



## Introduction to the Special Issue

### Lesson study from Japan to the world

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#### **Abstract**

*This article introduces the five substantive papers in this special issue on Lesson Study. It begins with a short description of the practice and the assumptions behind it, highlighting features that may not be easily appreciated by an international audience. Reflections on each of the contributions in this special issue follow.*

#### **Introduction**

Educators in many countries have been fascinated by the practice of Lesson study in Japanese schools, especially in primary schools and junior high schools, and have recognised its impact on the professional life of teachers and its potential for improving the teaching and learning of mathematics. That may well explain the enthusiastic adoption and growing use of Lesson Study in other countries.

Japanese Lesson Study is a process by which teachers of mathematics in one school or from several schools in the same community agree upon and jointly undertake a design brief, so to speak, to work together to research teaching materials, to develop teaching plans (lesson proposals), and to practice teaching together.

Underlying the practice of Lesson Study, is the idea that teachers can learn the principles of lesson design, and so improve their practice by working with other teachers, and by observing other teachers teach. A second assumption is that those teachers and outside experts who have developed deep pedagogical content knowledge in mathematics should be encouraged to share that knowledge and experience with their colleagues. A third assumption is that the design process does not stop simply with what a teacher does, but how teachers can cultivate students' interest in mathematics and to enhance the quality of students mathematical thinking and learning. Finally, it is assumed that the various cycles of Lesson Study, with their focus set on improving the quality of students' learning, will result in artefacts, primarily detailed lesson proposals, annotated and revised as a result of practice, that can be studied by other teachers, contribute through further trials and modifications to teacher professional learning, and can themselves become objects of

study and research. These ideas provide a rationale for this special issue of *Educational Designer* dedicated to Lesson Study.

## Lesson study as exemplifying a careful design process

Stephens' paper seeks to link Lesson Study, as exemplified in Japanese schools, with the principles and practice of educational design. Too often these underlying design principles are left unstated. While the artefacts of Lesson Study may be visible – through videos of actual lessons or through actual lesson plans – it is easy to assimilate these products to one's local culture and to assume that similar artefacts may be replicated by following a set of steps or procedures.

The expectations and assumptions that Japanese teachers bring to planning and implementing Lesson study are not always apparent. Essentially, the focus of their work is researching how students' mathematical thinking can be fostered by engaging in carefully designed problems. This is quite different from piecing together or assembling a set of activities that will constitute a lesson. The latter can be achieved relatively simply. But success in the former requires commitment to a thorough a planning (scoping) study. that links the topic of the research lesson to curriculum materials and connects it with what students have learned before and what they will learn in the future. The Lesson plan needs to anticipate how students are likely to respond to the problems posed; how they may approach a solution from different directions; and identify likely directions that are not productive. There will also be careful attention to the questions that the teacher needs to ask, and how the teacher can identify different examples of students' work that can be used to help other students to see the diversity of successful responses as well as pitfalls along the way.

Annotated lesson notes of the kind used by Japanese teachers are seen by Hiebert and Morris (2012) as instruments that can be used to improve the quality of teaching by working directly on the methods used to teach. They are not focussed on content or content transmission, as are textbooks. They have the potential to overcome two problems that beset efforts to improve teaching. First, these special materials are a means of preserving pedagogical content knowledge in a way that can be shared among teachers in other locations, and they can be used to support professional development beyond the immediate circle of those who have prepared them. Second, these artefacts can themselves become the objects of continuing trials and research by teachers, teacher educators and researchers. In this way, the artefacts of educational design begin to take on some of the features of engineering or architectural design as we know them.

## Lesson study and culture

A central goal of lesson study is improving teachers' understanding of students' mathematical thinking and how they learn mathematics. While this can only be achieved over several cycles, it does need to be built into the design of each cycle. Teachers need to be able to identify different stages of students' understanding. Teachers should know the similar stages that many students go through as they learn new concepts; and how to assist students to move through to the next stage. Teachers need also to be aware of

prevalent misconceptions for given topics which lead to predictable errors; and how these can be addressed.

Marlon Ebaegu examines the cultural foundations and pedagogical assumptions of Lesson Study through his research in some Philippine schools where Lesson Study has been adopted. Towards the end of his paper, Ebaegu reports from one of his research schools where the teachers had uniformly endorsed the goals of Japanese Lesson Study; and yet after completing two cycles many teachers, when presented with a sample of a student's work from their own school, were still unable to identify the stage that student was at, and how they might respond appropriately to what the student had done. This reminds us that any successful implementation of lesson study must always be measured against teachers' improved understanding of students' thinking and how they can respond to it.

Ebaegu's paper draws attention to several cultural underpinnings of lesson study that are easy to overlook. Central to his argument is the belief that lesson design should be viewed as a culturally framed activity. This may help to explain why Japanese teachers accept and see value in the quite arduous and time-consuming process of preparing a comprehensive and detailed lesson proposal, in contrast with teachers in other countries who need to be convinced to do something similar.

