

Mathematics Education – An Asian Perspective

Bill Atweh

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Catherine P. Vistro-Yu *Editors*

# Asian Research in Mathematics Education

Mapping the Field



Springer

# **Mathematics Education – An Asian Perspective**

## **Series Editors**

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Bill Atweh · Lianghuo Fan · Catherine P. Vistro-Yu  
Editors


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# Preface

In 2021, the then newly elected president of the International Commission on Mathematical Instruction (ICMI), Frederick Leung, aspired that “[b]ased on scholarly research, we should facilitate and encourage sharing of best practices and cross-fertilization of ideas, while focusing on capacity building. And in the course of doing so, we should be sensitive to contextual and cultural differences in different countries” (March 1, 2021 ICMI Newsletter). Around two decades previously, Feuer, Towne, and Shavelson (2002) cited the need to raise the quality of educational research worldwide and argued for establishing a strong scientific research culture to help raise the standards of educational research. This collection of chapters examines recent research in mathematics education in various Asian economies.

This is the sixth book in the Springer series *Mathematics Education—An Asian Perspective*, edited by Berinderjeet Kaur and Catherine Vistro-Yu. It is the first book in the series that focuses on recent research in mathematics education in various Asian economies that has developed at different times and rates and in recent decades according to the various economies’ history and political priorities. Asia covers a wide region of the globe and is home to over half of the population on earth. During the past two decades, almost all economies have established policies and infrastructure to promote quality research in most areas in education, including mathematics education. For us here, this is an opportune time to examine this research critically in order to highlight its contribution for international audience and to reflect on its strengths and remaining challenges for the benefit of both the international audiences and policy makers, researchers, research managers, and postgraduate students in the continent.

Many economies in Asia are known for their generally high rankings in international large-scale assessments such as in Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA). However, this exemplary achievement is not uniform across the continent. The outstanding performances of Singapore, Japan, Chinese mainland, South Korea, and Taiwan have been consistent, eclipsing other Asian economies unremarkable achievements in these assessments.

In the area of mathematics education research, however, we see a different scenario. Research in the continent is still developing and is establishing its identity at an international scene—albeit at a rapid rate. Currently, almost all economies in Asia are actively engaged in producing mathematics education research and, more importantly, are publishing their own journals with special focus on mathematics education. Below is an alphabetical list of some of these journals that have been publishing mathematics education research, with some having been indexed by reputable international journal databases.

1. *Asian Journal for Mathematics Education* (AJME) published, e-ISSN: 2752-7271 and ISSN: 2752-7263 (Print), by SAGE, founded by East China Normal University. <https://uk.sagepub.com/en-gb/asi/asian-journal-for-mathematics-education/journal203738>
2. *Brunei International Journal of Science and Mathematics Education* (BIJSME), ISSN 2076-0868, Sultan Hassanal Bolkiah Institute of Education. <https://shbieejournal.wordpress.com/journals/bijsme/>
3. *Hiroshima Journal of Mathematics Education* (HJME), e-ISSN 2758-5263 and ISSN 0919-1720 (Print), is the official English-language journal of the Japan Academic Society of Mathematics Education (JASME). <https://www.jasme.jp/hjme/>
4. *Indonesian Journal of Science and Mathematics Education*, e-ISSN: 2615-8639, is a journal that is published by the Research and Scientific Publication Unit. <http://ejournal.radenintan.ac.id/index.php/IJSME/index>
5. *International Journal of Education in Mathematics, Science and Technology, Turkey* (IJEMST), ISSN 2147-611X, is affiliated with International Society for Technology, Education and Science (ISTES). <https://www.ijemst.net/index.php/ijemst>
6. *International Journal of Science and Mathematics Education* (IJSME), e-ISSN 1573-1774 and ISSN 1571-0068 (Print) published by Springer, Founded by National Science and Technology Council, Taiwan. <https://www.springer.com/journal/10763>
7. *Intersection*, ISSN 0118-6876, is the official journal of the Philippine Council of Mathematics Teacher Educators (MATHTED), Inc. <http://mathted.weebly.com/intersection.html>
8. *Journal of Japan Society of Mathematical Education*, e-ISSN 2434-8619 and ISSN 0021-471X (Print), is published by Japan Society of Mathematical Education. <http://www.sme.or.jp/en/>
9. *Journal of Science and Mathematics Education in Southeast Asia* (JSMSEA), ISSN 0126-7663, the official Journal of SEAMEO Regional Centre for Education in Science and Mathematics (RECSAM). <http://www.recsam.edu.my>
10. *Journal on Mathematics Education*, e-ISSN 2407-0610 and ISSN 2087-8885 (Print), published by Universitas Sriwijaya in collaboration with Indonesian Mathematical Society (IndoMS). <http://jme.ejournal.unsri.ac.id/index.php/jme/>

