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Editorial: Future of STEM education: Multiple perspectives from researchers

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Editorial on the Research Topic
Future of STEM education: Multiple perspectives from researchers

In recent times, STEM has become a buzz word in the educational milieu. Standing for Science, Technology, Engineering and Mathematics, STEM has attracted attention from stakeholders in the educational ecosystem and even politicians. They recognize that with the rapid pace at which science and technology are developing and impacting on society, there is a need for students, who constitute the future workforce, to be proficient in STEM. While science and mathematics have traditionally been part of the subject offerings in schools, technology and engineering are not yet mainstream subjects in most schools. The importance of STEM has spawned research efforts to better understand the situation through evidence-based research.

In the context of the foregoing, this articles collection focused on getting multiple perspectives from STEM education researchers on the future of STEM education. The rationale was that by getting researchers to articulate views from the lens of their experiences, we can get the benefit of diverse perspectives that can inform the current debate on STEM education. A flexible interpretation of the theme was adopted.

The articles collection attracted 17 submissions but only seven were accepted after Editorial scrutiny, peer review, and revisions. Representing the efforts of 25 authors (including a Nobel Laureate in Physics) from 14 institutions in five countries, it truly presents multiple perspectives.

We present below a snapshot of the various papers featured in this articles collection.

Achieving multidimensional educational goals through standard-oriented teaching. An application to STEM education

In this study by Schiepe-Tiska et al., a view is advanced that while the emphasis on national educational standards has traditionally been on cognitive outcomes, there is also a need to focus on non-cognitive outcomes. In support of their stance, they propose a

view that curricula that place emphasis on cognitive and non-cognitive standards have the potential to better tune teachers' perceptions to the multifarious challenges involved in promoting STEM education outcomes among students. To this extent, the authors suggest that changes need to be enacted at the levels of policy, teacher education, and classroom. These merit consideration from stakeholders.

The co-development of science, math, and language interest among Spanish and Finnish secondary school students

The study by Sainz et al. is cross national in nature. Such studies in STEM education are rather sparse in the educational literature, and there is a need for more of such work as it can present valuable country perspectives. The authors' insertion of language in the STEM education debate is noteworthy as this is not often explored; language is, after all, a key vehicle for learning. The findings, based on a 3-year longitudinal study involving secondary students, offer useful pointers on co-development of students' interest in the three disciplines of interest.

Development of interdisciplinary STEM impact measures of student attitudes and reasoning

STEM, by virtue of the four disciplines within it, is interdisciplinary in nature. While the impact measures of individual disciplines within the STEM continuum are available, that from an interdisciplinary viewpoint presents challenges. In this study, Mayes and Rittschof address the challenges of developing impact measures of students' attitudes and reasoning in STEM education. Psychometric indices are presented to show the efficacy of these measures. The findings would be useful to researchers who contemplate working on interventions related to interdisciplinary STEM education.

Inclusive instructional practices: Course design, implementation, and discourse

In this study by Salehi et al., useful perspectives on course design, implementation and discourse are presented as part of inclusive instructional practices that aim to promote good learning outcomes among students of different backgrounds. They draw upon findings from the fields of cognitive psychology, social psychology, and discipline-based education research to advance useful pointers that can help to promote equity in STEM education.

Potential factors to enhance students' STEM college learning and career orientation

An important aim behind promotion of STEM education is to interest the younger generation in STEM-oriented careers and innovations in STEM fields. Rivera and Li used a survey on high school students to explore potential factors that can enhance STEM college learning and careers. Six predictor variables were found to account for variations in STEM learning and career inclinations: (a) involvement of parents; (b) engagement in STEM activities; (c) academic experience; (d) pedagogy; (e) technology/facilities; and (f) self-esteem. The overall findings suggest possible directions for educational practice.

The future of embodied design for mathematics teaching and learning

The field of embodied cognition has triggered interest in exploring teaching and learning of STEM from design and analysis perspectives. In this study, Abrahamson et al. advance some insightful perspectives for improving teaching and learning of a STEM subject, mathematics, *via* innovative learning environments that leverage interactive technologies.

Developing pre-service teachers conceptualization of STEM and STEM pedagogical practices

From a pre-service teacher education perspective, much needs to be done to promote integrated STEM. Pursuant to this, Berisha and Vula worked with trainee teachers in mathematics and chemistry to explore collaborative practices in STEM through workshops. It was found that a conductive environment was fostered, in the process enhancing these teachers' conceptualization of STEM. Key attributes in this regard were the collaboration between university faculty to deliver the workshops, synergistic interactions between participants in the two disciplines, and meaningful professional development to better prepare these teachers before deployment in schools.

It is our hope that these articles collection would be useful not only for STEM education researchers but also for others in the educational fraternity. We also express optimism that the articles, which have been carefully curated for this Research Topic, would promote further research in STEM education as well as generate talking points among practitioners.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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