Editorial

Asia-Pacific Science Education (APSE): Making Connections with Science Education Research in the Asia-Pacific Region

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1 Introduction

With this issue, we celebrate the beginning of our 8th year as a journal. Since the beginning, APSE has been dedicated to creating a space for researchers in the Asia-Pacific region to share research with an international audience. The explicit intention of APSE is to provide more context for understanding the ways in which local policies and practices are informing how science teaching and learning is being experienced in formal and informal settings in different countries in the Asia-Pacific. Our editorial board is especially proud to work with graduate and early-career scholars seeking to publish their research in an international English-language journal. Part of this process includes providing detailed reviewer comments and editorial support to authors so they can strengthen their work and publish high-quality studies of interest to a wide readership. As a reward for this commitment to expanding access to academic publishing, APSE has been able to continually offer our readers publications about cutting-edge research that has the potential to inform and support a new generation of scholars. We believe that as the APSE readership grows and...
develops, we will all benefit from a more informed and connected community of science education researchers, teacher educators, and science teachers.

2 Overview of This Issue

This issue features four sets of papers prepared by 23 authors from four countries, each related to diverse issues of importance in science education in the Asia-Pacific region today. The topics include AI integration in science, studies related to the 2015 revised national science curriculum of Korea, comparative international studies, and an innovation in science teacher preparation coursework to promote the implementation of new teaching pedagogies in secondary science.

2.1 Applications of Artificial Intelligence to Science Teaching and Learning

Research on artificial intelligence (AI) for application in everyday life has accelerated as a result of the social distancing that has been experienced during the global pandemic. While AI is increasingly playing a role in our lives, there is limited information for teachers about how to address AI education in the context of the K-12 school curriculum. In Korea, the government has developed national-level plans to introduce AI education in schools and in teacher education and preparation courses. The first two papers explore issues related to technology in science education and specifically focus on the topic of AI integration in science and society in the context of Korea. These authors ask us to consider possibilities for how researchers and educators can begin to approach the topic of AI integration in school science.

Won Jung Kim shares a position paper exploring the ways in which digital transformation and advances in artificial intelligence are driving the need for schools to offer students sufficient AI-integrated learning opportunities in all areas, including in science. Kim proposes a pedagogical approach to AI-integrated science education via the facilitation of epistemic discourse in classrooms using Chinn et al.'s (2014) epistemic cognition framework that attends to epistemic aims, ideals, and processes. Using Chinn et al.'s (2014) epistemic cognition framework, Kim compares epistemic similarities and differences between how scientific knowledge is constructed and how AI agents learn. Building from this analysis, Kim offers four bins of instructional strategies for facilitating epistemic discourse in AI-integrated science classrooms to help students be better prepared to be knowledge constructors and critics and users of AI and science.
Jiyeong Mun, Mijung Kim, and Sung-won Kim share a study exploring Grade 7 students’ perspectives about complex issues related to the use of autonomous vehicles in society. Students engaged in a 6-week course that engaged them in role-playing and group discussions to consider different perspectives about the issue. The researchers compared students’ stances on these issues before and after the class and examined how students’ participation in group discussions had an impact on their group decision-making. The researchers found that students had considerable reservations about artificial intelligence systems, and, through their group discussions, students were able to effectively justify the basis of their opposition to this new technology. The researchers found different patterns in group decision-making processes when students experienced conflicts that have some implications for how educators can support students to reach group consensus while still incorporating diverse perspectives.

2.2 Explorations of the 2015 Korean National Science Curriculum
The next three papers focus attention on different explorations of the 2015 Korean national science curriculum. This paper set provides readers with an in-depth analysis of various features of the Korean national science curriculum to better understand the strengths and challenges of the curriculum. The 2015 revised national science curriculum has had a considerable impact on innovating science teaching and learning in Korea. The new curriculum introduced new science textbooks and lab books at all grade levels, changes in both the depth and breadth of content being covered, and a more defined focus on having students engage in student-centered inquiry learning and competency-based assessments. These changes in the curriculum have offered researchers a rich array of research topics to address in K-12 science classrooms. The papers in this set offer diverse insights into the structure and implementation of the national science curriculum standards.

Mihyun Son, Wanchul Lim, Jeongwoo Son, and Daehong Jeong share their analysis of middle school inquiry activities proposed by the 2015 Korean national science curriculum to determine the suitability for implementing these activities in real classroom contexts. The analysis involved in-depth interviews with veteran science teachers who identified a variety of challenges associated with the inquiry activities, including mismatches in inquiry levels and students’ ability levels, challenges related to the access and ability to use certain methods and equipment/tools, difficulties when inquiry results do not match intended outcomes expressed in the curriculum materials, and difficulties faced when teaching content “out of field” and that may pose safety concerns for implementation with middle school students. The authors share
their analysis and then offer some practical strategies for inquiry improvement plans that can support teachers to meet the standard teaching objectives more effectively. Examples include providing more detailed guidance materials for non-major science teachers tasked with teaching content out of their field of study and more institutional level support to provide schools with appropriate infrastructure by building school laboratories and providing classroom learning environments necessary for conducting inquiry activities, especially those that require utilizing technology.

