

Preface to the Series: Monographs on Lesson Study for Teaching Mathematics and Science

Lesson study is a system of planning and delivering teaching and learning that is designed to challenge teachers to innovate their teaching approaches, and to recognize the possibilities of intellectual and responsible growth of learners while fostering self-confidence in all concerned. It operates when teachers develop a sequence of lessons together: to *plan* (by preparing the lesson in advance, including a prediction of the possible learning), to *do* (by presenting the class to children observed by other teachers), and to *reflect* on the learning with the observers (through discussion) so as to *improve* the lesson for future presentation on a wider scale. It is intended to develop good pedagogical content knowledge that will be useful for the everyday good practice of teachers and the consequent long-term learning of students.

The theoretical frameworks in lesson study involve both an overall global theory and local theories that apply in a particular situation for a particular task. These theories which have been developed through a number of lesson studies are intended to support the design of the classroom teaching. On this meaning, lesson study is a re-productive science which produces good practices to develop children in classrooms in various settings. There has already been worldwide growth of research in the first decade of the twenty-first

century that recognizes the role of teachers' theories of teaching and learning. Lesson study is a key component that draws together these theories to develop innovative ways of improving teacher practice through sharing observations in the classroom. Evidence of good teaching practice is rarely seen by others, and lesson study provides the opportunity for teachers to share and develop their personal expertise within a wider framework. Lesson study offers well-developed children's activities and teachers' actions and interactions in the classroom that can be beneficial for the improvement of teaching and learning in mathematics and science.

This monograph series provides teachers, educators, and researchers with illuminating exemplars of the theoretical advances in teaching mathematics and science that are the outcomes of lesson study. It also proposes that teachers, educators, and researchers develop their own teaching approaches and theorize about their own knowledge of teaching to be shared more widely. The series editors welcome anyone to propose his/her theory of teaching mathematics and science in this series and to join the movement of lesson study.

Series Editors

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Preface to the Book

For teachers:

Are you enjoying mathematics with the children in your classroom? If you develop children who think mathematically, your class will be really enjoyable for both you and the children.

This book explains how to develop mathematical thinking in the elementary school classroom. It is especially written for elementary school teachers who are not math majors and wish to teach mathematics in interesting ways. For secondary school mathematics teachers, it will also be useful, because most of the examples are open-ended tasks which will be meaningful to both kids and adults.

For researchers:

How can you work with teachers to enhance innovation in mathematics education? How can you theorize about it?

This book provides you with a theory of mathematics education which has been developed with teachers through lesson study and shared by teachers in their daily teaching practices. This theory supports better reproduction of the mathematics class in order to develop children's mathematical thinking. It already has a wide range of evidence through the lesson studies during the last fifty years. You may recognize that developing the theory of mathematical thinking with schoolteachers in the context of lesson study is also an innovation for mathematics education research, because it provides you with the methodology as in reproductive science.



Developing mathematical thinking has been a major objective of mathematics education. In today's knowledge-based society, developing process skills such as innovative ways of thinking for problem solving are much desired. Mathematics is also a subject necessary for innovation, as it develops creative and critical thinking in general, and mathematical and statistical thinking in specific situations. In the famous picture *Scholars of Athens* (ancient Greece), by the Renaissance painter Raphael (1483–1520), there is Euclid showing constructions to his students. At the center of the picture is a student who is explaining his findings to some ladies. This is an image of what ought to be the mathematics classroom: students enjoying mathematical communication among themselves. As well as in ancient Greece and during the Renaissance, mathematics is an enjoyable subject for developing mathematical thinking which is necessary for all academic subjects and useful for the modern world. This is an invariant feature of the subject of mathematics passed on from the age of the ancient Greece school called the Academy.

Parts I and II of this book are written by Shigeo Katagiri, who is the former president of the Society of Mathematics Education for Elementary Schools in Japan, and edited and translated by Masami Isoda, corepresentative of the APEC Lesson Study Project. Katagiri's theory of mathematical thinking is well known in Japan, and also in Korea through Korean editions. If you are a beginner or a schoolteacher who is not a math major, the authors recommend that you try out two or three examples for problem solving in the Introductory Chapter and Part II. If you solve them by yourself, you may begin to imagine how enjoyable this book is. After you have captured some images for enjoying and developing mathematics, you may read from the Introductory Chapter, Part I, and Part II. The Introductory Chapter explains the teaching approach to developing mathematical thinking and provides the views on developing mathematical thinking. Part I explains what mathematical thinking is and how to develop it using questioning. Part II provides illuminating examples using the number table with assessment to show how you can develop mathematical thinking in your classroom.

Katagiri's theory is one of the major references for mathematics education research in Japan. It is a pleasure to publish it in English for readers worldwide who are engaged in mathematics education research and mathematics teaching.

Masami Isoda, representing the authors