NEWSLETTER

E·A·S·E East-Asian Association for Science Education, Vol.12, No.1 December 31, 2019

Congratulations on the new issue of the 2019 EASE newsletter!

It is wonderful that we finally have the newsletter that highlights our activities in 2019 in East Asia and the schedules for several Science Education Conferences in 2020. It is my great apology that we have had the only one newsletter for 2019 in my term as the president of EASE. I want to express sincere appreciation to the Vice President of EASE, Prof. Seo, Hae-Ae, who showed great leadership for the newsletter initiation for 2019 and beyond 2020, 2021.

For Asian countries, it will be more important to keep the quality of researches in the fields of science education, including Science Literacy and STEM/STEAM education research or SDGs related researches. Mainly, it is highly valuable to develop international collaborative researches not only among Asian countries, but also European and North American countries and eventually all over the world.

This newsletter is a reminder for ourselves the goals of EASE that our responsibilities as researchers in science education are very critical for Asian countries and the global community towards our own countries. We can improve our society that could share the peace, helping to create equity and well-being.

We will be challenging to provide members or non- EASE members about what is going on in terms of science education communities. I would like to express sincere thanks to all the people who contributed great articles and editors in each of the countries. Please enjoy reading the articles in this newsletter.

YOSHISUKE KUMANO Ph.D.
President of East-Asian Association of Science Education,
Vice President of Society of Japan Science Teaching,
President of Shizuoka Earth Science Education
Professor of Science Education
Graduate School of Science & Technology, College of Education, Shizuoka Education

836 Ohya Shizuoka-Shi, 422 JAPAN
TEL & FAX: 054-238-4636
e-mail: kumano.yoshisuke@shizuoka.ac.jp

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Editorial Board

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Address (Headquarter)

Education Faculty K building 601, Shizuoka University, Ohya 836, Shizuoka Prefecture, Shizuoka City, 4228529, Japan

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EASE Autumn School 2019

Nurul Sulaeman
Ph.D. Student, Dept of Information Science and Technology,
Graduate School of Science and Technology, Shizuoka University

Overview

The EASE Autumn School aims to provide valuable opportunities for sharing research experiences and developing future research collaborations among Ph.D. candidates from EASE constituent regions. The EASE Autumn School 2019 was held at Shizuoka University on 16th-22nd September 2019. During the 7-day Autumn School, senior professors shared their expertise and experiences in science education. All the twenty-six Ph.D. candidates from different regions formed five or six groups and each group of students was supported by a scholar when they were discussing their dissertations and developing cross-region collaborative research proposals. In the last sessions, all candidates had opportunities to share their ideas and gave a presentation at the Society of Japan Science Teaching (SJST) National Conference. Each group of students was accompanied by one senior professor and one coach from the regions.

Professors and Coaches

Country	Professor	Lecture Title	Coach
USA	Gillian Roehrig University of Minnesota roehr013@umn.edu	Enhancing science education research	-
Japan	Yoshisuke Kumano Shizuoka University kumano.yoshisuke@shizuoka.ac.jp	STEM learning for science education and strategies of STEM practices to Asian countries with Asian contexts: preparation towards 5.0 Society	Shuichi Yamashita Chiba University syama@faculty.chiba-u.jp
Korea	Sung-Won Kim Ewha Womans University sungwon@ewha.ac.kr	STEAM education in Korea	-
Hong Kong	May May Hung Cheng The Education University of Hong Kong maycheng@eduhk.hk	Towards building a framework to analyze STEM education in the Asia-Pacific region	Wai Chin Li The Education University of Hong Kong waichin@eduhk.hk
Thailand	Chanyah Dahsah Srinakharinwirot University dahsahc@gmail.com	STEM: Integration of STEM and non-science subjects for holistic problem-solving and innovation	Tussatrin Wannagatesiri Kasetsart University tussatrin_k@yahoo.com
China	BaoHui Zhang Shaanxi Normal University baohui.zhang@snnu.edu.cn	The "S" in STEM education and implications for the global STEM movement	Dongying Wei Beijing Normal University weidy@bnu.edu.cn
Taiwan	Chen-Yung Lin (林陳涌) National Taiwan Normal University lcy@ntnu.edu.tw	What is missing in STEM education?	Shu-Chiu Liu (劉叔秋) National Sun Yat-sen University shuchiuliu@mail.nsysu.edu.tw

Photos

Figure 1. All professors, coaches and participants

Figure 2. Outdoor activity


Figure 3. Group activity during workshop


Figure 4. Group discussion for research collaboration

Figure 5. Group discussion for research collaboration

Figure 6. Group presentation

Figure 7. Best group collaboration

Figure 8. SJST conference

Figure 9. SJST conference

Figure 10. Visiting museum of Natural and Environmental History, Shizuoka

Thank you all Professors, Coaches and Participants. Looking forward to more collaboration in the future.

Memorable experiences attending the 2019 EASE Autumn School in Shizuoka, Japan

She Jianyun, He Cuiling
The University of Hong Kong

Twenty-six Ph.D. candidates majored in science education from EASE constituent regions attended the 2019 EASE Autumn School on 16th - 22nd September, 2019. During the 7-day autumn school, we not only learned the knowledge and experience from teachers and group members in the workshops, but also got a chance to explore the traditional Japanese culture by attending various activities. Through the keynote speeches, oral presentation, collaborative proposal development and informal chats during break time, we had a big picture about how STEM education is being implemented in East Asian regions; explored what it means to be East Asian students.

Developing a collaborative research proposal with group members from different countries and regions is a traditional academic activity in EASE school. With the guidance by our professors and coaches, we had very good experience of working with our groupmates. We first presented our own Ph.D. research projects. We found presenting our work by each groupmate inspiring. After that, we conducted an in-depth discussion of the research of each group member to determine the focus of the collaborative research proposal. After the topic was selected, we assigned the task to each group member. Everyone worked very hard and we did a great job in our presentation in the competition of the best collaborative research proposal.

Figure 1. We won the best collaborative research proposal

Figure 2. Discussing with our groupmates

The Autumn School is also an academic holiday for Ph.D. candidates to travel to new places, enjoy new food and take a break from daily research grind. Shizuoka is full of unforgettable sightseeing spots for history, culture, Mt. Fuji, etc. It is worth mentioning that the experience of staying in a natural forest for several nights can rejuvenate and refresh our minds from stress.

Figure 3. Experience interesting Japanese culture

In conclusion, we really appreciate all the people who have contributed to the EASE autumn school. Their academic work inspired our minds and their hard work for organising the activity helped us learn more about science education. Although the autumn school ended, we are sure that the friendship developed will never end!

Learning science inquiry and systemic thinking on the E-game learning system

Chun-Yen Tsai, Shu-Chiu Liu
National Sun Yat-sen University

The E-game learning system is a role-playing game (RPG) website for students to learn online (http://egame.kh.edu.tw). In 2017, the research team from National Sun Yat-sen University, Kaohsiung, Taiwan, established a new component, Science Island, on the E-game to specifically help students develop science inquiry competencies, such as evidence-based reasoning, and systemic thinking. The Science Island allows students to perform ubiquitous learning outside the scope of school learning. At present, two themes, 'Troll Tribe' and 'Ocean Mystery', have been developed for the Science Island (Figure 1).

Figure 1. The Science Island on the E-game

The Troll Tribe theme aims to support student learning about ecosystems through games. The game scenario is for students to explore an ecological system using the concept of food web and consider how to create a tribe that is suitable for the trolls to live. The Troll Tribe theme introduces Taiwan native species such as Muller's Barbet as shown in Figure 2. In the plot of the game, the troll character originally has a tribal reconstruction design plan, but it is accidentally destroyed by heavy rain. The students must help him successfully rebuild the tribe by going through the levels and exploring three important species for the tribe.

Figure 2. Troll Tribe theme on the Science Island

Traditional science materials rarely develop students' systemic thinking and evidence-based reasoning. The idea of the Troll Tribe theme can nurture in students these scientific competencies. Figure 3 uses the food chain/web to assess students' systemic thinking skills.

