with suggested topics and references demonstrating the standard methods of environmental pollution investigation. It will not only supplement the existing monotonous academic textbooks, but also encourage students' self-study outside the classroom. The whole training programme consists of two main parts:

Part 1: A 3-hr seminar mainly focused on the general principles of environmental pollution and their importance in our daily life. This serves as providing background information to the teachers/technicians on the pollution status in Hong Kong and other areas which may facilitate their teaching in the future.

Part 2: A 3-hr experimental workshop/practical laboratory session to demonstrate some techniques and equipment used in collecting environmental samples, carrying out toxicological tests, and analysing various environmental quality parameters. The procedure of conducting an environmental pollution study is also illustrated.



In addition, pilot schools have been invited to initiate an environmental pollution investigation with students in their own schools, with HKIEd providing technical support such as sampling equipment and sample analyses, and professional consultancy. This will promote the development of field learning activities in secondary schools.

Also, we hope that from the environmental resources pack and the programme, the participants can have several benefits:

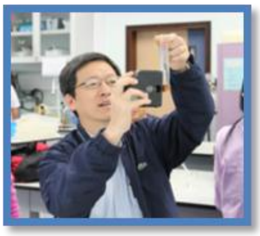
1. Teachers can use the knowledge to organize quality field-based learning activities;
2. Teachers will be encouraged to make good use of nature as an outdoor classroom to effectively teach students the importance of environmental conservation; and
3. Professional technical supports will be provided for in-service teachers/ technicians of pilot schools for conducting environmental pollution studies with their students.

C. Objectives

1. To promote the teaching effectiveness and quality of related courses by providing teaching resources for in-service teachers/technicians in secondary schools;
2. To improve the learning experience of secondary students;
3. To enhance in-service teachers/technicians' knowledge and understanding of various kinds of environmental pollution in Hong Kong;
4. To provide practical information on the pollution status in Hong Kong for the participants; and
5. To provide consultancy and technical supports for in-service teachers/technicians in environmental pollution studies.

D. Relevant disciplinary knowledge involved

1. Environmental Studies



Environmental Studies is the main disciplinary knowledge of this program. It aims to study the operation of the environment and human's interaction with the environment – to serve the final purpose of solving the living problems we encounter in the contemporary world. Basically, Environmental Studies can be viewed as an interdisciplinary subject as it encompasses knowledge in ecology and environmental sciences. Other concepts such as economics, politics, human culture, and resource management can also be involved when studying a specific issue in Environmental Studies.

2. Integrated Science

The program explores Environmental Studies from a Science perspective. Science techniques such as experimental design, sampling method, data collection and quantification, are implemented with ecology and other environmental concepts in the workshop, encouraging participants to adopt scientific procedures when studying the environment.

E. Knowledge transferred from the project

Three main aspects of environmental knowledge are delivered through the program:

1. Environment of Hong Kong

This part describes several environmental problems in our home city. Issues such as "Urban Heat Island", "Air Pollution", "Water Quality" and "Land Pollution" are discussed. Speakers have introduced the causes of pollution, mechanisms, impacts and handling strategies together with the participants to achieve a more comprehensive understanding of pollution issues.

2. Latest technology to solve environmental problems: Phytoremediation

This part aims to shift the focus to developing a deeper understanding of one particular environmental problem and its solution – water/soil contamination and using plants to clean up polluted areas (Phytoremediation). The mechanism, means of application, effectiveness, and limitations of phytoremediation are discussed. Participants are encouraged to explore more new pollution-control technologies, thereby becoming equipped for future teacher-student knowledge transfer.

3. Environmental Toxicology

This part establishes a link between environmental contamination and living organisms. Basic toxicology concepts are introduced, for example, the effect of the dose of heavy metal on toxicity. A toxicity test design is also shown in the workshop. Participants are encouraged to adopt toxicity tests such as soil/water tests in their own environmental education lessons.

Other knowledge such as knowledge of apparatus, safety guidelines, and teaching activity samples of environmental pollution study are also mentioned in the programme.

F. An alternative teaching method for Environmental Studies

Compared to traditional teaching methods of environmental studies such as lectures, environment observation, or case studies, this programme encourages participants to use laboratories more often, improves their data collection skills, and promotes self-directed learning of environmental issues. An alternative teaching method is proposed to promote an education environment with experiential and activity-based learning.

In conclusion, schools' responses to and participation in the pilot study provided rich information for the further development of seminars, workshops and resource packs. Teachers/ technicians concretely indicated their topics of interest for pollution investigation, as well as the difficulties they encountered when they developed related projects. The participants also showed interest in getting more information and teaching materials such as apparatus lists and safety guidelines to improve their teaching activities. Use of laboratories for pollution analysis was also suggested by the participants as it can be easily arranged in the school setting. The information collected from the pilot study established the foundation for designing the seminar, experiential workshop and resource pack.

