Book Review


This timely publication entitled *STEM Education from Asia: Trends and Perspectives* examines science, technology, engineering, and mathematics (STEM) education policies and practices in Asia. In Asia, STEM education in many countries is still an emerging pedagogical approach to teaching, but the editors of the book have done an excellent job of getting experts in STEM education in Asia to provide discussions related to STEM education policies, curriculum, teacher education, and research.

The book is divided into four sections and related chapters in each section. Experts (primarily from academia) in STEM education from around Asia provide a snapshot of STEM education policies, curriculum, teacher education, and research.

Section 1 reviews STEM education policies in Hong Kong, Malaysia, and Bhutan. In reviewing the chapters in this section, the authors from each of their respective countries have shown how STEM Education has evolved. In Hong Kong, the authors present interesting information on the government’s efforts to strengthen innovation and technology and efforts in promoting STEM education. Also in this chapter, the authors present a discussion on how STEM education is being practiced in formal and informal settings, how universities are supporting STEM education, and they comment that there is still a lot to do to strengthen STEM education.

In the next chapter, efforts to implement STEM education in Malaysia are discussed. Interesting in this chapter is a discussion related to the Malaysian education blueprint and its strategies to improve the educational system. Related to these strategies an in-depth discussion on improving the quality of STEM education is presented. The final chapter in this section presents a review of Bhutan’s journey toward STEM education. In this chapter, the authors
present a historical perspective of Bhutanese education at various educational levels with a special focus on science and mathematics education. In Bhutan, enhancing STEM education has become a key priority and the authors have done a very good job discussing the policies needed to make this a reality. These policies call for teachers and teacher educators to become more aware of what is needed and involved in teaching integrated STEM.

The next section of the book focuses on STEM teacher education and efforts in the Philippines and Thailand are discussed. In the chapter, the authors from the Philippines present an in-depth discussion related to preparing mathematics and science teachers to teach STEM. In this chapter, they also discuss the governance of teacher education programs (i.e., how the government split up the Department of Education, Culture, and Sports into more manageable and focused units) and the need for reform to improve STEM Education. In the next chapter, the focus is on teacher education in Thailand. The authors emphasize the importance of using a form of knowledge known as Pedagogical Content Knowledge (PCK). The discussion on PCK and its potential use in teaching STEM education is very interesting. PCK is a method of teaching science content and was promoted by Shulman (1986, 1987) and his colleagues. Shulman suggested that PCK was a third major component of teaching expertise, in addition to a teachers’ subject matter (content) knowledge and their general knowledge of instructional methods (pedagogical knowledge). It represents an idea that teaching requires considerably more than delivering subject content knowledge to students and that PCK is the knowledge that teachers develop over time, and through experience, about how to teach particular content in particular ways in order to lead to enhanced student understanding (Loughran et al., 2012).

Section 3 in this book deals with the STEM curriculum. In the most basic sense, a curriculum takes content and shapes it into a plan for teaching, learning, and student assessment. In the first chapter of this section, the authors present a case study on the development of STEM education curriculum in Hong Kong. In this section, via a case study, the authors discuss the personal and contextual aspects of developing a STEM curriculum in Hong Kong. They note that the teacher is the key person in the implementation of a curriculum.

The next chapter in this section examines advancing integrated STEM education in the Philippines. In this chapter, they present a very interesting discussion on the STEAM innovation program and the secondary STEM education strand program. The STEAM innovation program is a project with the Unilab Foundation that aims to create and sustain a culture of innovation and collaboration with all the stakeholders. In the appendix, of this chapter, a very helpful example of a STEM career readiness scale is shown. In the next chapter in
this section, results from an evaluation study of STEM programs in Singapore is presented. In their research, they looked at student attitudes towards STEM education, views on STEM, self-concepts in learning STEM, construction of STEM identities, and career decisions in STEM-related fields. This chapter is very helpful to those wishing to do research related to evaluating STEM education programs.

The final chapter in this section looked at the effects of using the 5E learning cycle in secondary education in Bhutan and they also presented a brief discussion on STEM education in Bhutan. This chapter is beneficial to anyone wanting to learn more about using the 5E model that was developed by the Biological Sciences Curriculum Study (BSCS) and consists of the following phases: engagement, exploration, explanation, elaboration, and evaluation. Each phase has a specific function and contributes to the teacher’s coherent instruction and the students’ formulating a better understanding of scientific and technological knowledge, attitudes, and skills (Bybee 2009). In the study presented in this chapter, they found that the 5E learning cycle approach promoted higher academic achievement.

The final section in the book looks at STEM education research in Asia, specifically in Malaysia, South Korea, and Singapore. In STEM education, research is needed to make sound decisions related to implementing integrated STEM education into the schools and this chapter does a very good job looking at various STEM education research efforts. The chapter on STEM education in Malaysia showed the need for more focused research on STEM education. In this chapter, they looked at what the research articles published on STEM education in Malaysia had noted. The next chapter presented STEM/STEAM education research in South Korea and presented research efforts in science education, mathematics education, informatics education, and STEAM education. The authors discussed the future direction of research in STEM/STEAM education in Korea and noted the need to strengthen basic education in STEM, to be more flexible, and to establish a STEM ecosystem.

The final chapter in this section looked at understanding STEM integration in Singapore using complex, persistent, and extended problems. An important highlight in this chapter is that the authors note that space must be created within STEM classrooms to enable learners to make sense of problems first before generating solutions. Also presented in this chapter are the essential features needed in an integrated STEM education classroom.

From my experiences as a STEM educator specializing in technology and engineering education in the U.S. for more than 34 years, and more recently, as a consultant for SEAMEO-STEM-Ed in Thailand, I appreciate the cultural and contextual factors that bring about the multiple ways in which STEM
learning is interpreted and practiced. In particular, I enjoyed learning about STEM education trends and perspectives in various Asian countries. Like the U.S., all countries mentioned in the book recognized the importance of STEM and Integrated STEM education. Many countries faced similar challenges that the U.S. faces as it tries to bring STEM into the school setting. These challenges included preparing teachers to teach STEM, building STEM experiences into the curriculum, and providing professional development for practicing teachers. I also found the various models presented in the book very interesting. These models showed such things as policy practice, STEM curriculum development, and professional development.

In conclusion, the editors have met the goal of providing a good snapshot of the trends and perspectives of STEM education in Asia. This publication is part of Routledge’s series on critical studies in Asian education and I found the book, *STEM Education from Asia: Trends and Perspectives* very engaging. The editors and chapter authors did a great job discussing STEM education happenings in Hong Kong, Malaysia, Bhutan, the Philippines, Thailand, South Korea, and Singapore. Asia is the largest continent in the world, and I highly recommend this book to anyone looking to see how STEM education policies and initiatives are working in Asia.

Edward M. Reeve  
Professor emeritus of technology and engineering education,  
Utah State University  
Senior STEM-ed. specialist, Southeast Asian Ministers of Education Organization (SEAMEO), STEM Education Centre, Bangkok, Thailand  
ed.reeve@usu.edu

References