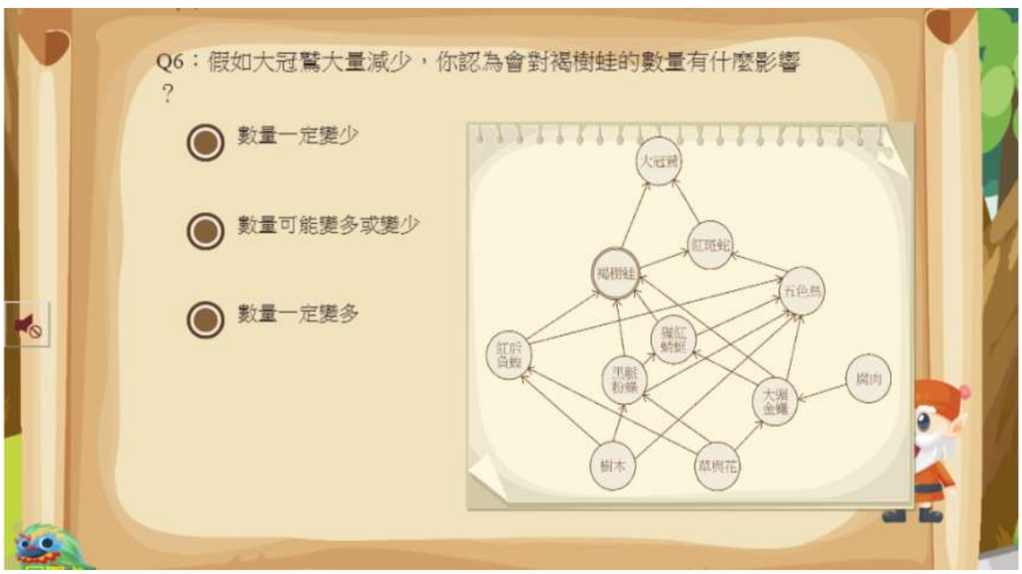

Figure 3. The item to test students' systems thinking skills

The Ocean Mystery is the second theme for the Science Island. The scenario is designed for students to carry out the investigation together with the imaginary tribal trolls when they find that the ocean is polluted. While investigating the ocean pollution, the students learn about what happens to several marine creatures, such as corals, clownfish, sea urchins, and seaweeds, and how they are related to one another. As part of the gamification design, when the student explores the treasure on the island, they encounter various interesting events to learn (Tsai, Lin, & Liu, 2019). In the past, traditional science materials rarely target at the learning of scientific competencies, such as designing an experiment and interpreting experiment results. The idea of the Ocean Mystery theme is to develop in students these competencies. Examples in Figures 4 and 5 are designed to test students' inquiry ability through experimental design. During the process of designing computer interactive scenarios, students can try simulated experiments.

Figure 4. The hands-on experiment

Figure 5. The training of evidence-based reasoning

The Science Island has successfully attracted tens of thousands of students from primary to secondary school level since the outset. The research team hopes to continue refining and expanding this powerful online learning platform for different facets of science competencies.

Reference

Tsai, C. Y., Lin, H. S., & Liu, S. C. (in press). The effect of pedagogical GAME model on students' PISA scientific competencies. *Journal of Computer Assisted Learning,* https://doi.org/10.1111/jcal.12406

Using innovative video technologies to promote pre-service science teachers' learning to notice, interpret and act on student thinking

Kennedy Kam Ho Chan
The University of Hong Kong

Science education reforms around the world have called for responsive classroom instruction that can promote students' deep and meaningful learning of science. At the University of Hong Kong, we have a long history of using authentic classroom video clips taken from local science classrooms to represent responsive classroom interactions to promote pre-service science teacher (PST) learning (Wong, Yung, Cheng, Lam, & Hodson, 2006; Yung, Wong, Cheng, Hui, & Hodson, 2007). Although we have some evidence showing that our pre-service teachers developed conceptions of good science teaching in line with the goals we envisaged, anecdotal evidence suggests that our PSTs experienced difficulties in putting their pedagogical intentions into action in the reality of the classroom. To better support PSTs' enactment of responsive teaching, I have created a set of workshops (21 hours). The primary purpose of the workshops is to promote PSTs' ability to elicit, interpret and act on student thinking by providing them with opportunities that approximate responsive teaching practices and to meaningfully reflect on their attempts.

The workshops make use of a teacher-education pedagogy called rehearsals (Lampert et al., 2013). Rehearsals differ from traditional micro-teaching in several significant ways (Benedict-Chambers, 2017). First, in rehearsals the PSTs deliberately practise certain instructional moves and routines that had previously been studied in video recordings of instruction. Second, the peers assume an active role in rehearsals by simulating the interactions teachers may encounter in a classroom setting. Third, the educators provide just-in-time feedback, in the form of pauses during rehearsals and debriefing sessions after the rehearsals, targeting at the focal moves and practices. Finally, the PSTs have the chance to *re*-enact the same segment of teaching, either in a real-life classroom (in student teaching) or in a controlled setting.

My previous research work in using video to promote teacher learning (Chan, He, Ng, & Leung, 2018; Leung, Chan, & He, in press) has led me to modify rehearsals in two ways. First, rather than asking peers to be the rehearsal audiences, I invited junior PSTs from another science education programme to act as student actors. These actors were assigned specific roles (e.g. target students or students expressing partial misconceptions). This design was to better approximate the real-life classroom for a greater feeling of authenticity. Second, rather than receiving feedback by the instructors of the methods course, I promoted peer and self-feedback on rehearsal performance. I video-taped my PSTs enacting rehearsals using an innovative video technology (i.e. point-of-view video [POV] camera goggles (Estapa & Amador, 2016)). The PSTs' rehearsals were video-taped using different cameras, including a static camera placed at the back of the classroom (O-CIB) (Figure 1) and POV camera goggles worn on the head of the PST (T-POV) (Figure 2) and one on the head of the student (S-POV) (Figure 3). The PSTs had the chance to watch and analyse their own videos (including the two POV clips) and their peers' videos. The design was to allow PSTs to revisit rehearsal experience from multiple vantage points captured in videos. It was believed that the PSTs would be better able to reflect on the classroom interactions by switching to the role of different actors.

Figure 1. O-CIB footage

Figure 2. T-POV footage

Figure 3. S-POV footage

The perception data collected showed that the PSTs regarded the workshops as extremely useful to their learning of how to notice, interpret and act on student thinking. The PSTs highly valued the chance to rehearse with actors who played different student roles to simulate complex classroom interactions and gave just-in-time feedback on their rehearsal performance. The PSTs also enjoyed analysing their peers' videos and their own videos, particularly the footage filmed from the back of the classroom. Surprisingly, contrary to what had been envisaged, the PSTs did not perceive viewing their own POV footage as particularly useful to their learning.

I further analysed the nature of the PSTs' noticing when they were reflecting on different types of video footage by assessing the observations of each type of clip (Chan, Yu, Sin, & He, 2020). Interestingly, although the T-POV clips did not provide visual access to the teacher (i.e. the PST who conducted the rehearsal), the PSTs tended to focus on *themselves* when watching the footage. Likewise, even though the S-POV clips did not capture the images of the student who wore the camera goggles, the PSTs placed their observation focus on that student. It seems that it is not what the PSTs could 'see' in the footage, but the first-person perspective of the camera that effectively shaped their observation focus. None of the observations referenced science content or specific student ideas when the PSTs were watching the first-person perspective footage (i.e. POV footage). Only when the PSTs were watching footage from a third-person perspective (i.e. O-CIB footage) did they notice specific student ideas. It appears that the PSTs were drawn to the motions/actions captured by the footage, effectively shifting their focus away from the cognitive thinking of the students.