Neuroscience in education: A study of student teachers in Hong Kong

Miss Ngai-Ying Fiona CHING, PhD candidate, Department of Science and Environmental Studies
The Hong Kong Institute of Education, Hong Kong

The brain, a spongy, 3-pound mass of tissue, is the most complex and mysterious organ in our body, on Earth and probably in the universe. Every human emotion, every human feeling, every human thought and every human decision involves the human brain. The brain has about 100 billion neurons, the basic functional units of the brain.

'Every fact we know, every idea we understand, and every action we take has the form of a network of neurons in our brain.'[1] If the brain is the 'organ for learning' and education is about enhancing learning, it is sensible that neuroscience would have something to offer for education. *(In case you don't know, neuroscience is the scientific study of the brain and nervous system.)* As the connection between neuroscience and education becomes more evident, a new interdisciplinary field has emerged. It is sometimes called 'neuroscience and education', 'neurolearning', 'educational neuroscience' or 'mind, brain and education'.

Neuroscience is alluring for our whole culture, and everyone is a potential target for neuromyths —popular, unrealistic beliefs about what neuroscience can do for education. Yet, educators appear to be particularly susceptible to misinformation about the brain and its potential use in education due to a combination of interest and lack of knowledge. *(You have probably heard of such things as Brain Gym, the VAK approach, 10% use of the brain, and critical periods. Yes, they are all neuromyths!)* Neuromyths have also been found to be prevalent among student teachers.

At present, neuroscience is rarely featured as part of teacher education. Experts in the field of neuroscience and education are calling for more formal teacher training in the biological underpinnings of learning. So far, educating teachers about neuroscience has been found to be beneficial. For example, maintaining patience, optimism and professionalism with their students, renewing their sense of professional purpose, and increasing self-confidence and use of neuroscience in their classrooms are all benefits of a greater understanding of neuroscience.

Since most studies in the field of neuroscience and education have been conducted in Europe and North America, I hope the findings from my study will add an oriental perspective to the field. Under the supervision of Prof. Winnie So, my study is a cross-sectional, mixed methods study on student teachers' neuroscience literacy, perceptions of neuroscience in education and use of neuroscience research-based teaching strategies. First, I will try to obtain an overview of the neuroscience literacy of Hong Kong student teachers and their perceptions of neuroscience in education using a questionnaire. Then, I will make an attempt to identify the predictors of neuroscience literacy and perceptions of neuroscience in education. Finally, I will examine the relationship between neuroscience literacy and perceptions of neuroscience in education and the use of neuroscience research-based teaching strategies using the case study approach which involves lesson observation, teacher self-assessment and interviews.

With the two exciting big projects, the 'BRAIN' Initiative in the US and the Human Brain Project in Europe, and some other smaller-scale projects carried out in different countries, we can expect to see many new brain research findings over the next ten years. With the ultimate goal of helping transform education by science, I hope my research will lead to a timely contribution in the field of neuroscience and education by providing useful recommendations for the planning and development of teacher education that include a neuroscience component. And I wish, as we know more about the brain, that we will know more about our students and ourselves as educators because 'exploring the brain is exploring the self'[2].

[1] Zull, J. E. (2002). *The art of changing the brain: Enriching teaching by exploring the biology of learning*. Sterling, VA: Stylus Publishing.

[2] Riken Brain Science Institute: http://www.brain.riken.jp/en/

Environmental science is a basic component of environmental education

Dr. Cheuk-Fai Stephen CHOW, Department of Science and Environmental Studies
The Hong Kong Institute of Education, Hong Kong

Committing to reducing wastewater pollution

Since World War II, chemicals have been widely used in the mass production of consumer products. The widespread use of organic chemicals in industry has led to significant wastewater pollution and serious health problems throughout the world. Decades on, the issue remains unsolved.

But the situation is changing. In a three-year study funded by the Research Grants Council under the Early Career Scheme, which started last December, a research team from The Hong Kong Institute of Education (HKIEd) has successfully invented a device that can detect and automatically degrade a major industrial pollutant, oxalic acid.

According to the preliminary results, it is found that a bimetallic complex, Ru_2Fe_2 can not only act as a chemosensor for oxalic acid, but can also function as a Photoassisted Fenton (PF) catalyst to degrade the pollutant.

The research team with background in applied chemistry and environmental protection technologies, has recently discovered. The study, Design and Synthesis of Bimetallic Complexes as Bifunctional Molecular Devices for Simultaneous Detection and Degradation of Industrial Pollutants, which is believed to be the first of its kind in the world, was inspired by the discovery of a major problem with the widely used PF waste treatment method.

PF processes generate highly oxidizing materials - such as hydroxyl radicals from oxidizing liquid H_2O_2 under UV irradiation - for the destruction and ultimate mineralisation of targeted contaminants. Despite PF having been proven capable of destroying a large range of hazardous organic pollutants, the method usually involves an over-dosage of chemicals (such as H_2O_2), catalysts (such as transition metal complexes), energy (such as continuous UV irradiation) and excessive manpower. In this context, a smart molecular device that can automatically degrade industrial pollutants when their levels reach a certain detection threshold is highly desirable.

