SCIENCE EDUCATION INTERNATIONAL

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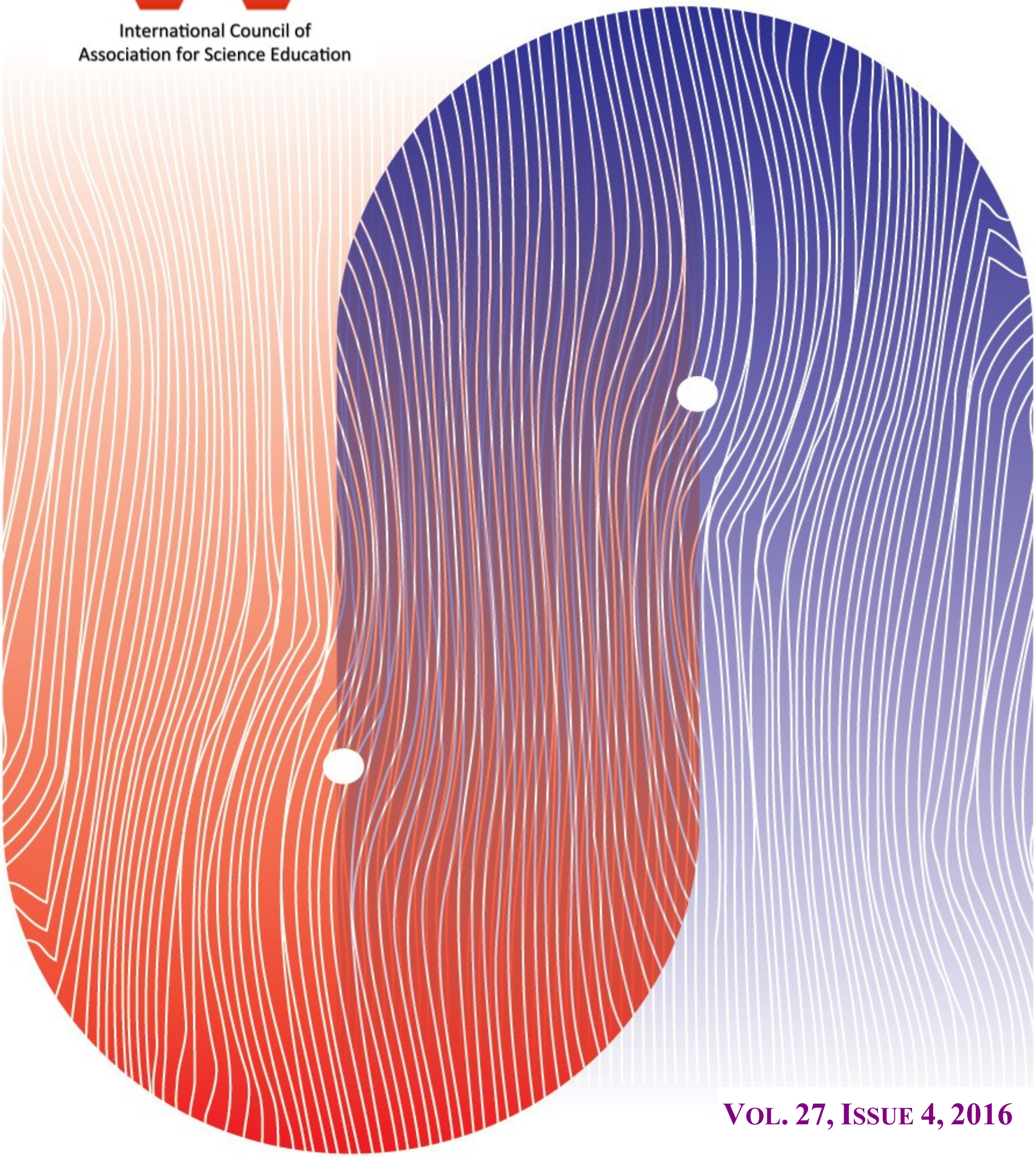

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Editorial

BULENT CAVAS, J. HOLBROOK

The December issue consists of 5 articles, covering aspect of science education at levels ranging from grade 7 to 12 and University teacher education. The contributions come from authors in Greece, Brazil, Australia and Turkey (2 articles).