Overall, although the data provide preliminary evidence for the effectiveness of POV footage in promoting PSTs' learning, they prompted a re-examination of the assumption that it was easy for PSTs to learn from the footage. In hindsight, POV footage is an extremely information-dense medium. It may be even more difficult for PSTs to home in on salient features in the video clips. More support and scaffolds should have been given to the PSTs to enable them to draw out more from the POV clips. As studies on the use of POV footage in promoting teacher learning are scarce, my future research will focus on this aspect and how PSTs' learning from the footage can be better supported.

References

Benedict-Chambers, A. (2017). Implementing tool-supported rehearsals for ambitious science teaching in an elementary science methods classroom. *Innovations in Science Teacher Education, 2*(7). Retrieved from https://innovations.theaste.org/implementing-tool-supported-rehearsals-for-ambitious-science-teaching-in-an-elementary-science-methods-classroom/.

Chan, K. K. H., He, T. C. L., Ng, R. C. K., & Leung, J. S. C. (2018). Student teachers' emotions when watching their own videos and those of their peers. *Journal of Professional Capital and Community, 3*(3), 192-211.

Chan, K. K. H., Yu, S. K. K., Sin, R. K. H., & He, T. C. L. (2020). *Different camera perspectives, different observations? Pre-service science teachers' noticing on different classroom videos*. Paper presented at the American Educational Research Association, San Francisco.

Estapa, A., & Amador, J. (2016). Wearable cameras as a tool to capture preservice teachers' marked and recorded noticing. *Journal of Technology and Teacher Education*, *24*(3), 281-307.

Lampert, M., Franke, M. L., Kazemi, E., Ghousseini, H., Turrou, A. C., Beasley, H., & Crowe, K. (2013). Keeping it complex: Using rehearsals to support novice teacher learning of ambitious teaching. *Journal of Teacher Education, 64*(3), 226-243.

Leung, J. S. C., Chan, K. K. H., & He, T. C. L. (in press). Student teachers' metaphorical conceptualisations of the experience of watching themselves and their peers on video. *Educational Studies*, https://doi.org/10.1080/03055698.2019.1691505

Wong, A. S. L., Yung, B. H. W., Cheng, M. M. W., Lam, K. L., & Hodson, D. (2006). Setting the stage for developing pre-service teachers' conceptions of good science teaching: the role of classroom videos. *International Journal of Science Education, 28*(1), 1-24.

Yung, B. H. W., Wong, A. S. L., Cheng, M. M. W., Hui, C. S., & Hodson, D. (2007). Tracking pre-service teachers' changing conceptions of good science teaching: The role of progressive reflection with the same video. *Research in Science Education, 37*(3), 239-259.

The first issue of Disciplinary and Interdisciplinary Science Education (DISER) was published on November 28, 2019

Dongying WEI
Beijing Normal University

The new journal, Disciplinary and Interdisciplinary Science Education Research, published the first issue on November 28th, 2019 and the link is as follows: https://diser.springeropen.com/articles.

The first issue has 13 invited articles, and the authors are all top scholars in the field of science education in the world and the research refers to biology education, chemistry education, geography and environment education, physics education, nature of science etc. All the articles have been peer reviewed.

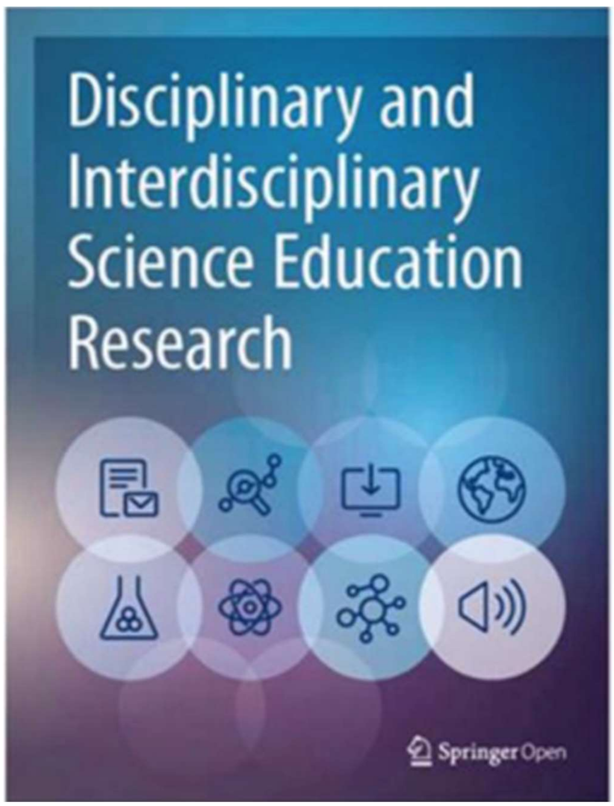

Figure 1. Cover of the first issue of DISER

Please find the information about the articles below.

Title	Author(s)	Organization
Editorial: Disciplinary and interdisciplinary science education research (DISER)	Xiufeng Liu Lei Wang	University at Buffalo, Buffalo, USA. Beijing Normal University, Beijing, China.
Physics education research for 21st century learning	Lei Bao Kathleen Koenig	The Ohio State University, Columbus, OH 43210, USA. University of Cincinnati, Cincinnati, OH 45221, USA.
The future challenge of Earth science education research	Nir Orion	Science Teaching Department, Weizmann Institute of Science, 1 Herzl St., 76100 Rehovot, Israel
Learning progressions: framing and designing coherent sequences for STEM education	Richard A. Duschl	Caruth Institute of Engineering Education, Southern Methodist University, PO Box 750278, Dallas, TX 75275, USA
Progressing chemistry education research as a disciplinary field	Keith S. Taber	Science Education Centre, Faculty of Education, University of Cambridge, 184 Hills Road, Cambridge, England CB2 8PQ, UK
Teaching and learning nature of scientific knowledge: Is it Déjà vu all over again?	Norman G. Lederman Judith S. Lederman	Illinois Institute of Technology, 3424 S. State St., Suite 4007, Chicago, IL 60616, USA
Promoting deep learning through project-based learning: a design problem	Emily C. Miller Joseph S. Krajcik	a Senior Researcher Consultant at Create for STEM, co-Principal Investigator on Multiple Literacies for Project-based Learning and ABD candidate in UW Madison. the Principal Investigator on Multiple Literacies for Project-based Learning, the Lappan-Philips Professor of Science Education and Director of CREATE 4 STEM at Michigan State University.
Argumentation and interdisciplinarity: reflections from the Oxford Argumentation in Religion and Science Project	Sibel Erduran Liam Guilfoyle Wonyong Park Jessica Chan Nigel Fancourt	Department of Education, University of Oxford, 15 Norham Gardens, Oxford OX2 6PY, UK
Science | Environment | Health – the emergence of a new pedagogy of complex living systems	Albert Zeyer Justin Dillon	University of Teacher Education Lucerne, Pfistergasse 20, Postfach 7660, CH-6000 Luzern 7, Switzerland
Reimagining public science education: the role of lifelong free-choice learning	John H. Falk Lynn D. Dierking	Institute for Learning Innovation, Oregon State University, 8100 NW Ridgewood Drive, Corvallis, OR 97330, USA
New directions in socioscientific issues research	Dana L. Zeidler Benjamin C. Herman Troy D. Sadler	Department of Teacher Education, College of Education, University of South Florida, Tampa, Florida, USA. Department of Teaching, Learning and Culture, College of Education and Human Development, Department of Biology, College of Science, Texas A & M University, College Station, Texas, USA. School of Education, University of North Carolina-Chapel Hill, Chapel Hill, North Carolina, USA.
Modeling competence in science education	Mei-Hung Chiu Jing-Wen Lin	Graduate Institute of Science Education, National Taiwan Normal University, 88 Sec 4, Ting-Chou Road, Taipei, Taiwan. Department of Science Education, National Taipei University of Education, No.134, Sec. 2, Heping E. Rd., Da-an District, Taipei City 106, Taiwan.
Integrating engineering in K-12 science education: spelling out the pedagogical, epistemological, and methodological arguments	Senay Purzer Jenny Patricia Quintana-Cifuentes	School of Engineering Education, Purdue University, 516 Northwestern Ave. Wang Hall 3500, West Lafayette, IN 47906, USA

DISER is published by Springer and its sponsor is faculty of education, Beijing Normal University. The chief editors are prof. Wang Lei from Beijing Normal university and Prof. Liu Xiufeng from University of New York-Buffalo. The executive editor is Dr. Wei, Dongying, an associate Professor at the Beijing Normal University

DISER's scope is broad in both methodology and content. It features research at all levels, including early childhood, primary, secondary, tertiary, workplace, and informal learning as they relate to science education. It publishes research in biology education, chemistry education, geography education, earth science education, physics education, science education, technology education, and engineering education. Research can take various methodological approaches, including qualitative research designs (e.g., ethnography, narratives, case studies, historical/philosophical approaches, etc.), quantitative research designs (e.g., experimental and quasi-experimental designs, survey research, correlation study, measurement study, statistical research, etc.) and mixed methods. DISER also publishes position papers, critical reviews of literature, critique and comments and book reviews.

