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EDITORIAL

Editorial

The third issue of Science Education International for 2021 brings together ten articles from seven countries investigating chemistry, physics, and cognition. Abdolahi Mohamed Adawe reports on chemical security in Somalia in the first article. In the second article, Boniface Yaayin, Emmanuel K. Oppong, and Ruby Hanson focused their study on the effectiveness of the jigsaw model on improving Ghanaian pre-service teachers' performance in selected functional group organic compounds. Turkey's Nejla Gültepe determined the differences in the conceptual understanding of students who were taught with a scientific argumentation approach in Grade 12 chemistry in the third article. The fourth article on chemistry was by Adolfo V. Obaya, Yvonne Rodríguez Barocio, and Yolanda Marina Vargas Rodríguez who investigated online simulators for the teaching of the law of conservation of matter and chemical reactions in Mexican high schools. The fifth article from Turkey's Nilüfer Didiş Körhasan presents the interaction of students' mental models with peer instructional elements in an undergraduate physics course.

The remaining five articles address areas of cognition ranging from values, attitudes, and views. The sixth article reports on science process skills (SPS) in the Greek primary school science textbooks by Andriani Sideri and Michael Skoumios. The seventh article was research which aimed to gain the value of responsibility implicitly through activity-based values education tasks (ABVET) prepared in Turkish secondary school science lessons by Havva Yaman and Burcu Anilan. The eighth article by Jeah May O. Badeo and Domarth Ace G. Duque proposed revisions in the psychometric properties of the "Colorado Learning Attitudes for Science Survey" (CLASS) based on their research in the Philippines. Mirac Furkan Bayar and Uluhan Kurt investigated the effect of mobile learning on 8th grade Turkish students' academic achievements and their opinions about the course in the ninth article. Then for the tenth article, Tuba Demirci and Esra Kabataş Memiş examined the views of Turkish preservice science teachers on concept map used in a General Chemistry II class. The eleventh and final article by Thialand's Nattakit Sawadthaisong developed a paradigm, pattern, and mechanism for the professional development of science teachers.

Abdolahi Mohamed Adawe reports on chemical security in Somalia in the first article. Adawe notes that the laboratory is a place where scientists can work safely and securely. However, while its safety management system plays an important role in minimizing incidents that happen in the lab, it depends on how its technicians, students, and other workers who run the lab are trained and equipped with knowledge about safety and security courses. Although universities in Somalia generally use chemicals in small quantities, some of these are known as "dual-use chemical" meaning that they can be used for both beneficial and harmful purposes. Adawe's paper reports on the importance of chemical safety and security awareness programs as well as best practices for chemical facilities in academia and industry to mitigate threats to chemical security. Adawe's study involved a survey questionnaire to measure the ideas of chemistry lecturers, university students, laboratory managers, and government lab personnel. Adawe highlighted chemical safety and security programs require consideration and serious commitment from all stakeholders. He goes on to conclude that his study showed that the safety and security system in Somalia is inadequate. Adawe concludes with recommendations based on this study.

In the second article, Boniface Yaayin, Emmanuel K. Oppong, and Ruby Hanson focused their study on the effectiveness of the jigsaw model on improving Ghanaian pre-service teachers' performance in selected functional group organic compounds. Their article begins with a rationale as to the importance of chemistry and why it is needed. They then acknowledge that most chemistry concepts are difficult for many students, especially organic chemistry. As such, their study explored the effectiveness of the jigsaw model as a teaching strategy with 144 pre-service teachers. One set of pre-service teachers were taught using jigsaw while the other set was taught the same content using conventional methods. Using a pre-test/post-test methodology, Yaayin *et al*. found that the jigsaw model produced a higher performance than the conventional teaching method. As a result of this study, Yaayin *et al*. conclude teachers in Ghana should consider using the jigsaw model as it is both a cooperative learning strategy and a learner-centered teaching strategy, that is highly innovative in developing problem-solving skills and creativity among learners.

Turkey's Nejla Gültepe determined the differences in the conceptual understanding of students who were taught with a scientific argumentation approach in Grade 12 chemistry in the third article. Gültepe highlights how teaching on a conceptual level is crucial for realizing a sound understanding related to chemistry subjects and concepts, such as chemical bonds. One concern Gültepe acknowledges is how teachers utilize symbolic representations and shift between the observable or macroscopic and abstract or symbolic levels without paying sufficient attention to how these relate to the micro level. This study was conducted with fifty-two students studying in grade 12 (students aged 17) and conducted over a four-week period to examine the effects of scaffolding with argumentation. Gültepe reports on the results of her study and makes recommendations on how teachers could better support student learning.

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The fourth article on chemistry was by Adolfo V. Obaya, Yvonne Rodríguez Barocio, and Yolanda Marina Vargas Rodríguez who investigated online simulators for the teaching of the law of conservation of matter and chemical reactions in Mexican high schools. Obaya *et al*. highlight how ICT has become more common in education, generating innovative teaching methods. As a result of this ICT, students are no longer be a mere passive recipient of content but must be able to obtain the information, analyze it, and apply it in contextual situations. Such as in educational simulators. Obaya *et al*. acknowledge simulators allow the formation of concepts, knowledge building, and the application of new contexts that students may not be able to access in other means. Their study consisted of thirty students between the ages of 15 and 18. Obaya *et al*. concluded that the use of online simulators facilitated the understanding of abstract and complex information, resulting in meaningful learning in students as it helped these students to visually understand what was happening in a chemical reaction. As a result of this study, teachers should be aware of the innovative tools available to them in supporting students' learning.

