

Theory and Practice of Lesson Study in Mathematics around the World



Rongjin Huang, Akihiko Takahashi, and João Pedro da Ponte

Contents

1 Introduction	4
2 Structure of This Book	5
3 Contributions and Limitations of the Book	10
References	10

Abstract Lesson study, a powerful teacher professional development approach, originating in Asia, has spread globally. Although the positive effects of lesson study on teacher learning and student learning have been widely documented, many challenges and obstacles facing the adaptation of lesson study have been identified. Moreover, theorizing of lesson study and methodologies for researching lesson study have just begun to emerge as research issues. This book is a collaborative attempt to synthesize state-of-the-art research on conceptualization, theorization, and adaptation of lesson study. The structure and major contributions of the book are described.

Keywords Lesson study · Conceptualization · Theorization · Adaptation

R. Huang (✉)
Middle Tennessee State University, Murfreesboro, TN, USA
e-mail: rhuang@mtsu.edu

A. Takahashi
College of Education, DePaul University, Chicago, IL, USA
e-mail: atakahas@depaul.edu

J. P. da Ponte
College of Education, University of Lisbon, Lisbon, Portugal
e-mail: jpponte@ie.ulisboa.pt

1 Introduction

Continued efforts to improve teaching and to develop teachers have drawn increasing international attention toward *lesson study* (LS hereafter in this book) over recent decades (e.g., Dudley 2014; Hart et al. 2011; Inprasitha et al. 2015; Isoda et al. 2007; Kieran et al. 2013; Lewis 2002). LS is a practice-based, research-oriented, student-focused, collaborative mode of professional development (Fernandez 2002; Lewis and Tsuchida 1998; Murata 2011; Stigler and Hiebert 1999). Originating in Asia (Japan and China) (Chen and Yang 2013; Lewis and Tsuchida 1998; Stigler and Hiebert 1999), it has spread across the globe (Lewis and Lee 2017). For example, more than 1000 participants from around the world attended the annual conference of the World Association of Lesson Studies (WALS) in 2016. In addition, a Special Interest Group of Lesson Study associated with the American Educational Research Association was established in 2017. As a strong endorsement of LS, the International Congress of Mathematicians in 2018 organized a panel discussion on the “use of lesson study to support quality mathematics teaching: practical and theoretical issues raised within the community of mathematics educators and mathematicians.” Because teaching is a cultural activity (Stigler and Hiebert 1999), various conceptualizations of LS and associated forms of activity have developed in different countries (e.g., Huang and Bao 2006; Yoshida 2012) both with in-service and pre-service teachers, assuming different purposes and following different formats (da Ponte 2017; Huang and Shimizu 2016; Lewis 2016).

A number of studies have documented that LS contributes to transforming teaching (Chen and Yang 2013; Lewis and Tsuchida 1998; Stigler and Hiebert 1999), promoting teachers’ growth (Lewis et al. 2009; Murata et al. 2012), sustaining professional learning communities (Moss et al. 2012), improving students’ learning (Lewis and Perry 2017), and building the connections between research and practice (Huang et al. 2016; Kieran et al. 2013; Runesson 2015). Yet, researchers have also identified obstacles and challenges when adapting LS in other countries (da Ponte 2017; Fujii 2014; Huang and Shimizu 2016; Larssen et al. 2018). With in-service teachers, Fujii (2014) indicated six misconceptions of LS such as regarding it as a workshop adhering to the research lesson as explicitly prescribed by the lesson plan. Huang and Shimizu (2016) classified the factors influencing the success of LS into two broad categories: (1) At macro level, these factors include its broad cultural value, the teaching and teacher learning culture, the teacher professional development system, the professional learning community, and the leadership of district leaders and school leaders. (2) At micro level, these factors include appropriate content and pedagogical knowledge of teachers; the development of inquiry stances such as critical lens as researcher, as curriculum developer, and as student; and classroom observation with a focus on student learning, teachers’ commitment, and so on.