Disciplinary and Interdisciplinary Science Education Research (DISER) aims to promote scholarship and best practices in education within and across science disciplines. DISER publishes original empirical, conceptual and policy studies reflecting the latest development in science education from disciplinary and interdisciplinary perspectives. DISER bridges the divide and facilitates dialogue between formal and informal, disciplinary and interdisciplinary, K-12 and post-secondary, as well as English-speaking and non-English speaking country science education.

The journal welcomes and is not limited to topics like science education, curriculum, instruction, measurement, evaluation and assessment, teacher education, learning environments, informal science learning, science education policies, history and philosophy of science in education. Researchers are welcome to submit your article and it is free of charge.

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Faculty of Education, Beijing Normal University,
No.19 Xinjiekouwai Street, Haidian District, Beijing, China, 100875
Tel: 86-10-58807455-1656
Fax: 86-10-58806955
E-mail: diseroffice@163.com

The Effort of HUE Asahikawa Campus in Teaching Science Using ICT

Kazumasa TAKAHASHI, Shigeru OKUDERA,
Masafumi NAGAYAMA, & Hidetoshi ANDOH
Hokkaido University of Education, Asahikawa Campus

In Japan, Education Personnel Certification Act was revised in 2016. This act regulates the curriculum contents of a teacher training course in Japanese universities. In 2017, the regulation for enforcement of this act was also revised and included the teaching methods using Information and Communication Technology (ICT) as curriculum content. Universities running a teacher training course must respond to this revision.

The Hokkaido University of Education (HUE) has five campuses, Asahikawa campus, Hakodate campus, Iwamizawa campus, Kushiro campus and Sapporo campus across Hokkaido, Japan. Asahikawa campus, authors work in, mainly focuses on secondary teacher education. Based on the revision, the Asahikawa campus started to prepare Wi-Fi and various devices in laboratories and lecture rooms, intending that students become familiar with ICT and are able to use it in their science teaching. Especially, some members of science education faculty attempt to create opportunities in which lectures proactively use ICT in their teaching. This attempt aims that students experience and imagine an instruction using ICT through our teaching. The following pictures are one of our trial classes using ICT in a secondary science teaching methods course. The lecture used a digital online whiteboard application program, an electronic blackboard, and Windows tablets. The lecturer thinks that these devices and the application program promote communication between the lecturer and students and facilitate students' discussion. The investigation of students' impressions and opinions toward the class with ICT will be the next step.

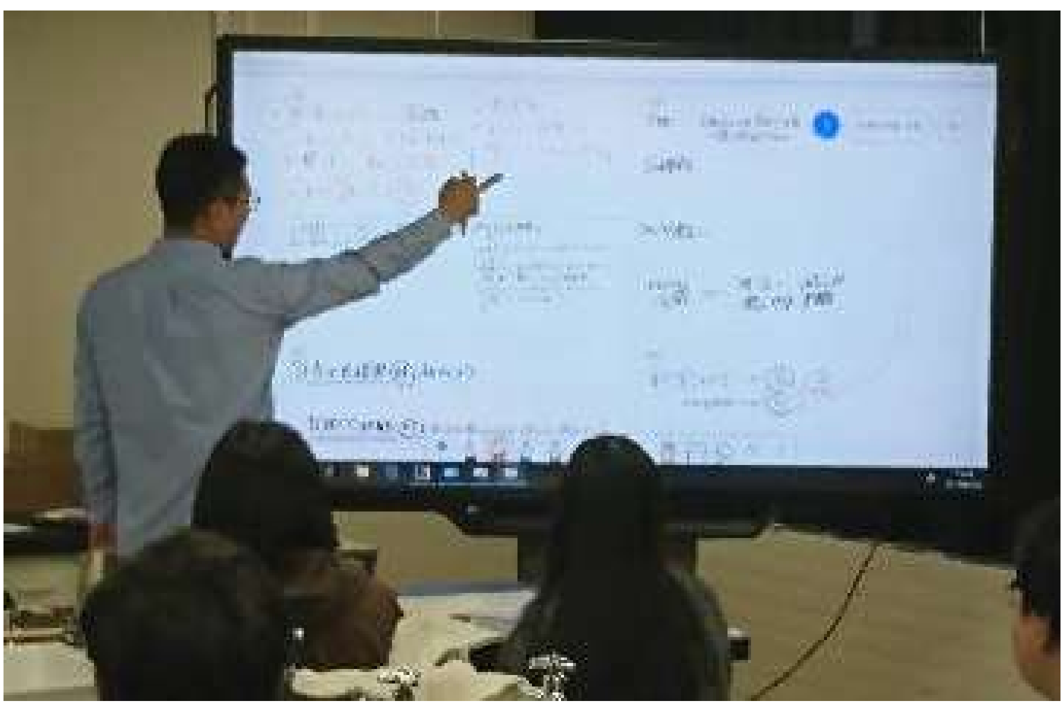

Figure 1. A class of secondary science teaching method

STEAM@soybean - Promotion of STEAM education through investigations of soybean cultivation

[1]Lau Kwok Chi, Victor, [2]Lam Hon Ming
[1]Faculty of Education, CUHK
[2]School of Life Sciences, CUHK

We developed a project aimed at promoting STEAM education in Hong Kong secondary schools through investigations of soybean cultivation. Soybean cultivation is chosen as the theme of the project because it is an important protein source to the world population, particularly to China where it needs to import more than 100 million tons of soybean each year. Its importance has been highlighted in the recent trade disputes between China and the US. Environmentally, soybean can reduce the use of nitrogen fertilizers via its nitrogen fixation ability. Educationally, soybean can provide theme-based learning on many parts of the secondary biology curriculum, for instance, genetic cross breeding, DNA markers, plant biology, nitrogen fixation. It also allows for the integration of knowledge from other disciplines such as geography, liberal studies and humanities on topics such as agriculture, sustainable development, food problems, trades, poverty.

This project brings in collaborations between scientists and educators – Prof Lam is a leading soybean scientist while Dr. Lau is an experienced biology educator at CUHK. Their collaboration will let secondary students participate in frontier science research. For instance, students can join the research of Prof Lam by cross breeding soybean lines to produce drought resistant soybeans that can grow in arid regions in North West China and South Africa. Students can also learn to develop DNA marker for soybean lines.