The new approach is more efficient than traditional methods as Ru_2Fe_2 can smartly control the PF degradation of oxalic acid, thus reducing the loading of chemicals, catalysts, energy and manpower. Initial findings of the study showed that upon addition of oxalic acid to the Ru_2Fe_2 solution under UV-vis sunlight, the total organic carbon content of the solution mixture decreased rapidly in the first 4 hours, and 95% mineralization of the pollutant took only 6 hours.

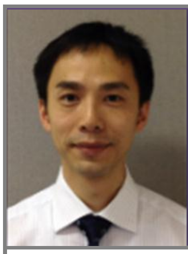
Oxalic acid is one of the most widespread organic chemicals used by many industries, such as printing and dyeing, production of pharmaceuticals, extraction of rare earth metals and chemical production. With the expansion of the biomedical and metals industries, the global demand for oxalic acid has increased in recent decades to 450,000 tons in 2009, of which over 300,000 tons were consumed in Mainland China. However, excessive accumulation of oxalic acid in the human body can cause a variety of health disorders, such as renal failure, urinary stone disease, and pancreatic insufficiency.

This discovery may shed new light on how to treat other industrial wastes (Figure 1). Currently, research is being carried out to investigate how the complex can function simultaneously as a chemosensor and a PF catalyst in treating oxalic acid. The feasibility of designing other complexes for detecting and degrading other hazardous industrial wastes, including cyanide, azo-dyes, carboxylic acids, and organophosphate pesticides, will also be explored. Finally, the research team will study how to apply the technology to real industrial wastewater samples - mainly composed of a mixture of oxalic acids, cyanide, and azo-dyes at rather high concentrations.

The results of the study are recommended to be used as teaching materials for environmental science education courses.

Different smart materials could be designed and synthesized to address different organic pollutants

"Chance favors the prepared mind."– Louis Pasteur



Energy sustainability: the need for a more rigorous chemistry education

Dr. Chi-Fai LEUNG, Department of Science and Environmental Studies
The Hong Kong Institute of Education, Hong Kong

The increasing global energy demands have resulted in an accelerating exploitation of fossil fuel. The associated anthropogenic carbon dioxide (CO2) emission is recognized as the major contributor to global climate change. To foster more sustainable energy usage, a number of renewable energy technologies such as solar cells, wind power and hydroelectricity have been developed. However, a major problem with these technologies is their unstable supply. In addition, their application is limited by geographical and climate settings. The capture of these energy resources requires a more diffuse and extensive network of facilities, in comparison to fossil-fuel power plants. To better tap the power derived from these renewable resources, low-cost efficient energy conversion and storage technologies will be highly desirable. [1]

To address the needs of the evolving renewable energy resources, it is commonly perceived that training in engineering school will be more relevant and essential. However, the evolution of new energy models and technologies has shown that a more rigorous chemistry education will also be crucial for the sustainable usage of energy. In fact, it is necessary that a broader range of specialized chemistry topics be provided in both science and engineering education, as a result of the current development of energy science and technology as an interdisciplinary subject.

The most widely used solar energy conversion technology is photovoltaic solar panels (PVs), which convert sunlight into electricity. However, the existing Si-based photovoltaics suffer low efficiency and high cost. Recently, the incorporation of synthetic chemical dyes and redox mediators in the semiconducting materials has resulted in a new generation of solar cells, commonly known as dye-sensitized solar cells (DSSCs) which convert sunlight into electricity at a higher efficiency and lower cost. However, the large-scale manufacture and subsequent commercialization of DSSCs are still far from realization due to several technological hurdles, such as the stability of the synthetic dyes. [1-3]

On the other hand, to better use the energy tapped from unsteady renewable resources, an efficient energy storage technology is also essential. Common existing electricity storage includes both chemical approaches such as batteries, and mechanical approaches such as pumped storage plants, which are commonly used for storing excessive electricity generated by power utilities. However, these technologies suffer low energy and material efficiency. In addition, an enormous physical space is required to accommodate the storage facilities.

An attractive approach for renewable energy storage is their conversion into storable chemical forms. Inspired by the photosynthesis in green plants, scientists have proposed converting electricity generated from renewable resources to form energetic compounds such as hydrogen, methane or methanol from earth-abundant materials such as water and carbon dioxide (equation 1–3). [1,4,5]

$2H^+ + 2e^- \rightarrow H_2$ (equation 1)
$CO_2 + 6H^+ + 6e^- \rightarrow CH_3OH + H_2O$ (equation 2)
$CO_2 + 8H^+ + 8e^- \rightarrow CH_4 + 2H_2O$ (equation 3)
$2H_2O \rightarrow O_2 + 4H^+ + 4e^-$ (equation 4)

To provide the electron and protons for such reductive processes, the complementary oxidation of water (equation 4) is also deemed essential in this new energy paradigm. A variety of catalysts, both homogeneous and heterogeneous, have been reported to facilitate the occurrences of these reactions at a lower electrical potential. If the factors hindering the development of such catalysts could be overcome [1,4,5], they could be used in dye-sensitized photoelectrosynthesis cells (DSPECs) which target the production and collection of oxygen and a high-energy fuel at spatially separated electrodes, instead of a photopotential and photocurrent as in the case of DSSCs. [6]

