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Title	Editorial: Special issue on innovations in mathematics education
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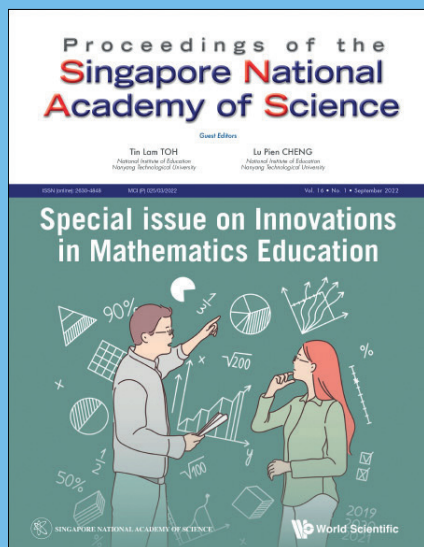
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## Editorial

# Special issue on Innovations in Mathematics Education

As with the previous issues of the Proceedings of the Singapore National Academy of Science (PSNAS), the papers that are accepted for publication consists of a wide range of topics that are of interest to the whole spectrum of specialists within the field. We were indeed humbled when we were invited by Dr Subramaniam, the editor-in-chief of the PSNAS to edit one volume on mathematics education. Pondering on how we could attract a wider readership for this issue, we decided on the theme of “innovation”.

The papers in this volume are organized under the theme “Innovative Practices in Mathematics Education”, with the objective to invite a wide range of papers reflecting the state-of-art of mathematics education, and to be relevant to mathematics education specialists from the different parts of the globe.

The word “innovation”, according to the Oxford English dictionary, means “a new idea or method, or the use of new ideas or methods”. Thus, the theme “Innovations in Mathematics Education” encompasses innovations in conceptions of mathematics education; design and development; classroom instructional practices; research methodologies. As such, we extended our invitation to renowned mathematics education researchers from different parts of the world: North and South America, Europe, Asia and the Oceania. The authors presented different aspects of innovations in mathematics education from their diverse areas of specialization, thereby providing the readers with a glimpse of different aspects of innovation in mathematics education occurring in different parts of the world.

The first paper by Liljedahl proposes a two-pronged approach to innovation in mathematics education: that of innovation in classroom instructional practices to encourage student thinking, and innovation of mathematics education research methodology to study student thinking. He asserts the importance of challenging the institutional norms if we are serious about innovating mathematics instruction. He also used his example of innovative research methodology, the result first methodology, to examine the goal of introducing innovation in mathematics instruction in order to get students thinking rather than mimicking.

The second paper by Seah recognizes the importance of innovative practices in mathematics for all levels of schooling to prepare students for the twenty-first century. Innovation takes into account, in addition to cognitive and affective factors, the conative aspect (in particular, values) as well. His paper presents what values associated with effective mathematics learning and with positive mathematical well-being look like, drawing on some contemporary research findings. He also presents research on the JEDI approach to values learning and reports on recent research on teacher strategies at orchestrating values alignment in their mathematics classrooms.

The third paper by Greefrath and Wess discusses the integration of teaching-learning labs into teacher education in the Muenster University to improve the quality of teacher education. Mathematical modelling was the focus of the lab. With the innovative and supportive learning environment, it was found that the development of modelling-specific diagnostic competencies increases significantly in the teaching-learning labs, in comparison with the control group.

The fourth paper by Mizoguchi *et al.* proposes the Study and Research Path (SRP) model, a model of inquiry-based learning based on the Anthropological

Theory of the Didactic. The paper discusses a study using the SRP model of learning and attempts to study how pre-service teachers and university fresh graduates create SRPs in an online environment in group work, and to categorize the institutional conditions and constraints encountered by each group.

The fifth paper by Moral-Sanchez *et al.* proposes a gamification approach to learning geometry via virtual reality. In a control-experiment research carried out on students' classification of polyhedral, it was found that gamification combined with virtual reality promote visualization skills in students. In fact, a combination of manipulative and immersive technologies is ideal for optimizing classification and improve visualization skills and spatial memory.

The sixth paper by Araya argues for the importance and feasibility of teaching agent-based models to elementary and middle school students. Despite the growing importance of agent-based models, they are not taught in schools. Araya demonstrates with exemplifications how agent-based models, both single-agent and multiple-agent, can be infused into mathematics lessons.

The seventh paper by Shahrill *et al.* argues that the use of comics for mathematics instruction is helpful for improving students' problem-solving skills at the primary and secondary levels. They presented a study of three teachers' journey on using their self-designed comics for lessons. The students' and the teachers' perceptions on the use of comics for teaching and learning were collected. Generally, the students were positive about the use of comics, and reported a positive impact on their learning, as comics tends to tolerate inclusivity at the schools. The teachers were also positive about the use of concepts in improving their students' understanding and performance.

We believe that the acceptance of these articles for publication in this volume shows that our philosophy behind this volume is aligned with the philosophy of the Proceedings of the Singapore National Academy of Science. Lastly, we would like to thank the authors for much effort from the submission of the initial draft to various rounds of revision. The authors have also served as peer reviewers in this issue. Whatever errors remaining in the papers are entirely the fault of the editors.

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