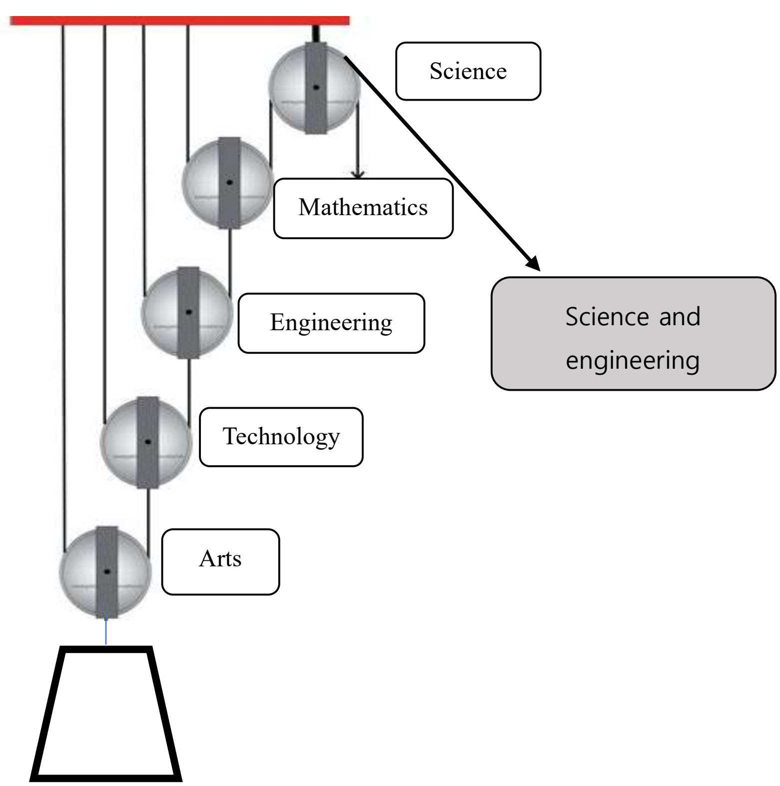

Figure 1. Framework of STEAM

A conceptual framework for STEAM learning (Figure 1) was developed for the project based on the one proposed by Kelley and Knowles (2016). In this pulley framework, the five pulleys denote the five disciplines: science, engineering, technology, mathematics and arts. They form an integrated system to elevate a weight – authentic problems. Connecting the pulleys is a rope, which represents the science and engineering practices as suggested in the Next Generation Science Standards (NRC, 2013). Arts here not only refers to artistic design, but the humanistic aspects of STEM. Agricultural problem is a case in point where solutions cannot be made solely on science and engineering, but the considerations of the livelihood of local people.

The project consists of **three phases**:

1. Soybean cultivation;
2. Visits to the soybean fields and soybean food industry;
3. Scientific investigations and design projects about soybean cultivation

In phase 1, biology students will grow cultivated and wild-type soybeans from seeds to seeds, during which students will learn how to grow soybean and control pests and various environmental parameters. Students will observe and record the growth patterns of the two soybean lines and the effects of adding nitrogen fixing bacteria. Teachers and students will learn the skills at workshops held at university and then grow the soybean at their own schools as normal class learning activity.

In phase 2, teacher and students will visit experimental soybean fields in Northwest China, where stress-tolerant cultivars developed by Prof. Lam is growing. They will have the opportunity to participate in field work and meet with local farmers and scientists so that they will experience the work of scientists and realise how a scientific discovery in laboratory could become a real product on the field and benefit the local people. Another visit is to soybean food factory e.g. Lee Kum Kee at Taipo and China, where students can understand how science and technology can contribute to the economy as well as the importance of social responsibility through the history of the company.

In phase 3, teachers will supervise their students to design and conduct scientific investigations or design projects related to soybean cultivation at school. Students needs to apply the knowledge and skills learned in the previous phases to address the authentic problems of soybean cultivation faced by the farmers in NW China, or tackle the challenges of manufacturing soybean foods after visiting the food industry. The solutions are STEAM based: it will integrate knowledge from science, technology, engineering and mathematics as well as their understandings of the sociocultural conditions in NW China. Various STEM workshops are conducted to support the investigations, including the use of DNA markers, skills of cross-pollinating soybean flowers, IT technologies such as Micro:bit, Arduino, 3D-Printing, virtual reality. Some of the investigations/projects can be:

- Identification of salinity-tolerant soybeans using DNA markers
- Cross breeding of salinity-tolerant soybeans with African fungal resistant soybeans to obtain progenies having all these desirable characters
- Design of 'smart' greenhouse for soybean growth
- Design of irrigation system for soybean cultivation in arid regions
- Investigations of the nutritional values of soy sauce, e.g. salinity

So far, a total of 300 students from 14 secondary schools had participated in the trial and the project has received funding of over 2 million to implement further in 40 schools and 1000 students in three years.

Figure 2. Visit to experimental soybean field in Gansu, China

Figure 3. Students comparing soybean with and without root nodules
(Source: Holm Glad College)

References

Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM Education, 3*, 11 doi:10.1186/s40594-016-0046-z

National Research Council. (2013). *Next generation science standards: For states, by states*. Washington, DC: The National Academies Press. https://doi.org/10.17226/18290.

Introducing Korean Science Education Standards for the Next Generation Developed by Song et al. (2019)

Minsu Ha
Kangwon National University

The Korean Science Education Standards for the Next Generation (KSES) developed by Prof. Jinwoong Song (principal investigator) and many scholars in science education was officially announced last August. KSES will be used as a guideline for Korean science education. In this EASE newsletter, I would like to share the KSES with EASE member. Three core parts of KSES is translated and introduced here. If you want to know more about KSES, please contact to me (msha@kangwon.ac.kr, Korea Regional editor of EASE) and refer to the journal paper "Song et al. (2019) Contents and Features of 'Korean Science Education Standards (KSES)" for the Next Generation. *Journal of the Korean Association for Science Education*, *39*(3), 465-478.

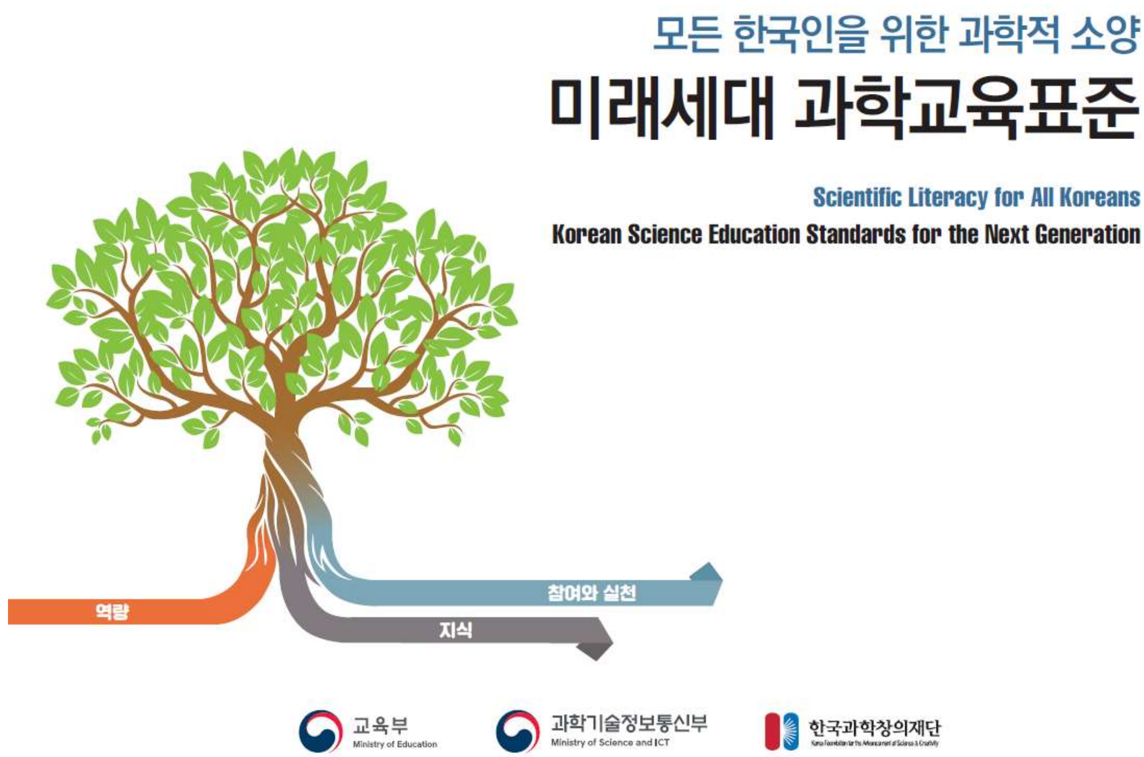

Figure 1. Cover of "Korean Science Education Standards for the Next Generation"

