

Preface

- Aik Ling: We have decided to present this Preface as a metalogue to capture the active exchanges of our views, sometimes diverse and sometimes converging. The three of us (Chew Leng, Shirley and myself) come from different backgrounds and represent different perspectives about science education. Chew Leng works for the Ministry of Education and hence has a comprehensive idea about policies and their implementation. Shirley, on the other hand, is a natural scientist who has a keen interest in education. She offers the perspective of science from the angle of a practising scientist. Well, I am a science educator who works in the area of science inquiry. We came together because we have a passion for science education and for the progress of science education in Singapore.
- Chew Leng: Indeed, we share a common passion for science teaching and learning in Singapore. Aik Ling, you kick-started this book project. Perhaps you could share with us the compelling reasons for launching this book project and why the focus on inquiry science?
- Aik Ling: We have intended for this book to showcase science education research, particularly those focusing on science as inquiry in Singapore. There are compelling reasons why this book is important. Firstly, with stellar performance by Singapore students in international comparative studies, there are surprisingly few science education research publications coming from Singapore (Lee, Wu, & Tsai, 2009). Secondly, it has been 10 years since the Centre for Research in Pedagogy and Practice was set up. In these 10 years, we have seen the development, evolution and maturation of science education research in Singapore. It is timely to take stock of what forms of inquiry have taken place in our classrooms. Lastly, we hope that the ideas presented in this book will help to promote reflection in shaping the direction that science education and science education research can move forward. Chew Leng, how do you think this book will help policymakers?

- Chew Leng: I thought the book is timely. We are five decades into science education in Singapore. We want to look back and see from where we came and look forward to what we aspire towards, but with the full knowledge of where we are now. The research findings are therefore helpful as they provide policymakers with honest and evidence-based feedback, particularly about the current reality of inquiry practice in the classrooms, the inroads made and the challenges to which we need to pay attention. Having said that, I must confess that I felt a little despondent when I read the chapters that describe the practice of inquiry in schools. There appear to be gaps and issues with our practices. Are they all telling us that we are not making any headway in the practice of inquiry in schools?
- Aik Ling: I share the similar initial reaction with Chew Leng – I mean we do so well in international comparative studies. Surely, we must be doing good things in the schools! The processes must be sound before we can have the outcomes we can be proud of. Many chapters in the book painted a less than rosy picture about science as inquiry in the classrooms. But having reflected upon the chapters, I realise that they epitomise what we value in Singapore – critical self-reflection in our pursuit for continual improvement, change and excellence. This is likened to Freire's argument for the central role of dialogue and reflection. If we put the ideals and contradictions of science as inquiry in the centre as the object of our inquiry (the nucleus), with teachers, science education researchers and policymakers as different stakeholders of science education, then in order to establish a common understanding and goal of science as inquiry, all parties need to undergo many cycles of dialogue and reflection.
- Shirley: Mindset changes in people are the most difficult to achieve as the acceptance of change is never easy. The most important point to note here is the awareness for the need to implement inquiry into the teaching of science in Singapore schools. As long as all the stakeholders concerned are open to and receptive to this need, there is hope!
- Aik Ling: The more the different groups of people meet to engage in genuine dialogue, the more issues and contradictions they reflect upon. The more the groups divide and then reintegrate as a whole, the more closely we will approach the nucleus (which in this case, could be contradictions of the practice of science as inquiry in schools). It is only through these multiple interactions and exposition of the same reality that the level of awareness of all stakeholders can be raised. As such, the seemingly 'negative' situations described by some of our colleagues in the chapters should serve as platforms of dialogue and reflection such that the various groups can collectively move

(rather than as individual groups representing only specific interests) towards the nucleus and develop a more holistic understanding of science as inquiry in Singapore.

Chew Leng: I think I see where you are coming from Aik Ling. If we can broadly categorise the chapters written by our colleagues into two groups – issues and suggestions – I think we have more suggestions than issues. Chapter 4 (describing teachers’ concerns and assessment literacy in science), Chap. 6 (describing how teachers work around structural constraints to enact inquiry), Chap. 9 (describing contradictions between intended outcomes and practice) and Chap. 15 (describing the state of science-related article for general scientific literacy) can be described as chapters highlighting gaps in our practices of science as inquiry.

Shirley: And Chap. 5 (describing a programme to help physics teachers work with inquiry), Chap. 8 (describing a framework to facilitate teachers planning for science as inquiry), Chap. 10 (describing technology-enabled knowledge building in science), Chap. 11 (describing context for meaningful learning of inorganic chemistry), Chap. 13 (highlighting the possibility of homework as a means of informal learning) and finally Chap. 14 (describing the role of science centres in bringing science to the general population) are chapters that provide suggestions about how we can potentially move forward from where we are at the moment. They provide ideas about possible interventions and their likely outcomes.