Regarding LS with pre-service teachers, da Ponte (2017) identified challenges such as defining the aims of LS, establishing the relationships among participants, scaling up LS, and adapting or simplifying LS for the particular purpose of educating

future teachers. In addition, Larssen et al. (2018) put forward the challenges in adopting LS with initial teacher education (ITE) programs including how to prepare student teachers to observe, the wide variation in the focus of classroom observation in these lesson studies, and the need for discussion of what is understood by learning to stand at the heart of preparation for LS in ITE. To maximize the benefits of LS and to address challenges facing the implementation of LS both with in-service and pre-service teachers, two major issues emerged: one about conceptualizing LS by consideration of the variation and adaptation of LS (Huang and Shimizu 2016; Tahahashi and McDougal 2016) and another about methodological and theoretical frameworks for researching LS (Quaresma et al. 2018).

A ZDM issue (Huang and Shimizu 2016) was devoted to deepening the understanding of the differences and similarities among different forms of LS with in-service teachers and of the underpinning cultural and/or philosophical rationales. Although the release of this issue has promoted dialogues of relevant questions, many excellent research studies could not be included due to space constraints. Moreover, the release of an ICME 13 monograph on theoretical and methodological issues (Quaresma et al. 2018) calls for the need to extend this line of study.

This book aims to synthesize and extend the current research efforts on adaptation, conceptualization, and theorization of LS by including more than 30 chapters from internationally known researchers to advance the studies on LS and to address the challenges facing the adaptation of LS to different cultures.

2 Structure of This Book

This book includes six parts. Part I provides an introduction and various theoretical perspectives of researching LS. Part II contains the historical and cultural perspectives of LS in China and Japan where LS has been practiced system wide for over a century. Part III focuses on adaptations of LS in selected educational systems. Part IV contains the use of LS for preparing future mathematics teachers. Part V includes studies on key aspects of LS. Part VI, the last part, includes commentary chapters and conclusions. The commentary chapters draw together the research reported in this volume and reflect on what we can learn from this international collaborative publication effort with possible research directions for the future.

Part I includes seven chapters. This introduction chapter provides readers with an overview of the book. The chapter “[How Does Lesson Study Work? Toward a Theory of Lesson Study Process and Impact](#)” proposes a theoretical model for explaining the impact of LS on teacher and student outcomes. Lewis and colleagues, building on their studies on LS over two decades, examine all four phases of a LS cycle (study, plan, teach, reflect) and identify major goals, challenges, strategies to overcome challenges, and relevant theoretical perspectives. In the chapter “[How Could Cultural-Historical Activity Theory Inspire Lesson Study?](#),” Wei provides a holistic analysis of the structure of LS from the perspective of cultural-history activity theory (CHAT) and illuminates the significance of LS at the ontological,

epistemological, methodological, and axiological levels using empirical data collected from his LS with elementary school teachers in China. In the chapter “[Developing Teachers’ Expertise in Mathematics Instruction as Deliberate Practice Through Chinese Lesson Study](#),” Han and Huang explore how LS developed teachers’ expertise in mathematics instruction in China from the perspective of deliberate practice. They concluded that through exploring the deliberate practice of perfecting teaching of division of fractions, teachers developed their expertise with enacting the core practices of revision of mathematical tasks and revision of mathematical representations. In the chapter “[Doing and Investigating Lesson Study with the Theory of Didactical Situations](#),” Bahn and Winslow adopt the perspective of the theory of didactical situations (TDS) to examine essential questions such as what is the role of different components of LS, how do they interact, and what are the effects of repeating research lessons. In the chapter “[Theorizing Professional Learning Through Lesson Study Using the Interconnected Model of Professional Growth](#),” Wanty and her colleagues use the Interconnected Model of Professional Growth (IMPG) of Clarke and Hollingsworth (2002) to examine the professional learning experiences of individual participants of LS. In the chapter “[Teaching for Robust Understanding with Lesson Study](#),” Schoenfeld and his associates describe how an empirically validated framework of the Teaching for Robust Understanding (TRU) can be used to strengthen LS. Using TRU-based LS in mathematics, teachers work together to design, teach, and reflect on a lesson that focuses on key mathematical issues and students’ engagement with the TRU framework.