11. *Southeast Asian Mathematics Education Journal* (SEAMEJ), e-ISSN 2721-8546 and 2721-8546 (Print), published by SEAMEO Regional Centre for QITEP in Mathematics, Indonesia. <https://doaj.org/toc/2721-8546>
12. *Journal of Educational Research in Mathematics* (JERM), e-ISSN 2288-8357 and ISSN 2288-7733 (Print) is the official journal of the Korean Society of Educational Studies in Mathematics. <https://www.jerm.or.kr/main.html>
13. *The Mathematician Educator* (TME) (ISSN: 2717-5634; formerly *The Mathematics Educator* from 1996 to 2019) is an official publication of the Association of Mathematics Educators, Singapore. <https://ame.org.sg/tme/>
14. *Turkish Journal of Computer and Mathematics Education*, e-ISSN 1309-4653, published by Science Research Society, Turkey. <https://www.turcomat.org/index.php/turkbilmat>

At least a few of these have received international circulation and reputation beyond Asia, attesting to the developing research activity in the continent. Asian mathematics education research, as a theme of international academic discourse, has received some attention, as shown in the two volumes edited by Sriraman, Cai, Lee, Fan, Shimizu, Lim, and Subramaniam (2015). It is worthy to note that that collection highlights research developed only in five high income economies in the continent: China, Korea, Singapore, Japan, Malaysia, and India. Our current book provides an update of contemporary research in the continent and adds contributions from other economies that are not often published internationally.

For this book, attempts were made by the editors to solicit contributions from a wide range of economies, especially those less familiar in international publications. However, this call for contributions has coincided with the outbreak of the COVID-19 pandemic, preventing the participations of certain groups of educators to develop their own chapters. In this collection, we attempted to encourage collaborative authorship where more experienced researchers support novice ones in compiling their chapters. Similarly, we were interested in critical reflections on the accounts and evidence-based learning from them in identifying arising or persisting problems in developing research in the respective economies.

The book consists of two parts. The first part consists of three chapters addressing issues in the *Developing Research Culture in Mathematics Education* in the continent. The first chapter entitled “[Building a Research Culture in Philippine Graduate Education: Reflections on Experiences in Mathematics Education](#)”, contributed by Enriqueta D. Reston and Richard R. Jugar from the Philippines, discusses research culture as a construct understood in five dimensions: individual identities, institutional attributes, community of practice, research environment, and research artifacts. Based on the experiences of one university in the Philippines, the chapter identifies two factors that contribute toward building a research culture in graduate research: graduate student identity and research learning environment. Finally, the chapter describes four concrete models for graduate research mentoring. The chapter concludes by arguing that the synergy of the three aspects, that is, the multi-dimensional conception of research culture in higher education, the factors that contribute to the development of research culture in graduate education, and the



mentoring models, can serve as both a guide and a tool for the development of the research culture in graduate education.

The second chapter “[Development of Chinese Mathematics Education Research Culture: A Case Study](#)”, by Jian Liu, Yaoyao Dong, Qimeng Liu, and Jiaxin Yan, discusses the Beijing Mathematics Education Seminar (BMES) founded in 1995, which brought together teachers, postgraduate students, and scholars working in the field of mathematics education working together to advance the research and teaching practices in mathematics education. Based on the core elements of Cultural–Historical Activity Theory, this diachronic case study explores the development strategies used and the challenges faced from three aspects: the *subject*, the *object*, and the *instruments*. The authors have identified some challenges faced in maintaining the group activities for over 25 years including some contradictions: maintaining the balance between theoretical and practical research perspectives, the orientation toward focused or more diverse agendas, and the relative effectiveness of both the “lecture” and “discussion” formats. The authors remain hopeful that their experience may provide an inspiration for the construction of mathematics education research culture in other contexts.

The third chapter in this part, “[The Evolution of Mathematics Education Research in Singapore](#)” by Berinderjeet Kaur, Tin Lam Toh, and Eng Guan Tay, examines how a research culture specifically in mathematics education at the National Institute of Education of Singapore was nurtured, developed, and supported from 1990 onward. The authors discuss both top-down and bottom-up approaches at play. First, institutional policies related to recruitment and promotion of academics were developed to ensure that emphasis was on both teaching and research. Second, the development of research progressed from individually led bite-sized grains that eventually developed into team-based projects with coherent themes. Significantly, through hosting of postgraduate students and holding of annual research conferences, Singapore has also assisted in the development of a research culture and skills in other Asian countries such as Thailand, Indonesia, and the Philippines.