Drawing on the studies of Hofstede (2001) and Hofstede, Hofstede, and Minkov (2010), Marlon identifies two dimensions of Japanese culture – attention to detail and a commitment to long-term planning – that may explain why Japanese teachers willingly invest time and effort to designing and planning research lessons, while teachers (for example from the United States or from Australia) appear happy to rely on activities that can be assembled in a far shorter period. 'Activities that work well' have a different design framework where the focus is on designing a learning activity that will work smoothly and engage students. A research lesson, on the other hand, is designed to elicit and refine students' mathematical thinking; to identify misconceptions, to provide for multiple solution strategies; and to enact teaching suggestions based on how students are expected to engage with the mathematical tasks, and the educational values of the school.

## **Building lesson study in the United States**

Tad Watanabe has first-hand experience of Lesson Study in Japan and has played a major role in promoting Lesson Study in the United States. In his review of the 15 years since Japanese Lesson Study was introduced in the United States, Watanabe examines those factors that have contributed to the adoption of Lesson Study as well as those factors that appear to have hindered its growth. He attributes one of the factors hindering the growth of Lesson Study in the U.S.A. to a lack of resources and leadership at school and district level.

Leadership from school principals and active support of all teachers can be assumed in Japanese primary schools. Watanabe's article also points to several misconceptions about and misunderstandings of lesson study that have impacted on the design process. One that stands out is the practice of shortening a lesson study cycle to fit within a single day,

where teachers may prepare a lesson in the morning; teach it in the afternoon; and review teaching of the lesson at the end of the school day. Even if the planning period were to be extended to a single week, there are very limited opportunities for the study of curriculum materials, *kyozaikenkyu*.

Essentially, this underscores a mistaken design principle - that a lesson can be constructed as a series of activities. The focus of teacher observation and post-lesson discussion is almost necessarily restricted to how well the lesson went, and on what the teachers did. Because the planning process has focussed at best slightly on the cultivation of students' mathematical thinking or possible misconceptions, these are unlikely to feature in the classroom observations or in post-lesson discussion. For future growth of lesson study, Watanabe agrees with [Takahashi and McDougal \(2016\)](#) that the model adopted in the U.S.A. needs to shift away from collaborative planning of teaching activities to a stronger focus on designing collaborative classroom research. Improved resourcing and stronger leadership will be needed if this is to come about, but the biggest change should be on how teachers conceive themselves as researchers and what or who is the focus of their research.

## Lesson study in senior high school

[Nishimura, Kobayashi and Ohta](#) from Tokyo Gakugei University and its attached secondary school, reveal a side of lesson study that is less well known outside Japan. In [their paper](#), they apply the design principles that are familiar to those who know Japanese Lesson Study in elementary and middle schools to mathematics teaching in the senior high school. Nishimura and his colleagues make the important point that, because of the more complex nature of the mathematics being taught in the senior high school, there is a tendency for research lessons there to focus more on the teacher's skills and techniques in presenting the mathematics to students. The authors note that less than 40% of lesson study proposals in the upper secondary years attend to anticipated student responses compared to 90% and 80% of proposals in the elementary and middle school years respectively.

Nishimura and colleagues present a case study of a research lesson undertaken in a 12th grade class where students were asked to investigate the classical problem of the spread of disease. This required students, first, to simulate weekly changes in the number of infected people if no preventative measures were undertaken; and, second, to recommend what percentage of the population should be vaccinated to halt the epidemic. Six planning sessions were spent in elaborating the problem and designing a sequence of five lessons. Essential to these lesson plans was assisting students to establish a suitable recursion formula to represent the daily or weekly number of infected and infectious people. These steps were intended to assist students to move from difference equations with which they were familiar to seeing the need for a suitable differential equation.

Five lessons were planned for this investigation. Three lessons were taught by the class teacher before a fourth lesson was held as an open research lesson and attended by 40 external participants. Evaluation of the research lesson was aimed to focus on students' thinking processes; using the kind of evidence that had been foreshadowed in the lesson

plan in terms of students' responses, both spoken and written, and including representations created using digital technology. Accordingly, the post-lesson discussion attended to the teacher's actions in so far as these had helped students' thinking to advance on the problem and where it had been held back for individuals and the group.

Initially, some students struggled to understand that the weekly increment in the number of infected and infectious people is proportional to the number of infected and infectious people in that week. Other students tried to model the spread of disease on a day-by-day basis. Teaching plans were designed to deal with these blockages, and to lead students to consider what simplifying assumptions might be necessary. For example, difference equations would be easier to formulate if it could be assumed that the disease progresses in one-week units. That is, by assuming that everybody who becomes infected does so on a Sunday evening, and then becomes free from infection exactly one week later. Students also needed to assume that the population of the city is constant for the duration of the disease.