The fifth article from Turkey's Nilüfer Didiş Körhasan presents the interaction of students' mental models with peer instructional elements in an undergraduate physics course. Körhasan argues that when new information is abstract, counter-intuitive, and mathematical as is the case with quantum theory, it is even more important that classrooms provide social environments for students as they construct their mental models. Körhasan study involves peer instruction (PI) as it increases student interaction in crowded physics classrooms. Specifically, for this study, PI provided opportunities for students to reveal their own ideas and articulate their thinking as they discussed concepts with each other. This study was conducted in Applied Physics 50B in the School of Engineering and Applied Science at Harvard University. It is an introductory calculus-based physics course intended for engineering and premedical students. It is an interactive, team and project-based course and relies heavily on peer interaction and discussion. Körhasan concluded that PI allowed these students to discuss the contradictive concepts, to realize the scientific knowledge, and to construct their mental models with peer discussion and her study points out the benefits of this approach for students' learning upper-level physics concepts.

The sixth article reports on SPSs in the Greek primary school science textbooks by Andriani Sideri and Michael Skoumios. Although the importance of students' involvement in SPSs has been well acknowledged Sideri and Skoumios highlight that the amount of research focusing on the inclusion of SPSs in the content of school textbooks is rather limited. Sideri and Skoumios note that SPS refer to the main skills employed by scientists when they conduct scientific research, which aims to address a scientific problem and provide explanations on natural world phenomena. In Greek formal education, educational systems revolve around the school textbooks as fundamental teaching tools. This study sought to determine whether and to what extent the activities included in Greek science school textbooks for 11–12-year-olds included SPS activities. As such, every problem, question, and labwork task included in the two textbooks was considered a unit of analysis, a total of 534 activities were analyzed. The results demonstrated that the involvement of SPS in the school textbooks examined does not follow a balanced distribution, as certain skills were more frequently and to a greater extent involved than others. Sideri and Skoumios conclude their article with suggestions to broaden the range of SPS students engage within education.

The seventh article was research which aimed to gain the value of responsibility implicitly through ABVETs prepared in Turkish secondary school science lessons by Havva Yaman and Burcu Anilan. Yaman and Anilan highlight how ABVETs are practice-oriented tasks that allow the student to behave more freely in the learning environment. Their research was conducted with the embedded quasi-experimental design with 37 sixth-grade students. Data were collected with the Dilemma Situations Form (DSF), structured student diary, researcher diary, activity documents, and semi-structured focus group interview form, all of which were prepared by the researchers. There was a statistically significant difference between the DSF pre-test and post-test scores of the experimental group students in favor of the post-test scores but no significant difference between the pre-test and post-test scores of the control group. Yaman and Anilan concluded as a result of their research, positive results can be achieved by integrating values implicitly in science education and ABVET should be used for different science subjects, various courses, and grade levels in future studies.

Mirac Furkan Bayar and Uluhan Kurt investigated the effect of mobile learning on 8th grade Turkish students' academic achievements and their opinions about the course in the eight article. Bayar and Kurt note how mobile learning can be thought of as supporting learning environments through technological tools such as computers, tablets, or smartphones. One of the most important features of mobile devices is to support and develop learning environments without space or time limits, e.g. distance learning. Their study sought to investigate their 28 students' academic achievement and to examine these 8th grade student' perspective on mobile learning environments. The students were offered "The Structure and Properties of the Matter Academic Achievement Test" as a pre-test and post-test 6-weeks later and semi-structured interviews were conducted with the thirteen experimental group students. When the results of the independent samples *t*-test of the experimental group and the control group were examined, it was seen that the academic achievement of the experimental group students was higher in the structure and properties of the substance after the application. While this research is limited to these students and this context, Bayar and Kurt conclude the learning could occur in almost any environment and mobile learning allows learning to continue beyond the classroom walls.

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Then for the ninth article, Tuba Demirci and Esra Kabataş Memiş examined the views of Turkish preservice science teachers on concept map used in a General Chemistry II class. Demirci and Memiş report how a concept map is a method of establishing meaningful interconceptual relationships and propositions and become more effective with active participation of students as students have to establish a relationship between the opinions in their mind and the map they draw. Their study aimed to determine the views of 47 1st-year preservice teachers studying Science Teaching on the concept map creation process over a 10-week intervention. The students' views were collected by an interview form which included nine open-ended questions. Demirci and Memiş concluded that concept map creation was a useful process for these participants, however, these participants stressed that they usually had difficulty in the process mainly because they lacked background knowledge. Demirci and Memiş conclude with recommendations based on this study.

The tenth and final article by Thialand's Nattakit Sawadthaisong developed a paradigm, pattern, and mechanism for the professional development of science teachers. Sawadthaisong argues that the quality of education is an important variable that is the main point and contextual aspect of education reform for the development of many countries to have the potential to drive sustainability on the world stage. Sawadthaisong goes on to argue that Thailand's professional development mechanisms and patterns are currently unable to improve quality education for its people. Specifically, Sawadthaisong is interested in the north-eastern region of Thailand as it is the largest region with the most schools and teachers. Through questionnaires, Sawadthaisong reports that science teachers' professional development has to be suitable for teachers' needs and students' outcomes and use a paradigm that emphasizes students' outcome-based learning. Sawadthaisong notes that this study can be used for further research on the development of teachers according to the concept of area-based networks to achieve concrete results for learners.

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