A number of nationwide energy research programs have been launched, including at the Center for Chemical Innovation (CCI) in Solar Fuels, and at leading universities in Europe and East Asia. These research efforts bring together material and molecular scientists, photo- and electrochemists, as well as engineers. [7-9]

To accommodate such as interdisciplinary development in energy technology, a strong and coordinated collaboration is of course essential. However, undergraduate education, in most circumstances, may not incorporate sufficient fundamental knowledge for such interdisciplinary research. For example, students from the material and engineering disciplines seldom have the essential background in the aspects of molecular catalysis and photosensitization, whereas chemistry students seldom receive sufficient theoretical training in material science or even the more closely related photo- and electrochemistry, which are occasionally excluded from undergraduate and postgraduate training. In fact, to better equip students from various related disciplines and to lay a stronger foundation for such a cross-disciplinary development, a flexible undergraduate or postgraduate education system, which allows the students to study courses provided by different academic departments or even by different universities will be crucial. Moreover, a more specialized and coherent curriculum will be required for students to better equip themselves with energy-related chemistry topics, in order that they could be better prepared for studies in advanced years and to fulfill the societal needs in both technological and managerial aspects.

With increasingly sophisticated energy technologies where chemistry is playing a central role, and also the increasing market share of renewable energy around the world, the demand for cross-disciplinary expertise in energy technologies is also expected to increase. Therefore, a more vigorous and specialized chemistry education in various related disciplines is foreseen under the current circumstances.

References:

1. N. S. Lewis, D. G. Nocera Proc. Nat. Acad. Sci. U. S. A 2006, 103, 15729–15735.
2. B. O'Regan, M. Grätzel Nature 1991, 353, 737−740.
3. A. Yella, H.-W. Lee, H. N. Tsao, C. Yi, A. K. Chandiran, M. Nazeeruddin, E. W.-G. Diau, C.-Y. Yeh, S. M. Zakeeruddin, M. Grätzel Science 2011, 334, 629−634.
4. P. Du, R. Eisenberg Energy Environ. Sci. 2012, 5, 6012–6021.
5. A. J. Morris, G. J. Meyer, E. Fujita Acc. Chem. Res. 2009, 42, 1983–1994.
6. D. L. Ashford, W. Song, J. J. Concepcion, C. R. K. Glasson, M. K. Brennaman, M. R. Norris, Z. Fang, J. L. Templeton, T. J. Meyer J. Am. Chem. Soc. 2012, 134, 19189−19198.
7. Center for Chemical Innovation in Solar Fuels (NSF), retrieved from http://www.ccisolar.caltech.edu/webpage/17
8. Institute of Chemical Sciences and Engineering (EPFL), retrieved from http://isic.epfl.ch/page-86923-en.html
9. Institute of Molecular Functional Materials (HKU), retrieved from http://imfm.chem.hku.hk/index.php

Microplastics pollution - an emerging issue for science and environmental education

Dr. Lincoln FOK, Department of Science and Environmental Studies

The Hong Kong Institute of Education, Hong Kong

Plastics are synthetic polymers engineered to endure natural degradation. In addition to durability, their excellent barrier properties, elasticity and flexibility, along with their ease of processing and cost effectiveness have promoted their usage in almost every aspect of our daily lives. In 2010, the global production of plastics (280 million tonnes) had increased by 2.8 times compared with 1989 (PEMRG, 2012). In terms of volume, production of plastic has rivaled and since the 1980s greatly exceeded that of steel. If we define human civilization by the materials most used for the construction of tools, we are undoubtedly living in the age of plastics. However, the use of plastics has often been maligned because they represent a major source of litter and waste. The very properties that led to the prevalence of plastics also render them hazardous to the environment. It has been estimated that 10% of all the plastics ever produced has ended up in the ocean (Thompson, 2006). It is also believed that all of the plastics which have entered the ocean still exist as polymers (Andrady, 2009). Due to their abundance and longevity, along with the buoyancy of the material that permits long-distance dispersal, accumulation of plastic debris in the ocean has been found to have reached global proportions in the most recent decade. The existence of plastic debris has been reported in marine waters as far away as Antarctica and in the abyssal waters of the deep ocean. Computer modelling has revealed that surface ocean currents converge drifting debris into five subtropical gyres (IPRC, 2008). The density of debris in these gyres is so high that the condition is often described as a ‘plastic soup’ by the media (e.g. Wassener, 2011), and these debris patches span millions of square kilometres.

