Teaching and Teacher Education 60 (2016) 164–178

Contents lists available at ScienceDirect

Teaching and Teacher Education

journal homepage: www.elsevier.com/locate/tate

A coding tool for examining the substance of teacher professional learning and change with example cases from middle school science lesson study

Christine Lee Bae [a, *], Kathryn N. Hayes [b], Jeffery Seitz [c], Dawn O'Connor [d], Rachelle DiStefano [e]

[a] Virginia Commonwealth University, Department of Foundations of Education, 1015 W. Main Street, P.O. Box 842020, Oliver Hall, Room 4074, Richmond, VA 23284, USA
[b] California State University East Bay, Department of Educational Leadership, 25800 Carlos Bee Blvd., Hayward, CA 94542, USA
[c] California State University East Bay, Department of Earth and Environmental Sciences, 25800 Carlos Bee Blvd., Hayward, CA 94542, USA
[d] Alameda County Office of Education, 313 W. Winton Ave., Hayward, CA 94544, USA
[e] California State University East Bay, Institute for STEM Education, 25800 Carlos Bee Blvd., South Science 142, Hayward, CA 94542, USA

HIGHLIGHTS

- A coding scheme to document components of teacher professional learning and change.
- Seven coding categories are presented with indices of the quality of teacher learning.
- Example findings from middle school science lesson study teams are presented.

ARTICLE INFO

Article history:
Received 18 December 2015
Received in revised form
17 August 2016
Accepted 22 August 2016

Keywords:
Lesson study
Professional learning
Teacher change
Middle school
Science
Coding

ABSTRACT

Although lesson study is increasingly adopted in the United States (U.S.), the impact of lesson study on teacher learning is uncertain. This study presents a theoretically grounded set of codes to systematically document the various aspects of teacher learning and change (knowledge and beliefs, professional learning community, resources) in lesson study across contexts. To present examples of the codes in use, a subset of codes related to change in teacher knowledge and beliefs were applied to analyze teachers' professional discourse in three middle school science lesson study teams.

Published by Elsevier Ltd.

1. Introduction

Commitment to continuous teacher professional learning is crucial for the success of education reform, instructional improvement, and student achievement (Akiba & Liang, 2016; Darling-Hammond & Ball, 1998; Desimone, 2009; Wilson & Berne, 1999). In the United States (U.S.), new education reforms have significant implications for changes in instruction, including in-depth coverage of new topics, facilitating literacy in science, language, and mathematics disciplines, and addressing the needs of an increasingly diverse student population (Lee, Quinn, & Valdés, 2013; Morgan, Farkas, Hillemeier, & Maczuga, 2016; Porter, McMaken, Hwang, & Yang, 2011). A large body of research points to the importance of teachers working in professional learning communities to implement reformed teaching, as they share knowledge and resources, critically examine and reflect on one another's practices, and use evidence from student work and

* Corresponding author.
E-mail addresses: clbae@vcu.edu (C. Lee Bae), kathryn.hayes@csueastbay.edu (K.N. Hayes), jeff.seitz@csueastbay.edu (J. Seitz), dawno@acoe.org (D. O'Connor), rachelle.distefano@csueastbay.edu (R. DiStefano).

http://dx.doi.org/10.1016/j.tate.2016.08.016
0742-051X/Published by Elsevier Ltd.

classroom observations to inform instruction (Bertrand & Marsh, 2015; Clarke & Hollingsworth, 2002; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; Wilson & Berne, 1999). Lesson study has been advocated as a particularly productive professional learning model for helping teachers adapt and shift towards reform-based teaching (Doig & Groves, 2011; Perry & Lewis, 2009; Lewis, 2015; Stigler & Hiebert, 1999). However, while there is growing interest in scaling lesson study to support long-term improvements in teaching and learning (Dudley, 2013; Lewis, 2015; Perry & Lewis, 2009), there is a need to further explicate the theoretical underpinnings and substance of teacher professional learning to better understand how lesson study supports improvements in teaching (Dudley, 2013; Lewis, 2009; Stigler & Hiebert, 2016).

To comprehensively examine the complexity of teacher professional learning in varying contexts, flexible but robust methodologies and tools are needed (Dudley, 2013; Lewis, Perry, & Hurd, 2009; Lewis, Perry, & Murata, 2006; Ming Cheung & Yee Wong, 2014). Empirical approaches to understanding teacher learning need to not only capture the diverse components of what teachers learn, but also the range in quality of professional learning within each of the different components (Clarke & Hollingsworth, 2002; Lewis, 2009; Stigler & Hiebert, 2016). To this end, this study draws from theoretical models of lesson study and teacher change to examine teacher professional growth within inquiry-based learning communities (Clarke & Hollingsworth, 2002; Lewis et al., 2006; Perry & Lewis, 2009). A set of codes were developed to systematically document growth in teachers' 1) professional knowledge and beliefs, 2) professional learning communities, and 3) tools and resources for instruction (Clarke & Hollingsworth, 2002; Perry & Lewis, 2009) that include qualitative indicators of the depth of teacher learning and change. In order to illustrate the use of our coding tool, detailed descriptions of three middle school science lesson study cases are presented, in which a subset of codes related to professional knowledge and beliefs were applied to analyze transcripts of teachers' collaborative discourse in lesson study. Findings highlight the utility of the codes for systematically documenting, and providing concrete evidence of, the substance of teachers' professional learning and change, particularly useful for multiple, comparative, and longitudinal case study approaches in teaching and teacher learning research.

