EDUCATIONAL DESIGNER
JOURNAL OF THE INTERNATIONAL SOCIETY FOR DESIGN AND DEVELOPMENT IN EDUCATION

Re-thinking the Quest for Teacher Quality

Improving instructional design to improve teaching and learning

Max Stephens
The University of Melbourne

Abstract

This paper highlights the difference between the common approach to improving educational outcomes by aiming to improve the characteristics of teachers, with an approach through Lesson Study that is directly focussed on the teaching and learning process. It points out the value of the lesson proposal as an artefact of the design process and a public record to be shared with the profession. Lesson proposals include tasks that can be solved in multiple ways and carefully anticipated students' solutions. Lesson Study focusses on the mathematical activity and thinking of the students, and supports a continuous process of action and reflection to improve teaching and learning.

Introduction

In their paper, *Teaching rather than teachers, as a path towards improving classroom instruction*, Hiebert and Morris (2012) imply that efforts in the United States of America to improve teacher quality have focussed too long and too exclusively on improving the characteristics of teachers; for example, through mandating new and more rigorous requirements for pre-service teacher education, or by more stringent teacher certification, or by producing more detailed textbooks, in the expectation that changes to these arrangements would lead to school improvement and enhanced student achievement. Hiebert and Morris claim that this focus has not yielded any substantive results; has not improved student performances, and that a teacher-directed and textbook-driven approach "has defined the way teachers and students interact about content", remaining almost unchanged "for a century of more" (p. 96).

Believing that the above strategies are the most effective ways to lift school performance draws on an assumption that knowledge for teaching is the personal possession of individuals. But in professions like architecture, engineering, music, medicine and surgery this is far from true. In these areas, professional knowledge is not simply locked away in people's heads and dies with them; it is also embodied in artefacts that are public in the sense that they are designed and produced in forms that can survive the individuals

who may have created them; that they can be discussed and shared with other members of the profession, especially new members; and, therefore, able to be improved over time. By contrast, Hiebert and Morris argue that "the U.S. education system has chosen a different path by investing in people and mostly ignoring the option of building instructional products than can be improved over time" (p. 93).

These authors are not talking about textbooks or activity sheets. A textbook typically consists of detailed explanatory material relating to a given topic, followed by some key points that are expected to be communicated to students by the teacher, and then followed up by practice examples. Activity sheets are, as their name implies, a collection of things for students to do. Textbooks serve an important role in assisting and guiding teachers, but their focus is primarily on presenting mathematical content, and rarely if ever do they address students' mathematical thinking.

Teachers in Japan and China commonly use textbooks for regular teaching but these kinds of materials are not the focus of research lessons or lesson study where the primary goal is the development of students' mathematical thinking. In both countries, teachers work together to improve teaching by collaboratively studying teaching materials, planning and observing lessons, and engaging in a continuous cycle of feedback and improvement (Ma, 1999; Huang & Bao, 2006; Isoda, Stephens, Ohara & Miyakawa 2007; Fujii, 2015).

Lesson Plans as Artefacts of a Design Process

On first encountering Japanese Lesson Study, outsiders are usually surprised by the amount of detail incorporated in a published lesson plan, or, as Fujii (2015) prefers to call it, a lesson proposal. Equally surprising is the amount of time that Japanese teachers typically spend designing and constructing a lesson plan or proposal. This is not something that can be accomplished in a day or a week by "cobbling together" a set of activities. (Similar attention to detail in the planning and design of lessons is evident in the way Chinese, Korean, Singaporean and other Asian teachers prepare what they call research lessons.)

The steps that are used by teachers in designing and developing a lesson plan are summarised by the Japanese word *kyozaikenkyu* which is intended to express the relationship between "teaching materials and tasks from mathematical and educational points of view, as well as from students' points of view" (Fujii, 2015, p. 278). In the latter case, two things are essential to consider: first, how are students likely to approach the tasks, including any difficulties or misconceptions they might encounter; and second, how can students be encouraged to solve a task or problem by themselves, and be helped to evaluate the solutions proposed by others. Watanabe et al. (2008) point to four main steps. These are:

1. understand the scope and sequence,
2. understand children's mathematics,
3. understand the mathematics, and
4. explore possible problems, activities and manipulatives.