There is now a general agreement that plastic is the dominant form of marine debris. However, the majority of marine litter studies have been focused upon larger debris, or macrodebris, which is easily identified by the naked eye. Macrodebris is in general both a physical and aesthetic form of pollution and a threat to marine ecology. Macrodebris is a form of physical pollution with the potential to cause wildlife entanglement and to vector invasive species. Sinking debris may also damage seafloor habitats. Such debris exists in Hong Kong and according to data from the 2011 International Coastal Cleanup Programme, 67.5% of the macrodebris collected in Hong Kong is comprised of plastics (Ecovision Asia, 2011). On the other hand, the smaller microplastic debris (Figure 1) has been largely ignored until recently, mainly due to the fact that it is not readily visible to the naked eye. However, this group of debris is of greater significance to marine ecology. In terms of its abundance, data collected from the NW Atlantic illustrates that microplastic concentrations in the 1990s were significantly greater than those in the 1960s (Thompson et al., 2004). In a microplastic study on the Tamar Estuary (UK), Thompson et al. (2007) report that microplastics may comprise over 80% of the total count of plastic debris. In addition, microplastics have a size similar to that of benthos / planktons making them susceptible to, and encouraging, accidental ingestion by foraging marine fauna. For example, 44% of marine bird species are known to ingest plastic (Rios et al., 2007). In a study of Lanternfish (Myctophids), plastic ingestion (mostly microplastics) was found in 35% of the sample (Boerger et al., 2010). Ingestion of plastics may lead to blockage of the intestinal tract, resulting in a reduction of food consumption which can be fatal to marine organisms. Furthermore, although polymers are considered to be biochemically inert, due to their large molecular size, plastic particles can adsorb hydrophobic chemicals and may contain additives and/or monomers. Results from Teuten et al. (2007) indicate that affinity to hydrophobic organic pollutants of plastics debris, polyethylene in particular, exceeds that of natural sediments. Mato et al. (2001) suggested that high concentrations of organic pollutants detected in microplastics are due to their buoyancy, which allows them to come into contact with the marine surface micro layer (SML), where these organic pollutant concentrations may be ~500 times greater than in the underlying water column (Wurl and Obbard, 2004). Some of these organic chemicals, such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), organochlorine insecticides (e.g., DDT), Bisphenol A (BPA) and phthalates, are harmful to organisms. Ingestion of the sorbent by marine biota implies an increase in exposure of the biota to these chemicals. Data from Ryan et al. (1988) show a positive correlation between PCB tissue concentration in seabirds and the mass of ingested plastic. These findings suggest a possible pathway for the transfer of organic pollutants to organisms. Microplastics may therefore be an important carrier of organic contaminants, which would enter the food web of even the most pristine ecosystems.

Microplastic pollution has now been recognized by the United Nations Environment Programme as one of the emerging environmental issues on a global scale (Kershaw et al., 2011). It is only in recent years that the heightened environmental concern regarding this persistent pollutant source has led to the revitalization of related research and public attention. Although from time to time knowledge and positive attitude are being transferred in an environmental education campaign, behavioural change is the ultimate goal of all forms of environmental education. A recent haphazard spillage of polypropylene pellets in Hong Kong waters in July 2012 led to a territory-wide campaign of coordinated pellet clean up actions. This event involved the public, green groups, non-governmental organisations and Sinopec International Company (HK) Limited and represented a case of engagement of the civil society in action aimed at the mitigation of an environmental issue. This campaign represented a rather unusual but successful case that demonstrated the action capability of the society in respond to an environmental crisis, and also shed light on the effectiveness of the bottom-up approach to environmental governance in nurturing the pro-environmental behaviour of our citizens. I am pretty sure that it will become a model case in environmental civil engagement, and perhaps it will become one of the most important channels for environmental education.

References:

1. ANDRADY, A. 2009. Fate of Plastics Debris in the Marine Environment. *In:* ARTHUR, C., BAKER, J. & BAMFORD, H. (eds.) *Proceedings of the International Research Workshop on the Occurrence, Effects, and Fate of Microplastic Marine Debris.* NOAA.
2. BOERGER, C. M., LATTIN, G. L., MOORE, S. L. & MOORE, C. J. 2010. Plastic ingestion by planktivorous fishes in the North Pacific Central Gyre. *Marine Pollution Bulletin,* 60**,** 2275-2278.