Authors:
Jinwoong Song (PI), Suk-Jin Kang, Youngsun Kwak, Donggeon Kim, Soohwan Kim, Jiyeon Na, Jong-Hoon Do, Byeong-Gon Min, Sung Choon Park, Sung-Moon Bae, Yeon-A Son, Jeong Woo Son, Phil Seok Oh, Jun-Ki Lee, Hyun Jeung Lee, Hyuk Ihm, Dae Hong Jeong, Jong Hoon Jung, Jinhee Kim, Yong Jae Joung

1. Why Korean Science Education Standards for the Next Generation (KSES)?

To date, school science education has focused on developing basic education and skills for the industrial age. The main goals are to develop the basic knowledge and inquiry skills necessary for students who will grow up to be professionals in various fields such as science, engineering, and medicine. In recent years, school science education aims to develop the scientific skills necessary to live in modern society which emphasises science and technology.

Diverse technological information and communication, also smart technologies, have become widespread in the 4th industrial revolution era. The world is rapidly entering a hyper-connected society. Thus, the scientific and educational environment faces fundamental changes as well. First of all, the future society demands talented people with creativity, cooperation and communication, passion and humanity, beyond those with rich knowledge. For instance, the Assessment and Teaching of 21st Century Skills (ATC21S) project involves nine countries including Australia, Finland, Portugal, Singapore, the United Kingdom, the United States, the Netherlands, Costa Rica, and Russian proposes the skills of the 21st century: 'thinking' (creativity, innovation, critical thinking, problem-solving, decision-making, and self-directed learning ability), 'work mode' (communication and cooperative ability), 'the way of work' (information and ICT literacy), 'social lifestyle' (local/global citizenship, life and career development skills, personal and social responsibility) (Griffin et al., 2011). In addition, the United States' Partnership For 21st Century Learning proposes the learning and innovation skills, information, media and technology skills, and also life and professional skills as the 21st century competencies. In particular, the "learning and innovation skills" referred to 4C which includes critical thinking, communication, collaboration and creativity (Choi et al., 2011). The demanded skills for the future are reflected in the Korean industry. For instance, Samsung is pursuing "a man who challenges the future with passion and immersion," "a man who transforms the world with learning and creativity," and "a man who communicates and collaborates with an open mind" as right people for your company. In other words, future society requires not only a well-knowledgeable individual, but also individuals who can resolve the real-life problems in society and are responsible citizens who can apply their creative thinking and problem-solving ability based on cooperation and communication.

Also, artificial intelligence technology based on big data demands a fundamental shift in thinking about education and learning. It is no longer possible to pursue the value of education only by acquiring information and simple knowledge. In response to these changes, developed countries are making various attempts and policies to innovate STE(A)M education in science education (e.g. AAAS, 1989, 1993; OECD, 2003). In particular, the recent development of Next Generation Science Standards (NGSS) in the United States, which has lasted for more than 30 years, is a major achievement (the NGSS Lead States, 2013; NRC, 1996). These advanced countries' efforts to innovate science education can be summarized as a direction to foster a convergent approach and practical problem solving across science, technology, and engineering.

On the other hand, according to international education comparative studies such as PISA and TIMSS, Korean students show relatively high academic achievement compared to other OECD countries. However, they remain at the lowest level of participation and confidence in science learning. Therefore, the change of positive attitude toward science and active participation are the most crucial tasks.

To sum up, it is necessary to transform science education that is scientific knowledge and problem solving-centered to one that is future skill-based and emphasises participation and action.

It is necessary to rearrange the goals of science education in Korea for a longer-term perspective by presenting scientific literacy not only for elementary and middle school students but also for citizens. There is a need to draw up guidelines for future revisions of the national science curriculum and to provide a comprehensive blueprint for innovating the in- and out-of-school science education. Korea Foundation for the Advancement of Science and Creativity, along with the Ministry of Education, has consistently supported related research project with the aim of developing the Korean Science Education Standards (KSES) for the next generations (Song et al., 2018; Kim et al., 2017; Jeon et al., 2017; Kim et al., 2016; Kim et al., 2015). The KSES content reported here is the accumulation and combination of the results of these research outcomes.

2. What is the goal of KSES?

What kind of people will we educate for the future? At KSES, future science education was set as a 'creative and collaborative people equipped with scientific literacy'. Scientific literacy is defined as 'the attitudes and abilities as democratic citizens to participate in and act for solving personal as well as social problems using science-related competencies and knowledge'. (Song et al., 2018).

Here, the 'pursuing human character' represents the direction of future science education based on KSES. At this time, the term 'future' in KSES refers to 2045. This is the middle of the 21st century, approximately one generation from now in 2019. In addition, 2045 is 100 years since Korea Independence Day. In this sense, 2045 is a meaningful time to look back on the future generation and what national education had been achieved for 100 years since Independence Day and prepare for the next 100 years.

KSES uses the term 'human character (人間像)'. The term 'talented character (人材像)' is frequently used in literature or policy documents at the national level, which implies a view of humans as a means for some purpose. Therefore, in KSES, 'human character' is used interchangeably with the term 'talented character'. The human character pursued by the KSES is 'a creative person who lives with a scientific literacy'. The future society is a society where innovative convergence areas are created based on advanced science and technology. It is led by a group of experts who exhibit the highest level of scientific problem solving, creativity, and citizens with scientific knowledge. Therefore, having a scientific literacy is essential for future generations. As mentioned earlier, the 21st century is changing to a society that values creativity for new change based on knowledge. People from various cultures are living together at the same time. As hyper-connected society implies, society has been changing to a society where human and machine, human and nature live together beyond a society where only human lives together. As a result, future generations need creative people who can live together. In other words, the future citizen the KSES aims for is a creative person who has scientific literacy and live harmoniously with other members of the society.

Meanwhile, the scientific literacy defined by the KSES is 'the attitude and ability to participate and practice as democratic citizens in solving problems of individuals and society with scientific competence and knowledge'. They must be able to solve various problems of individuals and society, and the way of problem-solving should be democratic. This scientific literacy should be for both students and citizens who are members of our society. Because of the nature of future society such as hyper-connected, lifelong-learning, and aging society, the scope of science education should go beyond the limits of school education.