Lewis (2002, pp. 127-130) reports that a proposal for designing a research lesson in Japan typically includes the following elements:

- Name of the unit
- Unit objectives
- Research theme
- Current characteristics of students
- Learning plan for the unit, which includes
    - connections to standards and to prior and subsequent learning
    - the sequence of lessons in the unit
    - the tasks for each lesson,
    - explanation of unit "flow"
- Plan for the research lesson which includes
    - aims of the lesson
    - teacher activities
    - anticipated student thinking and activities
    - points to notice and evaluate
    - materials
    - strategies
- Copies of lesson materials (e.g., blackboard plan, student handouts, visual aids)
- Background information and data collection forms for observers (e.g. a seating chart).

The Japanese term for the artefact created for a research lesson is *gakushushido-an* (学習指導案), which is usually translated as "lesson plan". As mentioned before, Fujii (2015) prefers the phrase "lesson proposal", because the document is much larger and broader in scope than what is usually meant by "lesson plan".

The word "proposal" also draws attention to an expectation that a teacher will use his or her judgment if students respond in unanticipated ways. A lesson plan is a kind of design artefact that is not intended as a script for teachers to follow in a mechanical way. Good design always leaves open the possibility for intelligent adaptation. As Lee and Takahashi (2011) argue,

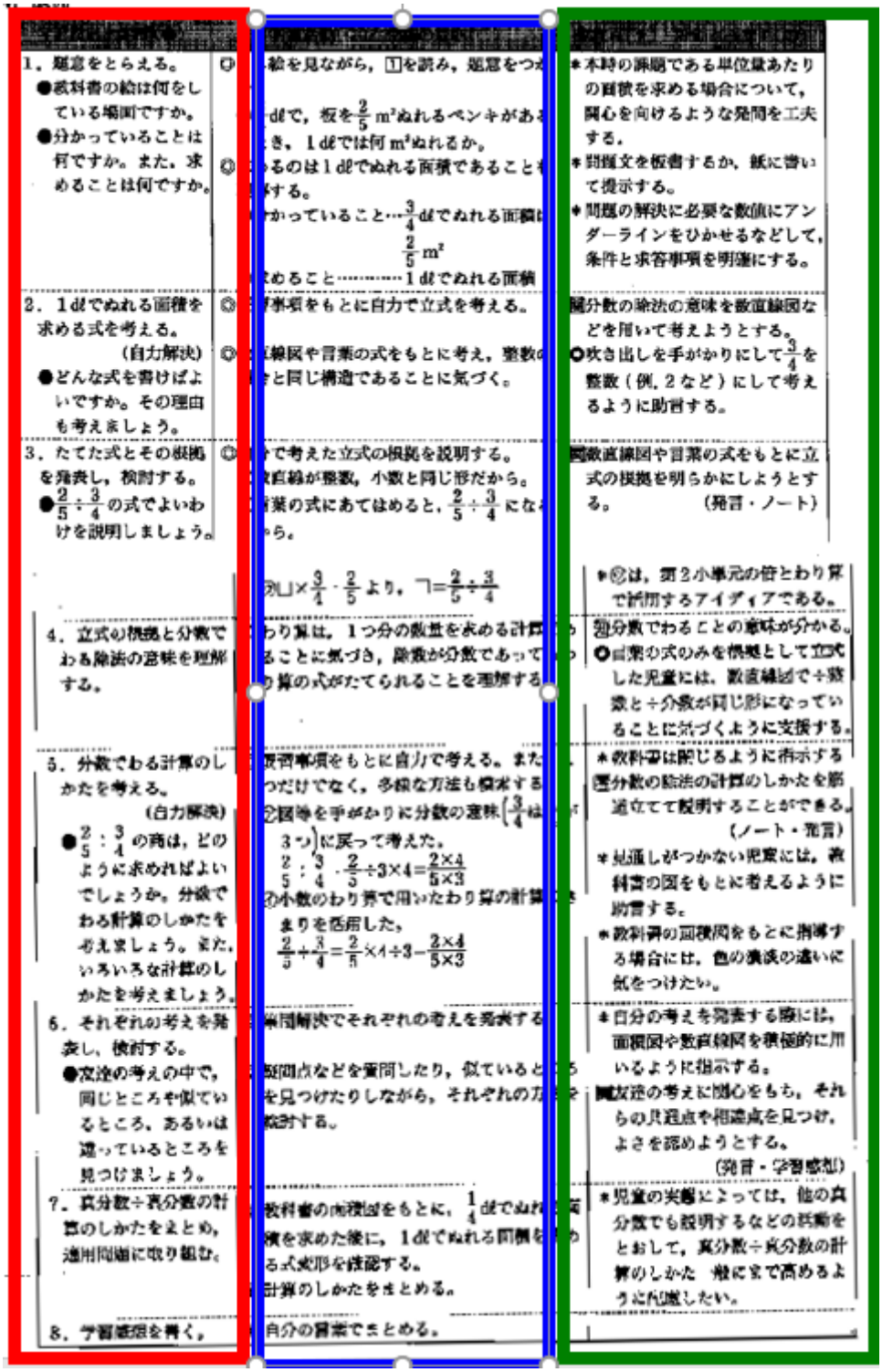
> "Classroom teachers use lesson plans as communicative resources to identify problems, specify assumptions about their teaching, and act on the evolving contingency of classroom interaction" (p. 209).