3. ECOVISION ASIA 2011. *The Hong Kong International Coastal Cleanup Challenger: 2011 report.*, Hong Kong, Ecovision Asia.
4. IPRC 2008. Tracking ocean debris. *IPRC Climate,* 8**,** 14-16.
5. KERSHAW, P., KATSUHIKO, S., LEE, S., SAMSETH, J. & WOODRING, D. 2011. Plastic debris in the ocean. *In:* UNEP (ed.) *UNEP Year Book 2011: emerging issues in our global environment.* Nairobi, Kenya: UNEP.
6. MATO, Y., ISOBE, T., TAKADA, H., KANEHIRO, H., OHTAKE, C. & KAMINUMA, T. 2001. Plastic resin pellets as a transport medium for toxic chemicals in the marine environment. *Environmental Science & Technology,* 35, 318-324.
7. PEMRG 2012. *Plastics - the Facts 2012: An analysis of European plastics production, demand and recovery for 2011,* Brussels, Belgium, PlasticsEurope Market Research Group.
8. RIOS, L. M., MOORE, C. & JONES, P. R. 2007. Persistent organic pollutants carried by synthetic polymers in the ocean environment. *Marine Pollution Bulletin,* 54**,** 1230-1237.
9. RYAN, P. G., CONNELL, A. D. & GARDNER, B. D. 1988. Plastic ingestion and PCBs in seabirds: Is there a relationship? *Marine Pollution Bulletin,* 19**,** 174-176.
10. TEUTEN, E. L., ROWLAND, S. J., GALLOWAY, T. S. & THOMPSON, R. C. 2007. Potential for Plastics to Transport Hydrophobic Contaminants. *Environmental Science & Technology,* 41**,** 7759-7764.
11. THOMPSON, R., BROWNE, M. A. & GALLOWAY, T. 2007. Microplastic – an emerging contaminant of potential concern? *Integrated Environmental Assessment and Management,* 3**,** 559-561.
12. THOMPSON, R. C. 2006. Plastic debris in the marine environment: consequences and solutions. *In:* KRAUSE, J. C., NORDHEIM, H. & BR GER, S. (eds.) *Marine Nature Conservation in Europe.* Stralsund: Federal Agency for Nature Conservation.
13. THOMPSON, R. C., OLSEN, Y., MITCHELL, R. P., DAVIS, A., ROWLAND, S. J., JOHN, A. W. G., MCGONIGLE, D. & RUSSELL, A. E. 2004. Lost at Sea: Where Is All the Plastic? *Science,* 304**,** 838.
14. WASSENER, B. 2011. How to rid the seas of 'plastic soup'? *New York Times*, May 23.
15. WURL, O. & OBBARD, J. P. 2004. A review of pollutants in the sea-surface microlayer (SML): a unique habitat for marine organisms. *Marine Pollution Bulletin,* 48**,** 1016-1030

Myths and Reality of Energy Technology

Mr.Ping-Man Paladin CHAN, Department of Science and Environmental Studies

The Hong Kong Institute of Education, Hong Kong

Recently, the topic of energy technology has attracted much attention in local communities both in the education sector and in public policy. Advocacy groups challenge the accuracy and neutrality of teaching materials being used in local schools about energy technology, in particular about nuclear fission energy (SCMP, 18 Nov 2013).

Nuclear energy is perhaps one of the more problematic topics in the school curriculum. Proponents of nuclear energy usually promote nuclear fission energy being “low emission” or even “carbon emission free”. A closer looks at the evidence being presented renders such claims both questionable and debatable.

Contrary to the above claims, nuclear fission energy is not free from carbon emissions. If we restrict our view to the power generation stage at the nuclear fission power plant, not much greenhouse gas is released at this stage. However, a more comprehensive carbon auditing of energy supply, which includes careful analysis of the whole nuclear fuel cycle (commonly referred to as “from-cradle-to-grave”), reveals that nuclear fission power plants do release very significant amounts of different greenhouse gases. Such emissions come from the use of heavy machinery during the mining of uranium ores, and the use of hydrofluoric acid during the fuel enrichment process. After we take stock of the whole fuel cycle, the total emissions from nuclear fission energy are known to vary greatly with the grade of uranium ore being used (Shrader-Frechette, 2011, p45-52).

The problems of such disputable claims in school textbooks sometimes have wider implications beyond the education sector. When governments consult the public about future options for energy supply, public perceptions of different energy sources can have important implications for public policy. It is also commonly known that different types of energy technology can have very important environmental health implications. As an example, conventional coal-fired power plants are known to be major sources of air pollutants. The relationship between greenhouse gas emissions and climate change is just one of the more prominent examples.

However, when we look at the arguments presented by different groups engaged in the energy debate, we sometimes find some questionable claims being used either to make the case for supporting one type of energy technology or to discredit the other types.

Renewable energy is sometimes discussed without reference to the crucial environmental factors. In other cases, the significant environmental impacts caused are either exaggerated or ignored.

In view of the possible catastrophic consequences of climate change, decisions about energy technology can be considered the most high-stake ones faced by humanity today. In our non-idealized world, any choice about energy technology has both pros and cons. These pros and cons should be fully reviewed and weighed for making sound and rational decisions about which energy technology to adopt. Such decisions should be made locally, but at the same time with a global perspective.

It can perhaps be argued that attempts made to simplify the messages for discussion of energy technology can potentially run the risk of distorting the “true picture”. However, simplification is nevertheless necessary in classrooms when we attempt to facilitate students’ discussion of social and environmental issues related to energy technology.

“All men’s gains are the fruit of venturing.”– Herodotus

Our role as science educators is not to be confused with advocacy groups. Our role is neither to pre-empt the discussion regarding energy technology nor to decide what choice should be made by students. The challenge of an educator is how to guide students to conduct a fair and comprehensive discussion about energy technology based on facts rather than myths or unsupported claims. A consistent framework for enquiry is desperately needed to be adopted for discussion, to avoid cherry-picking only the selected information favorable for a particular stance on the energy debate. Invalidated claims or misinformation should be actively avoided. We also need to provide students with sufficient and necessary scientific background knowledge to process the topic at hand.