The second part of the book focuses on *Reviews of Research in Mathematics Education in Different Economies*. The fourth chapter “[Critical Analysis of Mathematics Education Doctoral Dissertations in the Philippines: 2009–2021](#)” by Bill Atweh, Minie Rose C. Lapinid, Auxencia A. Limjap, Levi E. Elipane, Michel Basister, and Rosie Conde, presents a critical analysis of doctoral dissertations in mathematics education in the Philippines during the past ten years. It analyzes the dissertations with respect to the topics in the discipline they address, the targeted participants in terms of educational level, and roles of stakeholders and theoretical frameworks used to construct this research. In particular, the authors noted a diversification in this research. However, they also identified a few less traversed areas of research that focus on social goals of education, the relationship of mathematics teaching and learning to other disciplines, equity in terms of language and access to quality mathematics education due to poverty, elementary and kindergarten mathematics, assessment, technology use in informal settings, and research areas that are informed by critical and sociopolitical perspectives.

The fifth chapter “[A Critical Review of Mathematics Education Research in Korea: Trends, Challenges, and Future Directions](#)”, in this collection by JeongSuk Pang and Minsung Kwon, commences by a summary of two recent studies on the trends in mathematics education research using different approaches: content analysis and topic modeling. This chapter then provides critical reviews on the research trends, including an increase in research articles, diversification of research topics, and balance of research methods, while comparing and contrasting them with the international trends in mathematics education research. The authors concluded that, while it may be too early to characterize Korea’s research trends in one specific research topic or approach, two popular research topics (research on curricula/textbooks and research on teacher education) illustrate the particular issues, values, and contexts of mathematics education in Korea. The authors argued that mathematics education researchers need to activate international comparative or collaborative studies to better understand the research topics of a country, to better notice what gaps exist in the research trends, and to search for alternative approaches.

The sixth chapter is “[Mathematics Education Research Trends in Turkey: International Research Context](#)” by Yüksel Dede and Veysel Akçakın. Similar to the previous chapter, the authors investigated patterns in Turkish research published in three local journals in comparison with research published in two leading international research journals in mathematics education. The chapter demonstrates the dominance of quantitative techniques in Turkish research in comparison with international publications. Similarly, there is a tendency in Turkish research to be conducted on teacher education context rather than on school teachers and students. The authors argue that such analysis is helpful to identify gaps in research in the country toward widening of the research agenda.

Kwok Cheung Cheung, Chunlian Jiang, and Lianghuo Fan are the authors of the seventh chapter in this collection and discuss the “[Research and Research Culture in Mathematics Education: The Case in Macao, China](#)”. The authors argue for the unique characteristic of research published in Macao in that its mathematics education practice and research have integrated both the eastern and western traditions. The research reported here is dominated by those related to PISA assessments. Also, the survey revealed emerging research cultures in mathematics education over the past decade—the interests of researchers and practitioners in topics such as comparative studies, lesson studies, mathematical problem solving, and the use of information technology in mathematics teaching and learning. Some other areas such as teacher education, teacher professional development, ICT, and mathematics education are largely ignored. An interesting finding for this chapter is that the vast majority of mathematics education articles reviewed were written by school teachers. The authors conclude that there is a need for mathematics educators in Macao to broaden the scope of research (e.g., go beyond interpretation-oriented, policy-oriented, and practice-oriented types of research) and to enhance the capacity of research, in particular, in terms of research methods (e.g., diversification of research methods).

Finally, in the eighth chapter “[Trends in Mathematics Education Research in Indonesia](#)”, the authors, Nurwati Djam’an, Neni Mariana, and Mangaratua M. Simanjorang, survey mathematics education research in the country with respect to the trending types of research conducted, research topics investigated, the focus of research, targeted educational levels, and the outputs of the research. In terms of type of research, the largest group of studies were found to be experimental research. In terms of topics that the researchers targeted, learning media and ICT constituted 66% of the studies reviewed. The authors noted that academic achievement in mathematics remains the variable most focused on in such research. The authors also demonstrated the underrepresentation of studies aiming at primary years and early childhood. The most common output of such research consisted of instructional materials and learning models. The authors go on to argue that the new challenge of mathematics education research in Indonesia is investigating the social, cultural, and political views about mathematics and mathematics education including social justice issues.

We conclude this Preface by outlining some of the editors’ own reflections on themes arising from this review.