In this respect, a lesson plan is a kind of artefact somewhat like an architectural specification, or an engineering design brief.

Actual lesson proposals are published in the Journal for the Japan Society for Mathematical Education. The excerpt in Figure 1 shows some key elements. It would have been introduced by a statement of the goals of the lesson, and supplanted with additional information showing how this lesson is connected to related lessons in previous or following grades. The left-hand column of Figure 1 lists key items and questions for the teacher to ask. The middle column sets out anticipated student responses. The right-hand column includes teachers' advice on how to evaluate the lesson, what tools to use and what to emphasise. Clearly a proposal for a research lesson is not a disposable document. It is not something that is jotted down, later to be discarded. The level of design detail embodied in this kind of artefact suggests that a research proposal acts as a public record to be shared within the profession. The clear protocols with which these documents are composed set them apart from the kind of lesson notes that are more commonly used in many other countries.

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 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.

Figure 1. Excerpt from a Japanese lesson plan



In making their case for the use and promotion of annotated lesson plans, Hiebert and Morris enumerate five design features that need to be present if they are to provide effective support for teacher professional change.

1. The learning goals for the lesson are stated as explicitly and completely as possible.
2. The rationales for key instructional moves are presented so teachers understand the reasons for the instructional decisions and can adapt them to local lessons without changing the core aims of the lesson.

3. The learning goals, rationales and instructional activities are described in enough detail that teachers can implement them as intended.
4. Students' likely responses to instructional tasks and questions are predicted to allow teachers to plan how to use students' thinking during the lesson.
5. Information is presented to help teachers implement the lesson. (Hiebert and Morris, 2012, p.96).

All five requirements are satisfied by Japanese educators in designing and developing a lesson study proposal. The fourth element listed by Hiebert and Morris is a distinguishing feature of Japanese Lesson Study. Fujii (2015) points out that task design is an essential part of the process of planning a research lesson. He points out that task design is more than planning an activity which is mathematically appropriate, and likely to be interesting to students. A suitable problem solving task should, he argues, be capable of being solved in a variety of ways that may be relevant to and applicable in other mathematical contexts. But above all, task design includes:

> "anticipating students' solutions when writing the lesson proposal, and evaluating the task during the post-lesson discussion in light of the actual students' responses in the research lesson" (Fujii, 2015, p. 285).