As science educators, it is worthwhile to explore how energy technology is being learnt and taught in schools. It is also important to know whether students' knowledge is consistent with validated facts and is up-to-date. Such study should provide educators with clues to improve teaching materials and pedagogical practices related to the very important topic of energy technology and climate change.

References:

1. SCMP, 18 Nov 2013, "Textbooks 'cheerlead' for nuclear power", Hong Kong, retrieved at http://www.scmp.com/news/hong-kong/article/1358745/textbooks-cheerlead-nuclear-power
2. Shrader-Frechette, K. S. (2011), "What will work: Fighting Climate Change with Jan"
3. Willem Storm van Leeuwen (2006), "Secure energy: options for a safer world", ENERGY SECURITY AND URANIUM RESERVES, retrieved at http://www.oxfordresearchgroup.org.uk/sites/default/files/energyfactsheet4.pdf
4. Renewable Energy, Not Nuclear Power", Oxford university Press, p45-52.

The socio-scientific approach and the challenges to science educators

Dr. Yeung-Chung LEE, Department of Science and Environmental Studies
The Hong Kong Institute of Education, Hong Kong

"Socio-scientific issues (SSIs)" has emerged as a new curricular approach in school science education. It originated from the Science-Technology-Society (STS) movement which focuses on the linkage between science and technology in society including the applications of science in technology and the implications of these technological applications for society. The SSI approach can be viewed as a manifestation of STS, which reflects an emphasis on multi-perspective reasoning about socio-scientific issues. The SSIs commonly raised for discussion are global problems such as genetically modified foods, nuclear energy, stem cells, and global warming, to name just a few. There are also problems that are more locally oriented such as the protection of biodiversity, waste treatment, or industrial developments with ecological or environmental impacts on particular regions.

In support of this curricular approach, a range of pedagogical strategies have been implicated such as information search to identify stakeholders' views and their justifications, evidence-based argumentation on the validity of these justifications, and decision making based on the weighing of pros and cons, and the judgment of values that underpin the decision making process. A recent trend is to engage students in argumentation and decision-making from cross-contextual or cross-cultural perspectives, and research studies have been undertaken to compare how cultural contexts impact on students' reasoning on SSIs.

The SSI approach entails the switching of the role of the science teacher from a provider of scientific information and a coach for scientific inquiry to a facilitator of inquiry that combines both scientific and social traditions. The teacher has to guide students to maneuver between scientific and social inquiry, and negotiate viewpoints from multiple perspectives so as to make informed decisions about issues that are essentially multidisciplinary or interdisciplinary in nature. The teacher also has to help students to deal with values underlying each decision alternative that are diverse and embedded in cultural contexts.

Despite the potential of the SSI approach in extending the curricular goals of science education to make them more relevant to students, there are caveats to the full-scale implementation of this approach in schools. First, the switching of the teacher's role as discussed poses formidable challenges to the science teacher who might not be trained professionally to take up these new roles. Engaging students in argumentation and informed decision making about SSIs is a tall order which entails developing students' ability to assess risks in messy real-life situations rather than to experiment with carefully controlled variables in the laboratory. This type of reasoning is further complicated by the need to consider the issues from multiple perspectives which often intertwined with each other. It is likely that students will find it difficult to negotiate the scientific perspective and other perspectives to the extent that the balance is tilted toward non-scientific perspectives such as ethical and cultural ones which are easier to understand and communicate.

Nevertheless, the SSI approach is valuable in alerting both students and teachers to the complexity of global and local socio-scientific issues. It points to the complexity of real-life problems which cannot be solved solely by the application of scientific knowledge or reasoning. Teachers have to teach students to engage in evidence-based argumentation, but at the same time to come to terms with the tentativeness or uncertainly of science. An understanding of problem resolution as a matter of risk assessment and integration of multiple perspectives as informed by value judgment may be the goal that science teachers interested in the SSI approach should aim to achieve.

若要工夫深，鐵杵磨成針。(明朝 曹學佺)

Keywords-based Curriculum Linking System: Interdisciplinary, Cross Grades, Cross Media, and Scientific Literacy

Chin-Cheng Chou

Associate Professor, Department of Science Education

National Taipei University of Education, Taiwan

Teachers and curriculum designers frequently encountered difficulty of knowing how one particular concept being scattered over all curriculum. For solving this, we created a system, the Keywords-based Curriculum Linking System (KCLS), which was based on curriculum standards in National Curriculum Guidelines in Taiwan. The system is capable of assessing the concept correlation horizontally and vertically. Through the process of checking the concept linkage in curriculum, incoherence of one particular key concept from elementary school to high school could be revealed. This system also provides inter-disciplinary searching function by which teachers or curriculum designers could easily related a key concept in science and that in all other subjects.