First, we note that, based on the chapters here, the research culture in mathematics education is highly active and rapidly evolving. In addition to five advanced countries which were the subject of the Sriraman et al. review, in 1995, research policy in the different economies was successful in promoting research and publication activities in more economies represented here. Six of the eight chapters in this book report on research in economies not covered by the 1995 review, including Indonesia, Korea, Macao, the Philippines, and Turkey.

Second, the scope of research reported in this book has grown to cover most of the familiar areas of research internationally. Naturally, there are some variations in the emphasis of research topics between countries. For example, teacher education received more attention in Korea (Chapter “[A Critical Review of Mathematics Education Research in Korea: Trends, Challenges, and Future Directions](#)”) and Turkey (Chapter “[Mathematics Education Research Trends in Turkey: International Research Context](#)”), while the integration of ICT into mathematics classrooms, with more from a practical perspective, received more attention in Macao (Chapter “[Research and Research Culture in Mathematics Education: The Case in Macao, China](#)”) and Indonesia (Chapter “[Trends in Mathematics Education Research in Indonesia](#)”). However, there are some areas of research that remain underrepresented in the choice of research topics. Perhaps research on social dimensions of mathematics education and social justice aspects may be not as prominent as didactic or pedagogical research (Chapter “[Critical Analysis of Mathematics Education Doctoral Dissertations in the Philippines: 2009–2021](#)” from the Philippines, Chapter “[Mathematics Education Research Trends in Turkey: International Research Context](#)” from Turkey, and Chapter “[Trends in Mathematics Education Research in Indonesia](#)” from Indonesia).

Third, research in mathematics education in the continent has employed a variety of designs and research methods: for example, experimental research in Indonesia

(Chapter “[Trends in Mathematics Education Research in Indonesia](#)”), content analysis in Korea (Chapter “[A Critical Review of Mathematics Education Research in Korea: Trends, Challenges, and Future Directions](#)”), and quantitative techniques in Turkey and Macao (Chapters “[Mathematics Education Research Trends in Turkey: International Research Context](#)” and “[Research and Research Culture in Mathematics Education: The Case in Macao, China](#)”). Several of the chapters discuss a range of methodologies used by researchers within the respective researchers. We believe that the development in this aspect is a highly positive indicator of Asian mathematics education research, given the strengths of different research methods and what can they inform about the complex nature of educational practice. However, several chapters have identified the yet evolving tradition of qualitative research methods (Chapter “[Trends in Mathematics Education Research in Indonesia](#)” from Indonesia, Chapter “[Mathematics Education Research Trends in Turkey: International Research Context](#)” from Turkey) and some of the challenges to researchers in utilizing them (Chapters “[Building a Research Culture in Philippine Graduate Education: Reflections on Experiences in Mathematics Education](#)” and “[Critical Analysis of Mathematics Education Doctoral Dissertations in the Philippines: 2009–2021](#)” from the Philippines).

Fourth, there is noted evidence from these chapters that the pool of researchers in many Asian countries and economies is expanding. As more universities in the continent are guided by the focus of their governments on research, more faculty members are engaged in research as a normal requirement for their employment. Further, many universities have developed postgraduate degree programs that demand research projects. Several chapters in this collection discuss master’s and doctoral research projects, some of which lead into local publications, and in some cases at least, in international venues (Chapters “[Building a Research Culture in Philippine Graduate Education: Reflections on Experiences in Mathematics Education](#)” and “[Critical Analysis of Mathematics Education Doctoral Dissertations in the Philippines: 2009–2021](#)” from the Philippines, Chapter “[Development of Chinese Mathematics Education Research Culture: A Case Study](#)” from the Chinese mainland, and Macao, Chapter “[Research and Research Culture in Mathematics Education: The Case in Macao, China](#)” from Macao). In particular, Chapter “[Development of Chinese Mathematics Education Research Culture: A Case Study](#)” discusses the infrastructure that allows the inclusion of school teachers, along with postgraduate students and university researchers, in discussing research matters on a regular basis. With this widening pool of researchers, research productivity would continue to increase in the future.

Finally, we note that Asian research in mathematics education exists in a globalized world. This is evidenced in the similarities in research topics and methodologies adopted in the different regions of the globe. Here, we do not take the stance that these topics and methodologies are to be developed in one region and exported to the rest of the world. Topics and methodologies are always contextualized and modified according to the locality’s needs, traditions, and values. While it is beyond the aim of this collection to propose an identity for Asian research in mathematics education in contrast to other regions of the globe, it is our belief that with continued

collaborations in research and sharing of research outputs and internationalization of research publications, strong research in Asia can contribute to strengthening of research internationally. We hope and trust this book may increase the international recognition of Asian research as well as encourage continued dialogue about research in our field.

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