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EDITORIAL

Editorial

The first issue of *Science Education International* for 2022 begins this journal operating under new publication guidelines. We now make explicit our alignment with Committee on Publication Ethics guidelines. This has altered our publication guidelines. These new guidelines can be found at: http://www.icaseonline.net/journal/index.php/sei/about/submissions#authorGuidelines.

This first issue of Volume 33 includes contributions with a focus on high school students and pre-service teacher education. The first three article focus on the early years of high school. Emine Akdağ and Mustafa Serdar Köksal's study investigated the relationship of 8th grade Turkish gifted students' perceptions regarding science learning environment and motivation for science learning with their intellectual risk taking and science achievement. Turkey's Ercan Sayilgan and Adem Akkus examined the effect of STEM designed activities on academic achievement of 7th grade elementary school students in work and energy unit in the second article. The third article from Honk Kong's Winnie Wing Mui So, Qianwen He, Yu Chen, Wai Chin Li, Irene Nga Yee Cheng, and Theodore Tai Hoi Lee focused on Engaging ten-to 12 years old students with intellectual disability in STEM learning. The next two articles explore different aspects of high school Biology. The fourth article in this issue is from Emeka Sylvester Nwoke, Anna Uitto, and Jari Lavonen who offer a comparative study of upper secondary school Biology curricula rom the two countries of Finland and Nigeria. While the fifth article from Turkey's Said Doğru presents a study on the conceptual knowledge, experiences, and sources of information secondary school students have about owls. The next three articles deal with issues in Chemistry. Johnson Ayodele Opateye and Daniel Raphael Ejike Ewim explore the impact of research-and assessment-based instructional modes on the achievement of Nigerian senior high school students in chemistry in the sixth article. The seventh article from Oman's Batoul AL-Ajmi and Abdullah Ambusaidi reports on the level of scientific argumentation skills in Chemistry among students, specifically the role of logical thinking and gender. The eighth article by Nursen Azizoğlu, Bülent Pekdağ, Ayberk Bostan Sarıoğlan, and Gülnur Kuzucu used an inquiry-based instruction on the main subatomic particles intervention to enhance Turkish high-school students' achievement and motivation. Articles nine and ten address Physics. Tim Zenger and Philipp Bitzenbauer present a study that surveyed German secondary school students' conceptual knowledge of density in the ninth article. While the tenth article by Nikolaos Zarkadis, George Papageorgiou, and Angelos Markos reports on their investigation into the consistency of pictorial representations of the atomic structure drawn by students on the basis of particular quantum numbers' characteristics. The next two articles included pre-service teachers as participants. The eleventh article Emmanuel Kyame Oppong, Francis Quansah, and Soloman Boachie looked into improving Ghanian pre-service science teachers' performance in nomenclature of aliphatic hydrocarbons using flipped classroom instruction. The 12th article by Witchayada Nawanidbumrung, Sara Samiphak, and Noriyuki Inoue reports on the impact of Thai pre-service teachers' pedagogical beliefs on teaching science as inquiry. The final article from Ahmet Volkan Yüzüak and Recep Recepkethüda aimed to determine science teachers' opinions about the Skills-Based Questions (SBQ) used in Turkey's high school's entrance exam.

In the first article, Emine Akdağ and Mustafa Serdar Köksal's study investigated the relationship of 8th grade Turkish gifted students' perceptions regarding science learning environment and motivation for science learning with their intellectual risk taking and science achievement. They highlighted that the ability to provide rich, open-ended, and challenging learning processes in science courses is related to how much intellectual risk is allowed in the teaching environment, how positive the learning environment perception is, and how much motivational support is provided. They go on to note that students' ability to take intellectual risks to a certain extent is effective in increasing their motivation and science achievement. The motivation of those individuals while learning science is influenced by intellectual risk-taking behaviors and key components of teaching. Akdağ and Köksal's study used a correlational research approach with 132 14-year-old gifted Turkish students. Their study was found that these gifted students had high intrinsic motivation and considered the learning environment as full of constructive activities. However, there was no correlation between the environment and their achievement. Akdağ and Köksal's study provides suggestions for effective and cognitive components that should be taken into account from the design of science activities.

Turkey's Ercan Sayilgan and Adem Akkus examined the effect of STEM designed activities on academic achievement of 7th grade elementary school students in work and energy unit in the second article. Sayilgan and Akkus highlight that STEM education; it is aimed at students comprehending science phenomena and basic principles of science while practicing engineering, design, and mathematics. Their study was quantitative research using pre- and post-test, semi-experimental design with 41 7th grade students. Saylilgan and Akkus's pre-test indicated that there was no significant difference between the groups in terms of academic knowledge level. While the post-test showed a greater improvement in the STEM group, the retention assessment did not. Sayligan and

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Akkus reported although STEM activities benefited to students, a short number of activities does not fulfill the cognitive development. The article concludes with recommendation based on this study.