Part II includes five chapters. The chapter “[Preface: Historical and Cultural Perspectives on Lesson Study in Japan and China](#)” by Lynn Paine highlights big ideas across the chapters in Part II. Since historical tradition and cultural values shape the goals and enactments of LS, she emphasizes the importance of recognizing the complexity of LS and reminds us of a dilemma of lesson study’s role in reinforcing dominant traditions and its potential as an incubator of innovation. In the chapter “[The Origin and Development of Lesson Study in Japan](#),” Makinae details the origin and history of LS in Japan. Japanese LS initially is coined using an object lesson approach, evolved through criticism lesson, and, finally, developed as LS. In the chapter “[Lesson Study and Textbook Revisions: What Can We Learn from the Japanese Case?](#),” Watanabe examines a critical issue of how LS, besides promoting the implementation of curriculum, impacted textbook improvement in Japan in the 1980s. In the chapter “[An Analysis of Chinese Lesson Study from Historical and Cultural Perspectives](#),” Li tracks the origin and development of LS in China from initial demonstrating and critiquing lessons to an institutionalized routine of teaching research activity, to a currently further developed teaching research system. He also explains the cultural value and beliefs related to LS in China. In the chapter “[Lesson Study and Its Role in the Implementation of Curriculum Reform in China](#),” Huang and his colleagues provide a holistic picture of the system of Chinese LS and its role in mathematics curriculum reform in China. Through a case study, the authors show how LS can help to implement an innovative idea from curriculum into classroom practice.

Part III includes nine chapters. In the chapter [“Preface: Adaption of Lesson Study in Selected Education Systems,”](#) Wasył Cajkler provides insight into each chapter of Part III and highlights two big concerns of guiding theories of LS and knowledgeable others during LS. In the chapter [“Using School-Wide Collaborative Lesson Research to Implement Standards and Improve Student Learning: Models and Preliminary Results,”](#) Takahashi and McDougal address a critical issue of adapting LS outside Japan without losing authentic features of LS by proposing the Collaborative Lesson Research model. This model has been implemented in the USA and Qatar, and the initial results indicate its usefulness on school-wide LS to implement new curriculum and to improve student learning. In the chapter [“Implementing a New Mathematics Curriculum in England: District Research Lesson Study as a Driver for Student Learning, Teacher Learning and Professional Dialogue,”](#) Dudley and his colleagues describe a project which harnessed six cycles of Research Lesson Study at school and district level over 2 years to tailor the implementation of a new statutory curriculum in England and report the findings of research carried out regarding the project. In the chapter [“A Case of Lesson Study in South Africa,”](#) Adler and Alshwaikh present a LS which focuses on how to use examples to promote students’ learning during this process. This case shows the power of exemplification when studying and working on mathematics teaching and supports theoretically informed LS in general. In the chapter [“How Variance and Invariance Can Inform Teachers’ Enactment of Mathematics Lessons,”](#) Preciado-Babb and his colleagues describe how to use systematic variance and invariance to inform teachers’ continuous decision-making during a class as a critical component of LS. They further illustrate a teaching approach consisting of four components developed empirically through a multiple-year project. In the chapter [“Capturing Changes and Differences in Teacher Reflection Through Lesson Study: A Comparison of Two Culturally Diverse Malaysian Primary Schools,”](#) Kor and colleagues examine the characteristics of post-lesson reflection between different groups of LS. They conclude that at the earlier LS cycles, teacher reflection was mainly at the descriptive story level. Yet, teachers’ reflection gradually advanced to a higher dialogic level at the later cycles. In the chapter [“Representing Instructional Improvements in Lesson Study Through Principled Analysis of Research Lessons in Singapore: A Case of Equivalent Fractions,”](#) Fang and her colleagues develop a principled analysis of research lesson to represent and articulate instructional improvements systematically. They also further informed and improved their own ongoing LS with teachers locally and the LS work globally. In the chapter [“What Knowledge Do Teachers Use in Lesson Study? A Focus on Mathematical Knowledge for Teaching and Levels of Teacher Activity,”](#) Clivaz and Ni Shuilleabhain examine the knowledge that teachers used at different levels of teacher activity during a cycle of LS from a combination of perspectives of mathematics knowledge for teaching and teacher activity. They found that various dimensions of mathematics knowledge for teaching can be used at varying levels of teacher activity and at all phases of a LS cycle. In the chapter [“Identifying What Is Critical for Learning ‘Rate of Change’: Experiences from a Learning Study in Sweden,”](#) Gumarsson and her colleagues examine how teachers developed their knowledge about identifying objects of learning through learning

study, which is an adapted version of LS. Guided by variation theory, the aim of learning study is to make the object of learning identified by teachers available to their students. A case study shows how teachers' knowledge about such critical aspect evolves during the learning study cycles.

