Preface: Adaptation of Lesson Study in Selected Education Systems

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Contents

Abstract The eight chapters in this section demonstrate how lesson and learning study have been adapted and applied in a variety of educational contexts. The authors provide an informative series of research accounts which clearly demonstrates the extent to which there is now significant variation in the way that lesson and learning study are used in mainstream education systems. This preface briefly introduces the chapters and their detailed reports of how researchers, teachers and teacher educators enhance the quality of teaching and learning through lesson or learning study, highlighting the power, flexibility and versatility of both lesson study and learning study.

1 Introduction

Since the publication of *The Teaching Gap* (Stigler and Hiebert 1999), the adaptation of lesson study to educational contexts across the globe has gathered pace. There is now significant variation in the way that lesson study is adapted and applied in all phases of education. The chapters in this section provide detailed accounts of how researchers, teachers and teacher educators enhance the quality of teaching and learning through lesson study in a number of jurisdictions. These chapters provide

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evidence of the versatility of both lesson study and learning study, allowing them to be adapted across the globe.

2 Introduction to the Chapters

Takahashi and McDougal open this section with their evaluation of an adapted form of lesson study, Collaborative Lesson Research, henceforth CLR, designed to address the demands of new curriculum mathematics in the USA. However, they begin by claiming that key aspects of Japanese lesson study may be lost in translation, leading to projects with limited impact. Drawing on Takahashi's extensive experience, the chapter serves as a reminder to all of us, when adapting lesson study, of the essential qualities required to secure its effective implementation.

Five characteristics are defined by the writers as essential to the effective use of lesson study, namely, the focus on the refinement of pedagogic expertise through a clearly defined research purpose, not just the refinement of an individual lesson as in many projects outside Japan; secondly, lesson study is a school- or district-wide initiative, not individual; thirdly, time for 'kyouzai kenkyuu' (the study of teaching materials) is essential; fourthly, a lesson study cycle, with live observation and detailed post-lesson evaluation, is conducted over several weeks, not in a few hours; and, finally, knowledgeable others play a very important part at all points in the lesson study process, but their contributions to post-lesson evaluation are particularly highlighted. The following chapters echo this claim about the vital contribution of knowledgeable others.

CLR has been implemented in eight US city schools and in a project in Qatar. The five essential conditions are incorporated in CLR, the key guiding question being: 'How can we design a lesson so that students learn a certain concept or skill better than they have in the past?' This is allied to a general research theme, agreed and shared by the school community, e.g. 'fostering students' ability for problem-solving and reasoning by using teaching through problem-solving'.

Takahashi and McDougal argue that conducting multiple cycles of CLR leads to a situation in which the school becomes 'a place for teachers to improve mathematics teaching and learning, and implementing the new standards will be a collaborative effort'. Here, there are distinct echoes of Stigler and Hiebert's plea for professional development initiatives to be firmly focused on improving teaching as a whole, not just individual teachers.

Readers will find a detailed replicable practical explanation of how to do CLR. Impacts from the projects are also described, notably the growth of teacher understanding of children's mathematical conceptions and misconceptions. When used school-wide, CLR 'can help teachers meet the challenge of changing both what they teach and how they teach', an aspiration that should be at the heart of thinking behind any lesson study adaptation.

In 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 colleagues describe a London-based project of

6 cycles of research lesson study (RLS) in 96 schools, which sought improvements in students' mathematics learning. RLS differs from Japanese lesson study and CLR, discussed above, because it observes a small number of case pupils and uses post-lesson interviews to explore pupils' perspectives on learning. This iterative 'design study approach' affords opportunities for reconnaissance (Elliott 1991) and tentative 'field testing of hypotheses' in research lessons (Dudley 2013). At the planning stage, teachers engage in deliberative predictive visualisation of what is expected to happen (imagining) and how case pupils are likely to act at each stage of the lesson. Thus, imagining and reflective discussion are essential in the process.

The writers situate RLS in the action research tradition, drawing on Stenhouse (1981) and Elliott (1991), pioneers in promoting collaborative action research in the UK in the 1970s and 1980s. Dudley et al. demonstrate how policy failures and patchy use of action research in the past had left the field open for a lesson study adaptation to be accepted. RLS was thus a timely counterweight to increasingly top-down mandated forms of professional development which risked robbing teachers of their pedagogic agency. Anyone interested in establishing district-wide research lesson study (RLS) could benefit from reading this chapter.

While different to CLR, RLS allows teachers, through processes of hypothesising and rehearsing, to share experience, understanding and knowledge that are often tacit and difficult to access. Space limitations forbid detailed commentary on the multiple approaches to data analysis, but the researchers' data came from video recordings of planning and evaluation sessions, teachers' lesson study workbooks, survey data and pupil interviews. Studies of teachers' descriptive learning processes (DLP) and interpretive learning processes (ILP) feature strongly. Another distinctive feature of this research was the analysis of teacher workbooks for evidence of impact on both teaching and learning.