Nishimura and his colleagues highlight the important role of the external observer (*koshi*) in the research lesson in drawing attention to students' thinking processes in evaluating the research lesson. The authors present a convincing case for expanding the use of lesson study in the upper secondary years to enable teachers to focus more clearly on students' thinking processes as an essential concomitant of carefully designed teaching. Flowing from this, key design questions are:

1. how can students' thinking be scaffolded during the lessons,
2. what are the potential obstacles to clearly addressing the essential mathematics, and
3. how can students be assisted to formulate the problem efficiently and to represent it suitably?

Nishimura and his colleagues argue that evidence of students' thinking processes is needed, in the first place, for evaluating the original research proposal; and, secondly, that this evidence having been acquired during the research lesson becomes data that can be carried forward into the next cycle of lesson study. This is only possible if the research theme has been designed with a focus on *all three dimensions* of mathematical content, related teaching techniques and students' thinking processes.

## Lesson study in Portugal

[The paper by da Ponte, Quaresma, Mata-Pereira and Baptista](#) from the Institute of Education (IE) at the University of Lisbon links the design of lesson study to teachers' professional development in Portugal. Like the [paper by Tad Watanabe](#), these authors also point to the importance of organizational and resourcing issues when teachers are invited for the first time to join a lesson study activity; and to how that invitation may be construed by the participating teachers. This paper also connects with [Marlon Ebaeguín's paper](#) which also situates lesson study in a 'foreign' environment where not only the invitation to participate in lesson study may be new, but also where exploratory and

collaborative environments must be constructed from the ground up, so to speak, rather than assumed.

This Portuguese enactment of Lesson Study, like its Japanese counterpart, focusses on 'exploratory learning', where students work on tasks designed to enable them to construct their own problem-solving strategies, by employing flexible and varied mathematical representations. The IE authors contrast this exploratory approach with that of a traditional Portuguese classroom where teacher-led exposition is typically followed by students completing practice exercises. The authors are clear that an exploratory approach requires a very different approach to lesson design and needs to include specific attention to and greater sensitivity towards students' potential reasoning processes.

The IE paper focusses on two sequences of lesson study facilitated by its team and undertaken with teachers from Grade 3 and from Grade 5. Before the planning process commenced, there were misunderstandings from some teachers who were worried that planned classroom observations would lead to evaluations of their teaching performance. These concerns were addressed by the IE team. Positively, the Grade 5 teachers decided to develop and use a preliminary diagnostic test to ascertain students' prior levels of knowledge. Negatively, there were concerns as to which teacher would teach the research lesson. Several teachers were anxious about students misbehaving in their class. Having overcome these unexpected difficulties, collaborative planning for the research lessons took place utilising curriculum documents and research articles relevant to the topics to be taught. Post-lesson discussions were focussed directly on the students' methods and strategies that had been observed in the research lesson. These findings were then successfully applied in subsequent lessons by the five other Grade 5 teachers.

The IE authors then discuss how the Grade 3 lesson study got off to an even bumpier start with teachers apparently discouraged and unmotivated due, in part, to current educational policies impacting on schools; and, in part, because of lack of information and clear communication from the school administration about the proposed lesson study activity. However, as the authors report, the levels of support lifted and the post-lesson discussions added impetus to teacher engagement.

This paper underlines the importance of detailed and patient preparation of the research lesson. A process similar to *kyozaikenkyu* involved reviewing curriculum documents and studying research-based articles, some authored by members of the IE team. This paper reveals very clearly the various organizational and personal issues that may need to be resolved before lesson study can start. Fundamental to the design process utilised in this Portuguese report were the value of focussing on the mathematics underpinning the tasks that students are to engage in and anticipating students' reasoning when working on those tasks. It clearly portrays what lesson study looks like *on the ground*; and how necessary it is to support teachers who are experiencing lesson study for the first time, to be respectful of teachers' anxieties and concerns, and to not assume that everything needed for successful lesson study has been put in place at the school. As the IE authors conclude,

“anticipating possible difficulties of students and looking at what they actually do in the classroom ... were very effective in leading the teachers to reflect on what they observed and to consider changes in their own classroom practice. The teachers became more attentive to students’ reasoning processes, especially to generalisations and justifications”.

## Conclusion

This collection of snapshots of Lesson Study around the world shows the common issues in taking an established practice from one culture and adapting it to another. These are local variations on the global theme of improving teaching and learning. The collection also shows the benefits to be gained from the effort.

Max Stephens

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## About the Author

**Max Stephens** is a research fellow at the Melbourne Graduate School of Education. His interest in Lesson Study has included regular engagement with its implementation in Japan, Thailand and Australia. His current research interests include developing a construct of Teacher Capacity to support curriculum reform in mathematics, and investigating the cultural conditions that are needed for the successful adaptation of Lesson Study outside Japan. He has continuing interests in mathematics education and curriculum development internationally, especially in Japan and in China where he has been a visiting professor at several universities. Prior to joining The University of Melbourne, Max occupied senior roles with the Victorian Department of Education and at the Victorian Curriculum and Assessment Authority.