The third article from Honk Kong's Winnie Wing Mui So, Qianwen He, Yu Chen, Wai Chin Li, Irene Nga Yee Cheng, and Theodore Tai Hoi Lee focused on Engaging ten-to 12-year old students with intellectual disability in STEM learning. In Hong Kong special schools are for children with ID, visual impairment, hearing impairment, physical disability, schools for social development and hospital school and implement a school-based curriculum adapted from the mainstream school curriculum to address the learning capabilities of these students. Although the development of inquiry is often oriented to the normal learning abilities of students, there are an increasing number of studies which acknowledge the possibilities of employing inquiry for ID students. So et al.'s study included a class of ten students aged between 10 and 12 years who identified with ID. The study's design emphasised inquiry and at the same time leverages technology and engineering, consisting of Engaging in inquiry, Exploring through technology, Engineering for innovation, and Explaining for understanding, which can be concluded as a 4E model. A qualitative research methodology was used with observations of students during the lessons. So et al. reported that most ID students in this study engaged deeply and performed well in the lessons with teacher guidance. So et al.'s study ends with a recommendation.

The fourth article in this issue is from Emeka Sylvester Nwoke, Anna Uitto, and Jari Lavonen who offer a comparative study of upper secondary school Biology curricula rom the two countries of Finland and Nigeria. Nwoke et al.'s study compad the upper secondary school biology curricula in Finland and Nigeria for the coverage of scientific literacy to highlight similarities and differences. Finland and Nigeria are two countries with major differences in science curricula. Finland has adopted a curriculum influenced by both the German Bildung-Didaktik and Anglo-American curriculum. Finland has a decentralized education system in which the local curriculum is prepared based on the national-level curriculum and the public entrusts teachers to add their input to the curriculum. Nigeria is a member of Anglophone Sub-Saharan Africa, which has historically adopted Anglo-American curriculum theories due to colonial ties and operates a centralized education system with a science curriculum designed based on this central nature to guide teachers in educating their students. Nwoke et al.'s study adopted the deductive content analysis approach. The similarity of the curricula in many areas points to the convergence of the two curricula traditions which could explain the role of globalization in curriculum implementation across nations leading to the teaching of the same science concepts in schools.

The fifth article from Turkey's Said Doğru presents a study on the conceptual knowledge, experiences, and sources of information secondary school students have about owls. While Turkey is home to thousands of endemic species, this century has seen a decline especially in its bird species. Doğru highlights Turkish students have limited knowledge of endemic owl species that are part of our country's ecosystem. He also notes when the curricula are not integrated with nature and living world, students can grow up to become individuals who lack environmental consciousness such as perception of nature, comprehending the richness and variety of nature and caring about living things in nature. Doğru research determined students' schematic models about owls through a hermeneutical phenomenology research study with 878 sixth grade students. Doğru reported most students know what an owl looks like however misconceptions were found with most students providing information based on their opinions. Doğru concludes his article on what further research would be beneficial.

Johnson Ayodele Opateye and Daniel Raphael Ejike Ewim explore the impact of research- and assessment-based instructional modes on the achievement of Nigerian senior high school students in chemistry in the sixth article. Opateye and Ewim highlight topics which have been a challenge to Nigerian high school chemistry students and argue for how and why they need to be understood. How students are assessed is one area that needs to be investigated as Opateye and Ewim argue assessment of students' learning is central to effective instruction in the classroom. Their study was a 3 × 2 × 2 pre- and post-test control group in a quasi-experimental design with three public and three private schools totalling 240 Year 11 students. Their findings reveal that assessment-based instruction was more effective in teaching difficult chemistry topics when compared to research-based instruction. Opateye and Ewim note potential reasons for this difference and conclude with four recommendations based on this research.

The seventh article from Oman's Batoul AL-Ajmi and Abdullah Ambusaidi reports on the level of scientific argumentation skills in Chemistry among students, specifically the role of logical thinking and gender. AL-Ajmi and Ambusaidi note why and how the use of scientific argumentation in teaching is of great importance as it makes the students' engagement more effective in the teaching and learning process. AL-Ajmi and Ambusaidi conducted a survey of targeting 15 chemistry teachers in post-primary education grades (11–12) to find out if their students possessed the scientific argumentation skills and to identify what these teachers thought about their students' logical thinking skills. The study used two instruments: scientific argumentation and logical thinking. Their results indicated that the level of scientific argumentation skills among these participating eleventh grade students were at a medium level and very low for logical thinking. AL-Ajmi and Ambusaidi conclude their article with recommendations and potential future research as a result of this study.

The eighth article by Nursen Azizoğlu, Bülent Pekdağ, Ayberk Bostan Sarıoğlan, and Gülnur Kuzucu used an inquiry-based

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instruction on the main subatomic particles intervention to enhance Turkish high-school students' achievement and motivation. Azizoğlu et al. report on how and why there are challenges in science education's transition from traditional methods of teaching to inquiry-based instruction. In terms of their study, in teacher-centered instruction based on lecturing, students are not given the opportunity to think about abstract concepts, engage in an exchange of ideas, ask questions or investigate. Whereas, inquiry-based instruction provides an opportunity for all of this as well as allowing students to improve their social and emotional learning skills. Their research study was a quasi-experimental research design with 45 ninth-grade Turkish students half in a control group experiencing tradition teaching and half experiencing an inquiry-based teaching. Both groups were offered the study's two survey instruments. Azizoğlu et al. noted that while both groups improved their understanding, the inquiry-based teaching group improved significantly better. Azizoğlu et al. note limitation to their study, however, is able to conclude that inquiry-based teaching is effective.