The Wits Maths Connect Secondary Project described in chapter "A Case of Lesson Study in South Africa" (Adler and Alshwaikh) was conducted in South Africa between 2013 and 2016 in three low-income disadvantaged school clusters, with a particular focus on exemplification in the teaching of mathematics. The project draws on Mathematical Discourse in Instruction (MDI) (Adler and Ronda 2015), which focuses on four aspects of a mathematics lesson: the object of learning, exemplification, explanatory communication and learner participation. MDI was organised into a teaching framework, the Mathematical Teaching Framework (MTF). In contrast to the expectations expressed by Takahashi and McDougal above, time limitations play a significant part in Adler and Alshwaikh's adaptation of lesson study in South Africa, with face-to-face collaboration restricted to six after-school hours over three consecutive weeks. Teachers planned the first lesson in advance of or during the first meeting on an agreed topic; this was taught in the second week in after-school time, following which there was a review meeting, which also prepared the second lesson for teaching after-school in the third week. This is an example of how lesson study is enacted in time-constrained settings where the Japanese model would not be possible. Some might consider this adaptation inappropriate, while others would applaud the flexibility and versatility of lesson study.

The research described in the chapter focuses on work of four teachers and the simplification of algebraic expressions using brackets in different positions,

exploring two questions about changes in the example set across lesson plans and how these changes occur. This becomes a study of how teacher perspectives and plans change during reflection on research lessons. The researchers show how changes were collectively agreed as a result of the attention teachers gave to learner activity in the research lessons. Consequently, Adler and Alshwaikh are able to make a strong case for the inclusion of an explicit focus on 'exemplification and example sets in lesson study' given the critical contribution of examples in the teaching of mathematics. Like Takahashi and McDougal, this chapter highlights the importance of knowledgeable others but also stresses the essential driving agency of teachers and the importance of 'theoretically informed observation and reflection' in lesson study, in this case under the theoretical umbrella of MDI/MTF.

Chapter "How Variance and Invariance Can Inform Teachers' Enactment of Mathematics Lessons" (Preciado Babb, Metz and Davis) is a study of variance and invariance, through a partial application of lesson/learning study, in the Maths Mind Initiative in Canada, using variation theory (Marton 2015) and 'Chinese perspectives on variation', along with a strong focus on continuous formative assessment in the classroom. Impressive gains are reported through the Maths Mind Initiative in three elementary schools, which enabled the research team to identify effective teaching strategies in order to inform the development of an observation protocol. Their application of variation theory is described in detail; beginning with the identification of necessary discernments, they discuss the intended, enacted and lived objects of learning.

Four critical elements of Maths Mind teaching, related to critical discernment of the object of learning, are described and elaborated: ravelling, prompting, interpreting and deciding. Two classroom examples are used to show how the four elements of ravelling, prompting, interpreting and deciding are combined to support more effective teaching and learning of (a) how to represent numbers up to 20 and (b) partitive and 'quotitive division'. The key to effective learning lies in supporting learners to 'notice and integrate critical features of the targeted learning outcomes'.

We learn how learning study can be used to enable teachers to interpret children's understanding of number and division. Clear development of teacher thinking is illustrated in discussion of how the research lessons were crafted and amended through teachers' decision-making (deciding). In the Maths Mind approach, explicit guidance from the teacher is considered important as are the use of formative assessment and feedback:

> While our approach may be seen as offering explicit guidance, such guidance involves creating conditions for students to make critical discernments of the targeted object of learning.

In chapter "Capturing Changes and Differences in Teacher Reflection through Lesson Study: A Comparison of Two Culturally Diverse Malaysian Primary Schools", Kor, Tan and Lim, in a comparative study, explore the experience of two culturally diverse schools in Malaysia, one Chinese and one Malay, drawing on the research tradition associated with teacher reflection, including reference to Dewey (1933). For their analytical framework, the writers settle on Hatton and Smith's (1995) four-level model of reflection as their critical lens: (i) descriptive writing, (ii) descriptive reflection, (iii) dialogic reflection and (iv) critical reflection.

The lesson study cycle followed the model proposed by Lewis (2009), with teacher learning evaluated in relation to Lave and Wenger's (1991) Situated Learning Theory. The role of knowledgeable others in promoting deeper reflection was considered critical, echoing the advice of Takahashi and McDougal in chapter "Using School-Wide Collaborative Lesson Research to Implement Standards and Improve Student Learning: Models and Preliminary Results".

Data analysis, from five reflection sessions, revealed that reflection was often judged to be at descriptive levels (descriptive storying and reflection), with only gradual progress to dialogic reflection and hardly any evidence for critical reflection, mirroring other studies that have highlighted shallow levels of reflection (e.g. Myers 2012; Parks 2009).