Seoungheui Baek, Hyeonjeong Shin, and Chan-Jong Kim describe the development of a climate-change program aligned to the 2015 Korean national science curriculum for Grade 6 that was developed to integrate both socio-scientific inquiry-based learning (SSIBL) and science, technology, engineering, arts, and mathematics (STEAM) education components with a goal of cultivating elementary students’ character (sociality, morality, and emotion) related to environmental education competencies and STEAM education competencies (convergence, creativity, challenge, and caring). This study describes both the development of the program and the results of a pilot implementation with Grade 6 students. The researchers found that this combined SSIBL-STEAM education approach had a significant impact on students’ character and STEAM competencies, especially related to morality, emotion, and convergence factors.

Young-Shin Park, Kongju Mun, Yohan Hwang, and James Green’s contribution provides an example of how educators can expand curriculum opportunities for teaching students about democratic citizenship (DC) by developing supplemental science curriculum materials that can be used in formal and informal settings to foster students’ appreciation for DC in science. The authors first conducted a needs analysis by developing a DC framework (DCF) with eight components that were used to examine what and how much DC was currently included in a selection of science textbooks and lab books that are commonly used in Korean public schools. These books were all developed using the 2015 Korean national science curriculum standards. The researchers’ analysis focused specifically on the topic of energy, and they found an unequal distribution of the eight different DC components at different grade levels. Building from this analysis, the authors used the DCF to guide their development of four DC-inclusive STEAM books for four energy-related topics. These four books were designed to target different DC components and to engage students in learning about DC using a STEAM education approach. The authors engaged teacher consultants to provide feedback about their DC-inclusive STEAM books and made revisions based on teachers’ comments. The authors conclude by detailing the DC-related components targeted in each STEAM book and sharing suggestions for future use and research.
2.3 **Comparative Studies in the Asia-Pacific Region**

Next are two contributions reporting on comparative studies with different groups of participants from Korea, Singapore, Japan, and Indonesia. Comparative studies can offer researchers new insights and improved understanding about individuals and groups within a society. These two papers provide readers with new perspectives about how different factors may influence math and science learning outcomes and the doing of science. *APSE* encourages comparative studies that serve to identify similarities and differences among participants in different contexts in the region.

Hyunjung Kim shared results of her analysis of TIMSS data comparing Grades 4 and 8 Korean students' responses to non-cognitive variables, including interest, confidence, perceived value of education, and instructional clarity in science and mathematics with Grades 4 and 8 Japanese and Singaporean students. The average of responses of Grade 4 Singaporean students was the most positive in all areas overall, but Grade 4 Japanese students' responses in terms of interest and confidence in science were generally the highest. In contrast, her analysis found that Korean students' interest and confidence decreased as they transitioned from elementary to middle school and that Korean students' responses about whether they know what teachers expect from them or if they want to pursue future careers in science or mathematics were quite low compared to the other groups.

Yustika Sya’bandari, Sarah Meilani Fadillah, Ai Nurlaelasari Rusmana, Rahmi Qurota Aini, and Minsu Ha conducted a study to assess cognitive bias in Korean and Indonesian scientists by considering sociocultural factors used for making judgements and choices in science. The authors used the cognitive bias assessment (CBA) instrument to measure responses from 184 professors and scientists in South Korea and Indonesia and found that the respondents had some similar response patterns, but that Indonesian scientists scored significantly higher for optimism and belief bias. The authors use these results to discuss the importance of awareness of the bias in the context of science teaching and learning. This work offers important implications for training scientists to have systematic thinking, reasoning, and judgment through understanding scientific methods.

2.4 **Innovations in Science Teacher Preparation in the Asia-Pacific Region**

The final contribution is a paper that shares an innovation in teacher preparation and education courses implemented with pre- and in-service biology teachers in Indonesia. Indonesia has one of the largest and fastest growing K-12 and university student populations in the world. To meet the needs of these learners, science education researchers and teacher educators are working to
develop innovations in teacher preparation programs necessary to help a large professional body of teachers to effectively implement a new national science curriculum that emphasizes student-centered learning. *APSE* especially welcomes research focused on sharing the development and implementation of new programs for improving and creating innovations in science teacher education.

Faisal and Sonya Martin describe a mixed-methods study involving 45 pre- and in-service biology teachers who participated in an 8-week socio-scientific issues (SSIs) teaching course at an Indonesian university that was designed to provide teachers with both theoretical knowledge and practical SSI teaching experience. The goal of the research was to explore the impact of the course on teachers’ perceptions and attitudes about SSI-based instruction. The authors drew from teachers’ responses to an SSI-based instruction questionnaire, interviews, and course assignments and found that after the course, teachers had a high awareness of some core aspects of instruction and perceived themselves as having sufficient knowledge about pedagogical aspects. Although the teachers demonstrated positive attitudes and perceptions about SSI-based instruction, the researchers found teachers were concerned about challenges of implementation of SSIs in Indonesian school contexts. Teachers were especially concerned about whether this approach would limit their ability to meet the curriculum requirements and whether or not they would have the capacity to design and manage SSI discussion activities with students who were not used to engaging in these kinds of learning activities.

3 Invitation to Contribute to *APSE*

*APSE* is currently accepting new submissions for consideration in the December 2022 issue. We invite you to make *APSE* your home for accessing new and informative research from both established and developing scholars from the region.

About the Author

Sonya N. Martin is a professor in the Department of Earth Science Education at Seoul National University in Seoul, Republic of Korea. Sonya holds a bachelor’s degree in biology from Bryn Mawr College, and master’s degrees in elementary education and in chemistry education from the University of Pennsylvania in the United States. She also holds a doctoral degree in science
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**References**