Aik Ling: Well analysed. In fact, if we examine the ideas presented in the various chapters more closely, there are more authors presenting viable ideas and the way forward than those presenting the gaps in our current practice. Personally, I think we have a good balance of ideas and issues presented in this volume. The key issues raised by our colleagues with regard to the practice of science as inquiry in the Singapore classroom related to (1) teachers’ ideas and their practices, (2) constraints posed at a systemic level, (3) students’ competencies and readiness to learn through inquiry and (4) need for greater awareness of the role of informal learning avenues in science education.

Chew Leng: I concur with Aik Ling. Our passion is the unifying force amidst our differences in experiences. This is the first time I am involved in editing a book. Thanks, Shirley and Aik Ling for guiding me through the process. But, as usual, I have questions and questions. First off, why publish a book? Why not just send the articles to journals? Won’t it save us a lot more work?

- Aik Ling: It certainly will save us a lot of time. Books, however, serve slightly different purposes from articles in journals. Articles in journals are mainly aimed at a scholarly audience within a specialised knowledge domain. For example, articles published in a science education journal are targeted at researchers working in the field of understanding how people learn science. Even within science education, there are also subdomains of specialisation where some scholars examine only conceptual change, while there are others who delve into informal learning. Books, on the other hand, are likely to be less specialised (although a certain level of specialisation still exists). While still intended for scholarly readers, books such as these are broader and more divergent in the ideas that are expressed. Some scholars describe books as ‘ideas playground’ since they allow new and emerging ideas to be expressed and trialled. The format of books also offers greater depth of the ideas to be explored – this is a privilege and luxury that journal articles cannot afford. Hence, while both books and journal articles are important platforms for expression of scholarly ideas, their format and purposes differ to some extent. Both are hence necessary.
- Shirley: While there is the perception that books may not be as ‘specialised’ as journal articles, they are ‘specialised’ in their own unique way. Let me explain by first distinguishing between an authored book and an edited volume, as well as comparisons with a special edition or proceeding published by a journal. Book authors are generally experts in their respective fields with a broad perspectives of the various topics featured in each chapter. In contrast, an edited book is conceptualised around a central theme by the editor(s) involved; after which, scholars and experts in the fields related to the theme are invited to contribute various chapters. This is quite similar to published proceedings of conferences and symposia that constitute special issues of journals, except that there is no preceding conference.
- Chew Leng: Then how do you ensure high quality and robustness?
- Aik Ling: Quality is indeed important in a piece of publication. Scholarly quality can be characterised by different aspects – (1) soundness of ideas that are expressed by the authors, (2) originality of the research that is conducted, (3) proposition of new insights into issues that are crucial for change and improvement and (4) robustness of research design that is employed in the study. Certainly, the characteristics of scholarly quality list are not exhaustive, but are fundamental for a good piece of work. In this edited volume, you would have realised that we read through each of the contributions by our colleagues with these conditions in mind.

Within the research community, the idea of blind (or anonymous) peer review or open peer review is also often taken as another measure of worthiness of a journal or book. While there are major criticisms (including that of differential power interplay) of blind peer review and open peer review process (Osborne & Brady, 2002), it is still used as a measure for worthiness of publications. Many universities rate peer review publications higher in terms of rigour and prestigious compared with non-peer-reviewed ones. This, of course, stems from the belief that ideas that are endorsed and accepted within the community of practising scholars are more valid than those that are not. As such, while we are cognisant of the pitfalls of a peer review process, we also recognise and embrace the process of peer review for every article in this book as we see the process as one that will help our peers develop their ideas further. Each article was subjected to a single blind peer review, and the authors of each chapter made amendments based on the recommendations. Their amended chapters were subsequently reviewed by the editors, and peer discussion ensued to ensure that the final product is something of which the authors can be proud. As an editor, while I am eager to suggest changes for each chapter to improve the quality, I am always cognisant to keep the authors' voices and the original ideas that they want to express. That, to me is one of the most important aspects of an edited book volume.

Shirley: And we are indeed grateful for friends in Singapore, Ken, Barbara, Benny and John, who have anchored each section with a commentary. They are busy people with numerous speaking engagements as well as heavy demands on research work and publication commitments – yet they have taken time to pen their views. Their commentaries help to consolidate the ideas presented by individual authors and also position the ideas and issues in Singapore against the international literature. We invited these four well-published science education academics because of their expertise in science education, as well as their familiarity with the science education scene in Singapore. We hope that the readers will read their views and reflect upon them. This is also an attempt to allow the authors, the commentary writers and the readers of this book to 'interact' and 'exchange' ideas with each other through reading the chapters.

Aik Ling: We must also not forget that Chaps. 1 and 2 set out important contexts for us to understand the state of science education in Singapore and the journey we have taken to arrive at this peak today. As a Singaporean actively involved as a teacher educator and directly with students, I am certainly very proud of how far we have come.

Chew Leng: Indeed, the ideas presented in all of the chapters are generally tangible and doable ideas that policymakers, teachers, students and school administrators can adopt, adapt and improve upon. After working on the chapter, tracing the development of science education in the last five decades, I am excited about how far we can all help make the science classrooms an exciting and engaging centre of learning and inquiry in the next 25 years of science education in Singapore.

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