The first article relates to an understanding of the atom and relevant misconceptions. Analysis of data from four tasks revealed a significant number of students' misconceptions. While it seemed that the curriculum played a noticeable role in the formation of profiles, students' understanding of the differentiations in-between atoms, molecules and ions are not necessarily associated with building an inter-relation between micro- and macro-characteristics. What seems to be more likely is that students relate to micro- and macro-characteristics when they learn the behavior of particles of the microcosm as a whole, not linked to the properties of substances at the macro-level. However, when the objective is the explanation of chemical phenomena, the understanding of the atom itself as an identity and behavior, as well as its differences from the other particles of the microcosm, is a fundamental precondition. In other words, the findings specify the degree to which the knowledge relevant to the atom is associated with a realistic connection between macro- and micro-characteristics.

The second article focuses on argumentation markers emerging from interviews with physics teacher educators. It explores the identification and recognition of argumentation by physics teacher educators, linked to "opposing" of ideas and "reciprocal justifications." Findings suggest that most educators mix aspects of argumentation with explanation, or offer alternative visions of argumentation in science teaching. The article stresses that these findings are problematic and further clarification among teacher educators is needed, related to the nature of argumentation and how it differs from explanations. It is suggested that argumentation is not only be viewed as a way to make decisions, but, as a way to enrich the interactions by means of "firing" more complex thought processes in the classroom discourse and thus aid students' cognition and understanding of the topic taught to students. Undertaking argumentation in science education is still identified as a troublesome situation, even though it is widely recognized by the research community and official documents as an urgent, paramount tool in 21st century education.

The 3rd article considers the role of motivation and cognitive engagement in science achievement. It investigates the contribution of motivational beliefs (self-efficacy and task-value), plus cognitive engagement on science achievement by seventh grade students. Results reveal that motivational beliefs positively and significantly contribute to the prediction of students' science achievement with students' self-efficacy appearing as the best predictor of the science achievement. Although Bandura (1997) asserted that the expectation for success construct, within expectancy-value theory, refers only to outcome expectations and is not related with personal or efficacy expectations (self-efficacy), expectancy value theorists claimed that expectation for success construct measures individuals' own expectations and is more related to personal or efficacy expectations rather than outcome expectations.

The 4th article is a review of journal contributions from the disciplines of Science, Technology, Engineering and Mathematics to STEM education. This paper, through reviewing contributions from 25 well-known journals, discusses STEM literacy, factors influencing students' engagement in STEM education, effective pedagogical practices and their influence on student learning and achievement in STEM, and the role of the teacher in STEM education. Three key factors are identified as: (1) the importance of focusing on the junior secondary phase of teaching, (2) implementation of effective pedagogical practices and (3) the development of high-quality teachers. This disciplinary perspective to examining the field has inherent limitations which are acknowledged in this paper, including a recognition that 'the whole is more than the sum of the parts,' and the contribution of interdisciplinary and transdisciplinary approaches to STEM in future research. However, the strength of this paper lies in the identification of common themes, practices and approaches drawn from empirical research in each of the STEM disciplines, which can inform future evidence-based approaches to STEM education in school settings.

The final article Traces Argumentation in Turkish Science Curriculum. The aim is to investigate learning outcomes that might be conducive to argumentation and the categorization framework include argumentation, the nature of science (NOS), content of the learning outcomes, domain of the learning outcomes, and the relationship between argumentation and NOS. Results show that argumentation elements exist with the curriculum, explicitly or implicitly in all grades. Also, the distribution of explicit and implicit argumentation elements, NOS aspects, and socio-scientific issues are high, but there is not a clear pattern in their distribution across grades. The article concludes by recognising the need for the curriculum to emphasize argumentation elements by stating these explicitly in the learning outcomes, increasing their use in the upper grades, greater integration with NOS aspects and increased frequency of the inclusion of socio-scientific issues.