Fang, Wang and Kim-Eng in their chapter "Representing Instructional Improvement in Lesson Study Through Principled Analysis of Research Lessons: A Case of Equivalent Fractions" explore how discourse analysis can be used to analyse and document improvements in teaching through a 2006–2007 lesson study project. The study was framed by Bruner's CPA model (Concrete-Pictorial-Abstract), in which novice teachers evaluated how the CPA approach could enable learners in their lesson study classrooms to understand and work with equivalent fractions. In Singapore, lesson study has been officially recommended since 2009 as an approach that contributes to the building of professional learning communities in schools. In their adaptation, they explore using lesson study as a vehicle for mentoring novice teachers, in relation to the teaching of equivalent fractions, following diagnostic tests of third to fifth graders. Wells' (1999) discourse levels (move, exchange, sequence and episode) were used to analyse classroom discourse and levels achieved by their learners in a detailed iterative study which demonstrates the power of lesson study to support the growth of expertise in novice teachers.

Clivaz and Ni Shuilleabhain (chapter "What Knowledge Do Teachers Use in Lesson Study? A Focus on Mathematical Knowledge for Teaching and Levels of Teacher Activity"), through a case study involving eight grade 3–4 primary teachers in Switzerland, explore the types of knowledge, both subject and pedagogical, that teachers used in four lesson study cycles over 2 years. Analysis of the first lesson study cycle, teaching integer number and place value, is the focus of the research reported here. Two frameworks were used in combination, very clearly and informatively, to shape the research: Mathematical Knowledge for Teaching (Ball et al. 2008) and Levels of Teacher Activity (Margolinas et al. 2005). They were chosen to enable researchers to delve into the 'multi-layered knowledge required of teachers during various stages of teaching', a theoretical combination neatly captured in Figure 1 of their chapter.

One of the principal insights lies in the identification of the power of lesson study to afford opportunities for the explicit articulation of 'all levels of activity, from the values and conceptions about learning and teaching to seeing mathematics through the eyes of the student'. Consequently, teachers sought to visualise more (like the imagining reported in chapter "Implementing a New Mathematics Curriculum in England: District Research Lesson Study as a Driver for Student Learning, Teacher Learning and Professional Dialogue") as they prepared for teaching. Clivaz and Ni

Shuilleabhain make important contributions to our understanding of teacher learning, not least its nonsequential iterative nature in all phases of the lesson study process. Their adaptation did not include the presence of knowledgeable others, and they acknowledge that this absence may have contributed to the relative lack of 'horizon content knowledge' in teacher discussions in their case study. The authors concluded by identifying further avenues for research to deepen our understanding of teacher engagement in and development through lesson study.

The final chapter by Gunnarsson, Runesson and Håkansson reports a learning study project from Sweden conducted by three mathematics teachers, focusing on how students understand rate of change (water level and time), in a lower secondary school (27 students aged 15–16). The chapter contains another thorough but different discussion of variation theory and its application, to complement that in chapter "How Variance and Invariance Can Inform Teachers' Enactment of Mathematics Lessons", particularly in relation to the precise identification of critical aspects. The discussion of the research takes this further, guiding the reader through the identification of tentative critical aspects to their refinement into critical aspects. The steps of the learning study are very clearly outlined, including graphs and tables of data points used to vary the task sequence during the research lessons, providing a replicable account of how the sequence of lessons progressed and how students refined their understanding of the rate of change. In their conclusions, the authors argue that variation theory not only provided teachers with a common language to discuss pedagogy but critically helped them 'to focus on the object learning and students' learning in a relational way'.

> It presents the key question which must be asked as:
>
> To teach towards a learning goal, that is, what students are expected to achieve, the answer to the question "What must be learned to achieve the targeted goal?" must be found. Why? Because the answer to this question fills the gap between teaching content and teaching strategies (what and how to teach), and the learning objectives (the intended results of teaching and learning).

Gunnarsson, Runesson and Håkansson helpfully demonstrate how 'keys to learning' 'are refined in the process of the learning study', showing very clearly how a learning study can be realised. When teachers find the keys to learning, these are used to inform the planning of lessons, so that they are responsive to students' needs and promote successful learning. Despite variation from approaches recommended by Takahashi and McDougal, this focus on keys to learning returns us to their question in chapter "Using School-Wide Collaborative Lesson Research to Implement Standards and Improve Student Learning: Models and Preliminary Results": How can we design a lesson so that students learn a certain concept or skill better than they have in the past?' That is at heart of lesson study in all its adaptations.

3 Reflections Concerning Lesson Study Adaptations

The chapters contribute to our understanding of how lesson study is adapted and applied in a variety of settings, not only highlighting the complexity of learning and teaching but also demonstrating how lesson study can be adapted to open up that complexity for scrutiny and allow teachers to explore the pedagogic black box in order to afford opportunities for reflection on and improvement of practice. A range of theoretical frameworks is used in the studies reported, variation theory for learning studies, but a number of others for lesson study projects, which tended to evaluate impact on teacher development more explicitly than learner development.

The role of the knowledgeable other is highlighted as critical, although their presence was not possible in all the projects described. Increasingly, lesson study is becoming positioned as a significant contributor to teacher development at a range of levels, and this section provides several examples that should serve as both guide and inspiration to other lesson study users. These chapters provide convincing evidence that when teachers collaboratively explore what challenges their learners, then pedagogy is enriched.

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