Tim Zenger and Philipp Bitzenbauer present a study that reports on the development and piloting of a German version of a concept test to assess students' conceptual knowledge of density. Zenger and Bitzenbauer argue how it is importance for students to understand density in early physics education in German secondary schools and therefore it is necessary to have an instrument that allows teachers to survey their students' conceptual knowledge of density. Their study offered a "Density Survey" to 222 7th grade German secondary school students from three public secondary schools as a post-test after instruction. Zenger and Bitzenbauer reported that their instrument had acceptable to good psychometric properties and allowed for a reliable assessment of learners' conceptual knowledge about density. Their results led them to offer potential solutions to some problems that students encounter.

The tenth article by Nikolaos Zarkadis, George Papageorgiou, and Angelos Markos reports on their investigation into the consistency of pictorial representations of the atomic structure drawn by students on the basis of particular quantum numbers' characteristics. They argue that research has identified that some students do have difficulties in interpreting the values of quantum number when determining the quantum status of an electron or writing the electron configuration. As a result, students' difficulties in the conceptualization of quantum numbers are also associated with problems in pictorial representations of the corresponding atomic structure. Their study offered survey to 192 Greek students near the end of their 12th grade. Their study reported that changes in the value of any quantum number did not significantly differentiate their representations indicating significant consistency. Zarkadis et al. further reported that pictorial representations appear to be reliable tools due to their consistency and as reliable tools could help teachers. Zarkadis et al. conclude their article with implications for science education based on their study.

The eleventh article Emmanuel Kyame Oppong, Francis Quansah, and Soloman Boachie looked into improving Ghanian pre-service science teachers' performance in nomenclature of aliphatic hydrocarbons using flipped classroom instruction. Oppong et al. note that flipped instruction or a flipped classroom is a kind of blended learning. In this type of learning, students learn new content online and what used to be done outside of the classroom (i.e., homework) is now done in class with the teacher. The teacher is now able to offer more personalized guidance and interaction with students, instead of a transmissive or lecture style of teaching. In this manner, the flipped learning is deeply connected to problem solving, active learning, inquiry learning, and interpersonal communications. Students are in class working with each other and the teacher to generate deeper learning. The design employed in this study was a single group pre- and post-test action research design offering two survey instruments to 45 pre-service science teachers at one of Ghana's colleges of education. The result of this study revealed that pre-service science teachers' performance in the post-intervention test was far better than that of pre-intervention test. This means that pre-service science teachers' performance had improved greatly after they have been exposed to flipped classroom approach intervention activities. Oppong et al. end with a discussion of the benefits of using a flipped classroom approach.

The twelfth article by Witchayada Nawanidbumrung, Sara Samiphak, and Noriyuki Inoue reports on the impact of Thai pre-service teachers' pedagogical beliefs on teaching science as inquiry. Nawanidbumrung et al. argue that the purpose of implementing inquiry-based science lessons is to motivate students to engage in thinking processes as "professional scientists." They go on to argue that these processes help students to understand scientific concepts deeply and develop their scientific abilities in personally meaningful ways. However, pre-service teachers' beliefs play a crucial role in directing how they design their inquiry-based lessons through the process of selecting learning theories and instructional strategies they think are "the best" for them and their students. The study interviewed and observed six Thai pre-service teachers who were in their final year of a 5-year teacher preparation program. Nawanidbumrung et al.'s study found that even if inquiry-based teaching was encouraged in teacher training program and many pre-service teachers seemed to agree on its significance, their science lessons did not show the spirit of inquiry and these pre-service teachers found it difficult to facilitate class discussions. Nawanidbumrung et al. conclude with discussions on lessons learnt in the research to support pre-service teachers in learning to teach inquiry-based lessons effectively.

The final article from Ahmet Volkan Yüzüak and Recep Recepkethüda aimed to determine science teachers' opinions about the SBQ used in Turkey's high school's entrance exam. Turkey, like many other countries' science curriculum and policies, has gone through several iterations over the past several decades. However, these changes have caused

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uncertainty among both students and teachers, specifically for Yüzüak and Recepkethüda's study was the change to skill-based questions on the high school entrance exams. What are classroom teachers' opinions concerning skill-based questions? This research was designed using Phenomenology to learn more about known but undetailed phenomena of 15 8th-grade teachers. Yüzüak and Recepkethüda's concluded that the teachers' felt that the textbooks used were not fully adaptive to skill-based questions, and there is a lack of compliance with the end-of-unit evaluation questions. Yüzüak and Recepkethüda conclude their article with recommendations.

Steven S. Sexton*

College of Education, University of Otago, Dunedin, New Zealand

***Corresponding author:**
steven.sexton@otago.ac.nz