Part IV includes seven chapters. In the chapter "[Preface: Mathematics Teacher Preparation and Lesson Study](#)," Raymond Bjuland provides further research directions in adapting LS in teacher preparation education, building on a critical analysis of each chapter of Part IV and recent research findings. "[Developing Learning Communities Through Lesson Study](#)" by Gunnarsdóttir and Pálsdóttir examines how a LS can enhance pre-service teachers' learning community in Iceland. The participants realized that LS can help develop a trustful, collective collegiate relationship and share beliefs about mathematics teaching and learning. Yet, they struggled with anticipating students' response to tasks when planning research lessons. In the chapter "[Lesson Study for Preservice Teachers](#)," Lewis examines how LS can build connections between theory and practice for pre-service teachers through a case study in the USA. She concludes that through participating in a LS cycle, pre-service teachers developed an expansive disposition of *mathematical care*, a repertoire of *pedagogical moves* linked to children's learning, and an expanded *sense of the teaching self*. In the chapter "[How Lesson Study Helps Student Teachers Learn How to Teach Mathematics Through Problem-Solving: Case Study of a Student Teacher in Japan](#)," Nakamura examines how to help pre-service teachers to teach mathematics through problem-solving through a case study in Japan. He found that the teachers transferred their teaching from lecture-oriented to a students' thinking-driven approach through a 2-week LS process. In the chapter "[Lesson Study in a Mathematics Methods Course: Overcoming Cultural Barriers](#)," based on their exploration of how pre-service secondary teachers can develop productive conversation about mathematics and students' thinking about mathematics in a method course in the USA, Peterson and his colleagues share their experience in the iterative revision of courses to overcome the cultural barriers regarding mathematics and mathematics teaching. In the chapter "[Improving Prospective Teachers' Lesson Planning Knowledge and Skills Through Lesson Study](#)," Chen and Zhang examine how a modified LS incorporated in a methods course can develop pre-service teachers' lesson planning skills. They found after experiencing the LS process that participants demonstrated significant improvement in thinking about learning objectives, analysis of content and students, anticipating students' solutions, and sequencing of mathematics tasks. "[Lesson Study in Mathematics Initial Teacher Education in England](#)," by Baldry and Foster, examines the potential and challenges of incorporating LS in mathematics initial teacher education (ITE) in England and proposes a theoretical model for using LS in mathematics ITE that takes account of contextual issues and offers ways to make the most of the opportunities available.

Part V focuses on studies on several critical aspects of implementation of LS. In the chapter "[Preface: Studies on Key Aspects of Lesson Study](#)," Wood Keith provides a framework of teacher learning through LS through which the major ideas of all chapters in Part V are put together, and then he concludes that lesson study,

informed by theory and facilitated by knowledgeable others, could promote teacher learning. “[Implementing Mathematics Teaching That Promotes Students’ Understanding Through Theory-Driven Lesson Study](#)” by Huang and his colleagues examines how theory-informed LS can foster students’ understanding and build connections between theory and practice. In the chapter “[Learning while Leading Lesson Study](#),” Lewis presents how novice LS facilitators can develop their facilitating skills at a reasonable level after an 18-month learning experience (studying materials, attending conferences, and leading LS), although they have to cope with issues such as teacher resistance and the use of time due to the countercultural bulwark of teacher learning. In the chapter “[Characterizing Mathematics Teaching Research Specialists’ Mentoring in the Context of Chinese Lesson Study](#),” Gu and Gu examine how experienced LS facilitators mentored practicing teachers during post-lesson debriefs in China. They identify the strengths and weakness of facilitating practice and propose a mode for LS facilitators to improve their professional skills. In the chapter “[Designing and Adapting Tasks in Lesson Planning: A Critical Process of Lesson Study](#),” Fujii examines the process and roles of lesson planning in LS based on a multiple-year project in Japan and identifies the key features of planning a research lesson. In the chapter “[A Critical Mechanism for Improving Teaching and Promoting Teacher Learning During Chinese Lesson Study: An Analysis of the Dynamics Between Enactment and Reflection](#),” Huang and colleagues examine the dynamics of enactment and reflection during the iterative process of LS. In the chapter “[Race to the Top and Lesson Study Implementation in Florida: District Policy and Leadership for Teacher Professional Development](#),” Ahkiba and her colleagues examine how district policy and leadership characteristics are associated with the levels of LS implementation on scale. In the chapter “[The Use of Lesson Study to Unpack Learning Trajectories and Deepen Teachers’ Horizon Knowledge](#),” Suh and her colleagues examine how a coach-facilitated, vertical LS (including teachers from multiple grade levels) can promote teachers’ use of learning trajectory and contribute to the expansion of teachers’ horizon content knowledge through investigating teaching of a similar rich task across grades.