We also noticed that linking everyday life and integrating interdisciplinary learning has been advocated for decades; yet, these are still unattainable in many classrooms. Thus, we extended KCLS and made it connect to the media cloud. The system automatically links curriculum standards, newspaper media, and related keywords, and provides an order of how the instruction of a concept maybe constructed. By KCLS, we can also know the importance of keywords by the number of times have been reported in the media. This is one of perspectives for observing citizenship literacy and, maybe, a way to plan effective approach to enhance citizenship literacy.

The KCLS is not intending to solve all problems of incoherence in curriculum, but it did help us find the incoherent parts of the curriculum and did frequently direct teachers/curriculum designers to solve those in a more efficient manner. In the future, we will continue to link to the full text of the textbook and enlarge the KCLS's applications.

Highlight Key Literacies for the 21st Century

- Report from 2013 Annual International Conference of Association of Science Education in Taiwan

Shu-Fen Lin

Graduate Institute of Science Education, National Changhua University of Education, Taiwan

The 29th ASET Annual International Conference was successfully held in National Changhua University of Education ,Taiwan on Dec 12-14, 2013. Changhua city is in central Taiwan, around many historical and cultural tourist areas. ASET (Association of Science Education in Taiwan) is the largest science education association in Taiwan, established since 1988. The 29th ASET Conference is also recognized by the East-Asian Association for Science Education (EASE). By cooperation with EASE, the conference has promoted further interaction of science education research in East-Asia.

The conference theme is "Science and Mathematics Manpower Cultivation: Key Literacies for the 21st Century", and the conference aims to strengthen relationships between school teachers, researchers, and educators. Thus, articles from science educators, researchers, and teachers related to education in science, mathematics, technology, environment or other fields were welcome. Moreover, the conference has provided science educators in Taiwan and around the world with a platform to communicate the research and practices in promoting key literacy and skills.

The conference features a rich program including 5 keynote speeches, 3 invited panels, 5 pre-conference workshops, a science fair, and 229 papers presented (195 papers in Chinese, 34 papers in English). The program attracted 361 researchers and science teachers to participate. The keynote speakers are international famous scholars, including Dr. Chia-Ju Liu, Graduate Institute of Science Education & Environmental Education, National Kaohsiung Normal University, Taiwan; Dr. Jonathan Osborne, Graduate School of Education, Stanford University, USA; Dr. Yew Jin Lee, Natural Sciences and Science Education, National Institute of Education, Singapore; Dr. Alice Wong, Faculty of Education, The University of Hong Kong; and Dr. Masakata Ogawa, Graduate School of Mathematics & Science Education, Tokyo University of Science, Japan.

In addition to the abovementioned academic activities, the conference also hosted a science fair composed of 18 exhibition booths. Especially, 14 exhibition booths were presented by the teams which won out in 2013 National Primary and High School Science Fair. Students in each team introduced their science/math projects by demonstrating their experiments/exhibits and posters to more than 400 participants (teachers, parents, and students) from elementary to high schools in Taichung and Changhua. The rule of 'answering more questions and getting a bigger prize' encouraged participants to engage in answering their understanding of science/math projects in the science fair. Other four exhibition booths were presented by the conference sponsors.

The 29th ASET conference has been dedicating to establish a strong connection with the EASE Association. We appreciate President of EASE, Professor Chi-Jui Lien, National Taipei University of Education, and many EASE members' participation.

The next 2014 ASET conference will be held in Taipei and hosted by National Taiwan Normal University. Let's meet in the 2014 ASET in Taiwan!

"It takes as much energy to wish as it does to plan."– Eleanor Roosevelt

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Upcoming Conferences

- **EASE Winter School 2014. Jan. 12-18, 2014 @ Ewha Womans University, Seoul, Korea**
- **ASTE 2014 International Meeting. Jan. 15-18, 2014 @ San Antonio, TX**
  http://theaste.org/meetings/2014-international-meeting/
- **2014 NARST Annual International Conference. Mar. 30-Apr. 2 @ Pittsburgh, PA, USA**
- **NSTA 2014 National Conference Apr. 3–6, 2014 @ Boston, MA**
  http://www.nsta.org/conferences/2014bos/
- **Canada International Conference on Education. Jun. 16-19, 2014 @ Cape Breton University, Nova Scotia, Canada**
  http://www.ciceducation.org/
- **Science Education at the Crossroads 2014. Call for Proposals in March 2014, with an anticipated meeting in September 2014.**
  http://www.sciedxroads.org/callpaper.html
- **11th International Conference of the Learning Sciences. June 23-27, 2014 @ Boulder, Colorado, USA**
  http://www.isls.org/icls2014/
- **2nd International History, Philosophy and Science Teaching Asian Regional Conference. Dec. 4-7, 2014 @ Taipei, Taiwan.**
  http://www.sec.ntnu.edu.tw/ihpst2014/index.html
- **2015 EASE Science Education Conference, Date will be announced. @ Beijing, China Mainland.**
- **2015 IHPST Biennial Conference. July 22 – 24, 2015 http://conference.ihpst.net/**

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You're welcome to contact the regional responsible editors,
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