Conclusion

Only by careful design and locally sensitive implementation can Lesson Study deliver the kind of improvements in teacher quality that have been advocated by Hiebert and Morris. The design process embodied in Japanese Lesson Study places high importance on careful planning that is aligned to the national curriculum and to the conditions of the local school. Teachers are expected to focus on available curriculum materials, and to think deeply about what students are expected to learn and possible ways in which that can be achieved successfully, but also giving attention to possible difficulties and misconceptions along the way. The planning document is intended to summarise this process for the teachers directly involved and to guide teachers who will be observing the lesson. The post-lesson discussion and reflection will draw not only on what teachers have done and observers have seen but will also use the pre-published lesson plan to focus the post-lesson discussion. In this way, the initial lesson plan can be improved, and possibly re-taught.

These key elements in the design process in Japanese Lesson Study are accompanied by assumptions about how teachers are expected to work together, and the role of outside experts. But beneath all this is an assumption that improvement in teaching and learning is the result of a continuous process of action and reflection; and that any given round of Lesson Study has the potential to produce artefacts that will be useful in the long term; not only to those who have been directly involved but also to teachers in other schools. This requires attention to detail and a commitment to producing long-term outcomes through Lesson Study. But practitioners of Lesson Study also believe that improvement in teaching and learning can be accumulated only by bringing the principles and practices of

Lesson Study as close as possible into one's everyday teaching. These cultural assumptions mean that Lesson Study is not simply a set of replicable procedures that can be easily transported to other countries.

As Hiebert and Morris (2012) conclude:

> "Changing cultures presents enormous challenges, and this alternative (i.e. building and continuously refining instructional products) would require a change of culture. But we do believe that working directly on improving teaching is a more productive approach because as parts of the problem get solved, teaching necessarily improves." (p. 99).

That is a sound design principle for a future agenda. Like Hiebert and Morris, one needs to be honest in believing that, while this is the right direction to take, achieving that goal will not be easy.

References

Fujii, T. (2015). The critical role of task design in Lesson Study. In A. Watson & M. Ohtani (eds.), *Task Design in Mathematics Education,* New ICMI Study Series, DOI 10.1007/978-3-319-09629-2_9. Switzerland: Springer International Publishing.

Hiebert, J. & Morris, A. (2012). Teaching, rather than teachers, as a path toward improving classroom instruction. *Journal of Teacher Education,* 63(2) 92-102.

Huang, R., & Bao, J. (2006). Towards a model for teacher professional development in China: Introducing Keli. *Journal of Mathematics Teacher Education,* 9, 279-298.

Isoda, M., Stephens, M., Ohara, Y., & Miyakawa, T. (eds.) (2007). *Japanese Lesson Study in Mathematics: Its impact, diversity and potential for educational improvement*. Singapore: World Scientific.

Lee, Y. & Takahashi, A. (2011). Lesson plans and the contingency of classroom interactions. *Human Studies* 34(2), 209-227.

Lewis, C. (2002). *Lesson study: A handbook of teacher-led instructional change*. Philadelphia, PA: Research for Better Schools, Inc.

Ma, L. (1999). *Knowing and teaching elementary mathematics*. Mahwah, NJ: Lawrence Erlbaum.

Watanabe, T., Takahashi, A., & Yoshida, M. (2008). Kyozaikenkyu: A critical step for conducting effective lesson study and beyond. In F. Arbaugh & P. M. Taylor (Eds.), *Inquiry into mathematics teacher education* (AMTE monograph series, Vol. 5, pp. 131-142). San Diego, CA: Association of Mathematics Teacher Educators.

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.

Stephens, M. (2018b) Re-thinking the Quest for Teacher Quality. *Educational Designer,* 3(11).
Retrieved from: http://www.educationaldesigner.org/ed/volume3/issue11/article41/