3. What is scientific literacy for the future society?

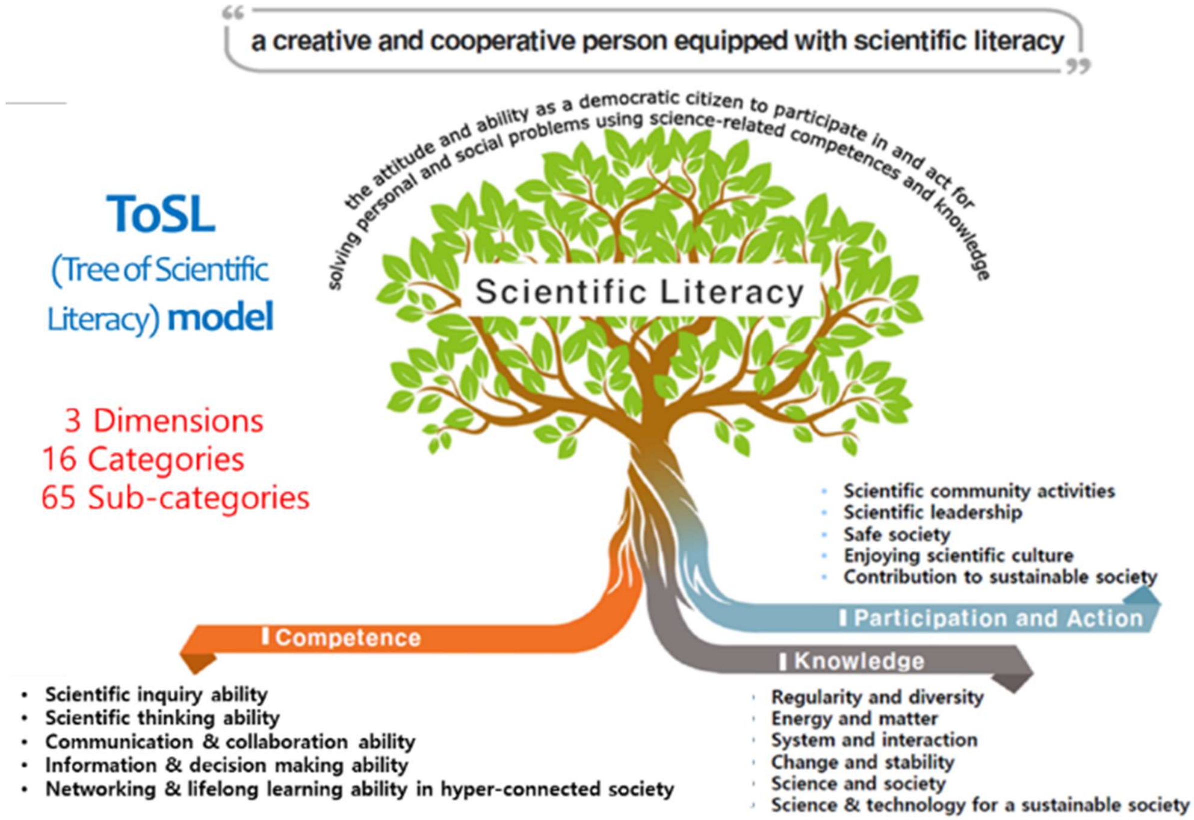

Figure 2. Tree of Scientific Literacy

The development of specific KSES was based on the concept of ToSL (Tree of Scientific Literacy) model. The ToSL model is a richly grown tree with 3 roots intertwining one another and figuratively illustrates the scientific literacy that KSES is aiming for.

The three roots of the ToSL model refer to three dimensions of scientific literacy which are the competence dimension, knowledge dimension, and participation & action dimension. Scientific literacy means that competence, knowledge, participation and action are achieved when they are combined. Each dimension is not a precondition for the other, but all three dimensions complement one another. Competence is nurtured by knowledge as well as participation and action; competence and knowledge are the basis of participation & action, and competence and participation & action are the basis of new knowledge. The three dimensions of ToSL are divided into categories, consisting of five categories of competence dimension, six categories of knowledge dimensions, and five categories of participation & action dimension.

First of all, the five categories of competence dimension are scientific inquiry ability, scientific thinking ability, communication and collaboration ability, information processing and decision making ability, and lifelong learning ability in a hyper-connected society. These five categories include skills that have traditionally been emphasised in science education, as well as skills that are expected to be necessary in a future society characterised by the digital revolution.

The six categories of knowledge dimension are regularity and diversity, energy and matter, system and interaction, change and stability, science and society, and science and technology for a sustainable society. The first four categories are corresponding to the basic knowledge and concepts of traditional science; however, the distinction is not fragmented such as physics, chemistry, biology, and earth science but is centered on big ideas. The last two categories, 'science and society' and 'science and technology for a sustainable society' go beyond the scope of traditional science education and these two are corresponding to science-related humanities, social and engineering knowledge that should be possessed by democratic citizens in future societies.

The five categories of participation & action dimension are science community activities, scientific leadership, contribution to a safe society, enjoying science culture, and contribution to a sustainable society. Participation & action are intended to promote active participation in inquiry activities and the application of real-life which have been particularly lacking among Korean students and it is also the most challenging task of KSES. This is an exceptional global initiative as it goes beyond the NGSS, which emphasises not only scientific and engineering practices in schools, but also active science learning and practical activities not only for students but also for the members of the society.

The category of each dimension is subdivided into 23 sub-categories of competency, 23 sub-categories of knowledge, 19 sub-categories of participation & action. Therefore, the scientific literacy of the ToSL model consists of 3 dimensions, 16 categories, and 65 sub-categories.

References

Choi, S.-D., Kim, J.-Y., Ban, S.-J., Lee, K.-J., Lee, S.-J., & Choi, H.-Y. (2011). *Education strategy to foster creative talent for the 21st century*. KEDI RRC 2011-01. Seoul: KEDI.

Jeon, S., Koh, H., Lee, Y., Kwak, Y., Choi, S., Kang, H., & Park, M. (2017). *Development for "Science for All Koreans"*. Seoul: KOFAC.

Kim, D., Han, K., & Jeong, D. (2016). *Research on the talent of 2045 future society and milestone of core science competencies*. Seoul: KOFAC.

Kim, H., Kang, N., Kim, M., Maeng, S., Park, J., Baek, Y., Son, J. W., Shim, K., Oh, P. S., Lee, G., Lee, B., Joung, Y., & Han, I. (2017). *Basic research for next generation science education standards*. Seoul: KOFAC.

Kim, Y., Kim, H., Baek, S., Han, I., Lee, Y., Shim, J., Kang, N., & Joung, Y. J. (2015). *A study of master plan for development of Korean Next Generation Science Education Standards*. Seoul: KOFAC.

Song, J., Kang, S.-J., Kwak, Y., Kim, D., Kim, S., Na, J., Do, J.-H., Min, B., Park, S. C., Bae, S., Son, Y.-A, Son, J. W., Oh, P. S., Lee, J.-K., Ihm, H., Jeong, D. H., Joung, Y. J., & Joung, J. (2018). *A development of Korean science education standards (KSES) for the next generation*. Seoul: KOFAC.

Recent news items from Taiwan

Shu-Chiu Liu
National Sun Yat-sen University

The 2019 International Conference of Science Education in Taiwan

The 2019 International Conference of Science Education in Taiwan (ICSET 2019) has just taken place on Dec. 5 (Thursday) to Dec. 6 (Friday) in 2019. ICSET is the official annual conference of the Association of Science Education in Taiwan. This year it was hosted by the Graduate Institute of Science Education, National Taiwan Normal University, Taipei, Taiwan. The conference theme was " Science Education and Research in the Innovative Era." The goal of ICSET is to become a platform for the exchange of ideas and perspectives provided by the science education practitioners around the world.
Website information: http://w2.dorise.info/icset2019/eindex.aspx

2019 Summer School for new Ph.D. Students in Science Education

The 2019 Summer School for new Ph.D. Students in Science Education was successfully completed. It took place in Taipei University of Education on August 15-16, 2019. The summer school is the annual event organised by Association of Science Education in Taiwan, aimed to support new Ph.D. students in their research by providing intensive seminars, workshops and student presentations for interactive learning and networking.
Website information: https://www.accupass.com/event/1907121221181808195474

The Chinese Journal of Science Education awarded for high impact

The Chinese Journal of Science Education (科學教育學刊) published by Association of Science Education in Taiwan has received the 'Award of Knowledge Impact' by Taiwan National Library in 2018. The 5-year impact factor of the journal was highly ranked in 2017 among Chinese academic journals.
Website information:
http://www.ase.org.tw/motion.asp?siteid=100495&menuid=9580&lgid=2&newsid=7965

The Chinese Journal of Science Education call for papers for a special issue "Multiple Assessment"

The Chinese Journal of Science Education (科學教育學刊) has announced a special issue on 'Multiple Assessment' published in 2020. Submission deadline is June 30, 2020.
Website information:
http://www.ase.org.tw/motion.asp?siteid=100495&menuid=9580&lgid=2&newsid=8775

EASE members, Prof. Chen-Yung Lin and Prof. Shiang-Yao Liu, in the advisory team of Best Documentary Program in Science for the 2019 Taiwan Golden Bell Award