The two commentary chapters of Part VI provide insights into understanding chapters and implications of the book from different perspectives. In the chapter “[A Western Perspective](#),” building on his long-standing “classroom action research” tradition, John Elliott provides a Western perspective on major themes and issues emerging from the book and discusses fundamental issues concerning the roles of academic experts, teachers in creating a “knowledge platform” and curriculum development, and the use of learning theories to inform LS and methodology issue of studying lesson study globally. In the chapter “[An Asian Perspective](#),” building on her development of learning study over a decade, Munling Lo provides insight into the major ideas posed in the volume. She emphasizes the importance of considering context such as school system and culture when adopting LS and developing theories for guiding LS, analyzing research lesson, and dealing with the objects of learning.

3 Contributions and Limitations of the Book

This book makes its unique contributions to the field of LS due to the following features: comprehensiveness, representativeness, and richness. First, it includes all of the following aspects of LS: (1) theorizing LS, (2) researching into LS, (3) origins of LS, (4) use of LS with in-service teachers, and (5) adaptation of LS with pre-service teachers. So, this book will be valuable for both researchers and practitioners. Second, the origins and adaptation of LS are presented systematically. Beyond the well-known Japanese LS, the book for the first time, introduces the origin, development, and cultural roots of LS in China, which may provide an alternative perspective about what LS may look like (essence of LS). For example, what are the benefits and weaknesses if a LS requires repeated teaching and requires knowledgeable others' involvement, with a goal of perfecting a research lesson? In addition, the adaption and/or enrichment of LS in different cultural settings can enrich and broaden the extensions of LS. For example, some questions emerged: Does LS need specific guiding theories? Should LS include pretest and posttest? Should LS focus on developing sharable instructional products? Third, this book particularly places an emphasis on research perspectives of LS from providing theoretical lens to demonstrating research methods and aspects. Any researchers who are interested in doing studies on LS can benefit from reading this book.

However, there are certain limitations of the book. It does not address how the availability of various technologies, particularly online conference systems, may reshape and strengthen LS to make it doable on larger scale. It does not explicitly address how LS may help students in poverty to learn mathematics or how to use LS as a tool to address equity of student learning opportunity.

It is not our intention to cover all possible issues or provide a prescription about how to do research on or how to conduct a LS. Rather, it is our goal to open the kaleidoscope to appreciate the richness and diversity of LS and provide a ground for readers to develop their own research agendas to advance LS as a promising field both theoretically and practically.

References

- Chen, X., & Yang, F. (2013). Chinese teachers' reconstruction of the curriculum reform through lesson study. *International Journal for Lesson and Learning Studies*, 2(3), 218–236.
- Clarke, D., & Hollingsworth, H. (2002). Elaborating a model of teacher professional growth. *Teaching and Teacher Education*, 18, 947–967.
- da Ponte, J. P. (2017). Lesson studies in initial mathematics teacher education. *International Journal for Lesson and Learning Studies*, 6(2), 169–181.
- Dudley, P. (2014). *Lesson study: Professional learning for our time* (pp. 29–58). London/New York: Routledge.
- Fernandez, C. (2002). Learning from Japanese approaches to professional development: The case of lesson study. *Journal of Teacher Education*, 16(1), 49–65.