1.1. Lesson study as a high quality model of teacher professional learning

Lesson study gained international attention when results from the Third International Math and Science Study highlighted it as a powerful model of professional learning (Saito & Atencio, 2013; Stigler & Hiebert, 1999). Originating from Japan, lesson study involves teachers working closely in collaborative teams to plan, observe, and reflect on live lessons in the classroom (Fernandez & Yoshida, 2004; Isoda, 2010; Lewis et al., 2006). What distinguishes lesson study from many other types of professional development is that student learning is the centerpiece of study (Lewis & Hurd, 2011). In lesson study, a team of teachers co-plans a 'research lesson,' (*kenkyu jugyo*) and observes students' learning as a member of the team enacts the research lesson in their classroom (Fernandez, 2010; Perry & Lewis, 2009). Following the research lesson observation, teachers critically analyze data collected about students' learning, drawing out evidence-based implications for improving instruction (Fernandez & Yoshida, 2004; Isoda, 2010; Lewis & Hurd, 2011).

In many ways, lesson study embodies features of teacher professional learning supported by research. First, lesson study is an ongoing cycle of inquiry, in contrast to short-term workshops that do not provide multiple opportunities for teachers to implement, test, and critically reflect on pedagogical strategies in their classroom (Borko, 2004; Clarke & Hollingsworth, 2002; Desimone, 2009; Wilson & Berne, 1999). Second, lesson study engages teachers as active, adult learners who construct personal and collective understanding about shifts in teaching and learning, rather than passive recipients of information (Borko, 2004; Bransford, Brown, & Cocking, 1999; Clarke & Hollingsworth, 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001). Third, teachers' professional learning in lesson study is embedded in their daily work and situated in classroom practice, promoting localized instructional improvement that meets the unique needs of their students (Doig & Groves, 2011; Putnam & Borko, 2000). Perhaps most importantly, lesson study hinges on skilled observations and discussions of how students learn, which guide teachers' decisions around changes to curriculum and instruction (Lewis et al., 2006; Mutch-Jones, Puttick, & Minner, 2012). In these ways, lesson study is structured for teachers to collaboratively experiment with classroom practices while keeping students at the forefront of their instructional decisions (Darling-Hammond & Ball, 1998; Doig & Groves, 2011; Perry & Lewis, 2009).

Although the lesson study model is aligned to research on quality teacher professional development, the research guiding lesson study in the U.S. currently lacks a strong theoretical foundation and research base (Clarke & Hollingsworth, 2002; Ming Cheung & Yee Wong, 2014; Rock & Wilson, 2005; Stigler & Hiebert, 2016). In this paper, we present a theoretically grounded coding tool for systematically capturing the features of teacher learning and change in lesson study, that could serve as future reference for educators and researchers seeking to not only document whether lesson study works, but to better understand lesson study as a model for teacher learning and change across contexts.

1.2. Variation in lesson study implementation in the U.S

Given that lesson study is adapted from Japan, it is important to document how lesson study is implemented in different education systems, and the ways in which lesson study may support improvements in instruction and student learning across contexts (Chokshi & Fernandez, 2004; Fujii, 2016; Saito, 2012; Stigler & Hiebert, 2016). Whereas the model of lesson study in Japan has a well-defined tradition in teacher learning and school reform, researchers examining U.S. lesson study have documented varying adaptations in terms of the format and types of activities involved (Fernandez, Cannon, & Chokshi, 2003; Lewis, Perry, Hurd, & O'Connell, 2006; Perry & Lewis, 2009; Saito & Atencio, 2013; Stigler & Hiebert, 2016; Wang-Iverson & Yoshida, 2005). For example, during the research lesson observation in Japan, it is typical that the teacher poses a problem (*hatsumon*) to the entire class, and allows students to work individually or in small groups as the they walk around the classroom to observe students' thinking (*kikan-shido*) (Doig & Groves, 2011; Fernandez & Yoshida, 2004). This is followed by a whole class discussion to summarize the key ideas of the problem (*matome*), where the chalkboard or blackboard is used extensively to organize and compare students' ideas (Chokshi & Fernandez, 2004; Doig & Groves, 2011; Fernandez & Yoshida, 2004). In contrast, there are many variations in how the research lesson is implemented in the U.S., all of which do not typically follow the format of Japanese lesson study (Chokshi & Fernandez, 2004; Doig & Groves, 2011; Lewis & Tsuchida, 1997; Saito, 2012).

It is fathomable that lesson study will be adapted as a function of the norms, beliefs, and systems of different cultures and contexts, and an exact replica of the Japanese model in other countries may not be possible (Stigler & Hiebert, 2016). After all, teaching is a