Documentaries series ‘Open the S files of social issues’ sponsored by Taiwan Ministry of Science and Technology (MOST) won the 2019 Golden Bell Award for Best Documentary Program in Science. The series highlighted the exploration of nationally or locally relevant socio-scientific issues, and have been advised by an expert panel, including Prof. Chen-Yung Lin, the EASE distinguished member, and Prof. Shiang-Yao Liu, both from Graduate Institute of Science Education, National Taiwan Normal University.
Website information: http://www.gise.ntnu.edu.tw/app/news.php?Sn=91

Activities to celebrate International Year of Periodic Table

The Association of Science Education in Taiwan has organised a series of activities in 2019 to celebrate International Year of Periodic Table (IYPT). Among them, design contests of both actual and computerised teaching-learning materials regarding periodic table of elements were held. The awarded works were content-rich while using interesting game-based design.
Website information:
http://www.ase.org.tw/motion.asp?siteid=100495&menuid=9580&lgid=2&newsid=8308

Announcing KASE 2020 International conference, we welcome you to Korea in 2020

Hye-Gyoung Yoon
Chuncheon National University of Education

I am Hye-Gyoung Yoon, a chair of KASE conference in Korea and I am happy to announce the upcoming 2020 KASE international conference. We cordially invite you to the international conference of the Korean Association for Science Education (KASE). KASE is an organization representing Korea's science education and holds an international conference every winter.

The organizing committee of the KASE conference welcomes your abstracts for paper presentations, symposium, or workshops. The theme of the 2020 KASE international conference is **"Visions of Research in Science Education for the Next Generations"**. At this conference, we as an international science education community hope to find innovative ways to facilitate science education through active and effective communication.

Brief information related to the conference is as follows. Please visit our website for details (https://sites.google.com/view/kase2020/home)

- Date: February 6 to February 7, 2020
- Venue: Seoul National University of Education, Seoul, Republic of Korea
- Important Dates:
- Submission: December 1 to December 23, 2019.
- Early bird registration: January 1 to January 23, 2020.
- Keynote speakers & presentation titles

Clark A. Chinn Rutgers University, USA
Developing a Grasp of Evidence in Science Classes
Christine Cunningham, The Pennsylvania State University, USA
Everyone Can Engineer
Jan van Driel University of Melbourne, Australia
Delivering STEM Education through School-Industry Partnerships: A Focus on Research and Design.
Gregory J. Kelly The Pennsylvania State University, USA
Epistemic Practices in Science and Engineering Education

The conference will be a forum for in-depth discussion of what further research should be done for the future of science education. We look forward to your participation.

KASE President's Welcome Message

Dear EASE colleagues,

On behalf of Korean Association for Science Education (KASE), it is my great pleasure to greet you. KASE is the flagship association in science education in Korea. It has lead science education research and practice since 1976. KASE has provided solid platforms for sharing accomplishments in science education research and practice through publishing Journal of Korean Association for Science Education (JKASE) and holding academic conferences twice per year. Recently, KASE expands its effort to promote international collaborations by publishing an English Journal, Asia Pacific Science Education (APSE) since 2015, and by holding international conferences. As the President of KASE, I would like to cordially invite all of you to our international conferences and APSE. May your wishes come true and may you have a joyous New Year.

Chan-Jong Kim, Ph.D.
President, Korean Association for Science Education

Invitation to 2020 Southeast Asia Science Culture Symposium

Coordinator: Dr. Yuh-Yuh (Luke) Li
Research Center for Promoting Civic Literacy
National Sun Yat-sen University

The Southeast Asia Science Culture Office is organsing a symposium in Feburary 2020 at National Sun Yat-sen Univeristy, Kaohsing, Taiwan. The duration of this event is about 10 days. It is a great opportunity for developing skills, exchanging knowledge and networking within the field of science culture and communication. All scholars and practioners in the related fields are welcome to join the symposium.

Reasons to attend this event:

- Connect with organisations from across Asia, engage in science communication initiatives supporting science and society collaborations, and find future partners.
- Get inspiration and new skills to inform the future development and sustainability of your own initiatives through our interactive workshops.
- Join the conversation about how we can further support the development of science communication in the future.

The event is **free** to attend for early birds. For further detailed information, please contact Dr. Luke Li at:
yyli@mail.nsysu.edu.tw

IOSTE 2020 International Symposium

[1]Hae-Ae Seo, [2]Youngjoon Shin
[1]Department of Biology Education, Pusan National University
[2]Department of Science Education, Gyeongin National University of Education

The XIX IOSTE International Symposium on 'Transforming Science & Technology Education to Cultivate Participatory Citizens' will be taken place in Daegu, Korea during August 23-28, 2020.

The International Organization for Science and Technology Education (IOSTE) is an international organization which aims to encourage informed debate, reflection on and research into science and technology (S&T) education. IOSTE was established in 1979 to promote contact and dialogue across political and ideological borders. A key concern is that education in S&T should be a vital part of the general education of the people of all countries. IOSTE has a board (committee) with representation from all regions of the world, and convenes international as well as regional symposia. These symposia provide a platform for scholarly exchange and collaboration. The symposia gather researchers, policy makers, teachers and others who are concerned about how science and technology can contribute to the world. IOSTE identifies science and technology education with the real and changing needs of humankind as a whole and with specific needs of its component communities and nations.

The XIX IOSTE 2020 International Symposium invited four keynote speakers, including Alton Grizzle, UNESCO – Paris, Kostas Kampourakis, University of Geneva, Section of Biology and the University Teacher Training Institute (IUFE), Swiss, Isabel Martins, Federal University of Rio de Janeiro, Brazil, and Jongwon Park, Chonnam National University, Korea.

Deadline for paper submission is March 11, 2020. For more information, please visit website, www.ioste2020korea.kr

The IOSTE 2020 organizing committee welcome all of you.

XIX IOSTE SYMPOSIUM
Transforming Science & Technology Education to Cultivate Participatory Citizens
Daegu, Korea, 23-28 August, 2020

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Region	Name	Affiliation	E-mail address
Mainland China	Bao-hui ZHANG	Shaanxi Normal University	baohui.zhang@snnu.edu.cn
	Yingzhi ZHANG	Capital Normal University	zhangyz@cnu.edu.cn
	Jiuhua HU	Beijing Capital Normal University	hujiuhua69@126.com
	Donging WEI	Beijing Normal University	weidy@bnu.edu.cn
Taiwan	Ying-Shao HSU	National Taiwan Normal University	yshsu@ntnu.edu.tw
	Lydia Mei-Chun WEN	National Changhua University of Education	mlwen@cc.ncue.edu.tw
	Chih-Hsiung KU	National Dong Hwa University	chku@gms.ndhu.edu.tw
	Chun-Yen TSAI	National Sun Yat-Sen University	chuyetsai@gmail.com
Hong Kong	May May Hung CHENG	The Education University of Hong Kong	maycheng@eduhk.hk
	Valerie Wing Yan YIP	The University of Hong Kong	valyip@hku.hk
	Victor, Kwok Chi LAU	The Chinese University of Hong Kong	laukwokchi@cuhk.edu.hk
	Wai Chin LI	The Education University of Hong Kong	waichin@eduhk.hk
Korea	Sung-Won KIM	Ewha Womans University	sungwon@ewha.ac.kr
	Jongseok PARK	Kyungpook National University	parkbell@knu.ac.kr
	Young-Shin PARK	Chosun University	parkys@chosun.ac.kr
	Hae-Ae SEO	Pusan National University	haseo@pusan.ac.kr
Japan	Yoshisuke KUMANO	Shizuoka University	kumano.yoshisuke@shizuoka.ac.jp
	Shuichi YAMASHITA	Chiba University	syama@faculty.chiba-u.jp
	Toshinobu HATANAKA	Toho University	hatanaka@c.sci.toho-u.ac.jp
	Tetsuo ISOZAKI	Hiroshima University	isozaki@hiroshima-u.ac.jp