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Teacher learning in the context of Lesson Study: A video-based analysis of teacher discussions

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HIGHLIGHTS

- The development of a reliable coding scheme for teacher learning is reported.
- Learning in a group has an impact on teachers' individual learning processes.
- Dialogic moves in Lesson Study discussions are a mechanism for learning.
- Descriptive and interpretative learning processes are observed in Lesson Study.

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ABSTRACT

This paper contributes to our understanding of teacher learning in the context of Lesson Study (LS), a model of professional development that involves collaborative lesson planning and evaluation. Video-recorded LS discussions of mathematics teachers based in London were analysed for this purpose. Two inter-related studies are presented: the first involved the construction of a reliable coding protocol for video analysis; the second used this protocol for coding 120 fragments of discussions amongst 91 teachers. Findings are discussed with reference to tests of reliability and results of multilevel analysis, which reveal differential effects of particular forms of interactions on learning processes.

1. Introduction

Despite some relatively recent work in the discipline of mathematics (see Section 1.1), research on in-service teacher *learning* is in its infancy. This is in contrast to studies on the relative effectiveness of teacher professional development (PD) (e.g. Guskey, 2002), of which there are many. Definitions of learning, and internal mechanisms for learning, have been debated for decades. For the purposes of this paper, learning is seen as a change or development in knowledge, resources or understanding that have the potential to lead to professional behavioural change. In considering teacher learning we adopt a sociocultural perspective, seeing the mechanism as "the dynamic interdependence of social and individual processes" (John-Steiner & Mahn, 1996, p. 192), with language as the central cultural tool in facilitating this interdependence and expressing developed understanding (the connection with language is explored in Section 1.3). This implies that learning takes place as the result of interactions between individuals, or between individuals and cultural tools, with knowledge within groups often being co-constructed as a result of spoken interactions.

When considering learning in groups, many researchers see the environment and social structures as key to the cognitive activities associated with collaboration (Dillenbourg, 1999). Following from this, a prominent finding of existing research into teacher learning is that professional communities are effective 'agents' for enhancing professional learning and sustained professional development (Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; Webster-Wright, 2009). Indeed, schools with strong teacher communities seem to have higher student achievement (Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010; Horn & Kane, 2015). However, Webster-Wright (2009) suggests that little is understood about the effective mechanisms of learning in such professional

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communities. 'Black box' models of teacher learning thus suggest teacher communities have an effect on teacher learning, but not how that effect is brought about.

It is the purpose of this paper to explore the processes of teacher learning within these communities. We focus on the role of dialogue and draw on the research into the effective use of talk in group contexts. We are interested in how talk is being used to foster learning in professional groups and we pursue this interest through studying teachers' discussions that occur in the context of Lesson Study (LS), a model of PD now employed in many countries around the world (Dudley, 2013; Lee, 2011). In so doing we demonstrate relationships between three fields of study – teacher learning, dialogue in education and professional settings, and Lesson Study (Fig. 1). In this, LS is distinct from the other two fields in one important respect; it is a specific methodology intended to improve student outcomes, rather than an argued theoretical domain, as teacher learning and dialogue might be viewed (Niss, Peng Yee, & Kilpatrick, 2015).

1.1. Teacher learning and teacher professional development

As we have stated, literature on teacher learning is largely situated in two separate contexts: that of pre-service teachers and that of in-service teachers, with an imbalance between the level of work conducted in each context clearly evident. While the field of pre-service teacher learning has received much attention, the field of in-service teacher learning - the focus of the present paper - is emergent. In the field of pre-service teacher learning, substantial work has been done on the learning of mathematics teachers and in particular on the types of knowledge that they should possess. Shulman (1987) identified seven types of teacher knowledge, placing particular emphasis on three types with content-specific dimensions: content knowledge, curriculum knowledge and pedagogical content knowledge. Later work in mathematics education built on Shulman's work by identifying or extending types of knowledge. This work has included Ball et al.'s *Mathematics Knowledge for Teaching* (Ball, Thames, & Phelps, 2008), and Rowland et al.'s *Knowledge Quartet* of foundation, transition, connection and contingency (Rowland, Huckstep, & Thwaites, 2005). One consensus is that "knowledge of *mathematics, didactics* and *pedagogy*" (Jaworski & Huang, 2014, p. 175) are necessary for mathematics teachers.

In addition to such work, substantial work has been concerned with the ways in which teachers can develop their professional knowledge. This is particularly important in the context of the work reported here. Our study is situated in the context of the introduction of the new National Curriculum for Mathematics in England (September 2013). This reform stressed the importance of developing skills such as mathematical reasoning and proof, and having mathematical fluency. Here, we focus on teacher LS discussions about how to develop the teaching of these skills, rather than on the varied mathematical content knowledge that was the context for such skills development. Thus, through the detailed case observations required in LS (Section 1.2), the central work of our teacher groups was to develop Knowledge of the interaction between Content (including mathematical skills) and Students (KCS - Ball et al., 2008). The subject areas within mathematics that the students' work focused on were many and varied.

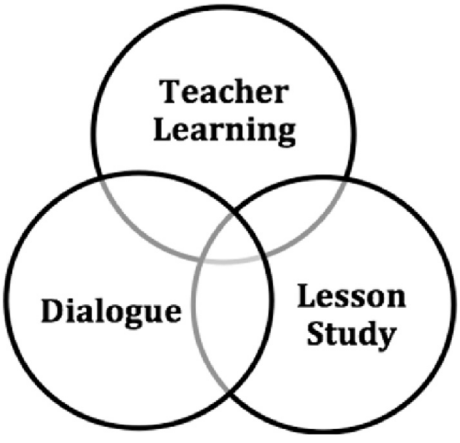

Fig. 1. Combination of three theoretical perspectives.

In considering the ways in which teachers can develop their professional knowledge, reflective practice is seen as key. As many authors argue, developing practitioners who are constantly *reflecting on-action* and *in-action* (Schön, 1987) is fundamental (Jaworski & Huang, 2014), as it allows teachers to develop a critical lens (Cochran-Smith, 2003) in their work. Nowadays, *communities of practice* (Lave & Wenger, 1991) or *"inquiry communit[ies]"* (Jaworski, 2008, chap. 13, p. 312) are a widely used means that enable teachers to learn in and from practice. They are made up of colleagues who share an understanding of school culture and have common interpretations of their intentions (Matos, Powell, & Sztajn, 2009). Participating in such communities allows teachers to *co-learn* (Jaworski, 2001, 2003) by developing situated learning through critical evaluation of their practice. Reflection thus becomes a social endeavour, rather than an individual, internal process. While the substantial work in this field offers insights on what and how teachers develop professional knowledge, work on the specific thinking processes that enable this learning is still limited. As Matos et al. (2009) state, 'research on learning shows that we need languages to describe in analytical terms the process of coming to know' (171).

Considering specifically in-service teacher learning, until recently this has been measured mainly by the 'effectiveness' of teacher professional development programmes. Several review studies demonstrate the ways in which these have been measured (e.g. Borko, Jacobs, & Koellner, 2010; Postholm, 2012). In a recent review, Van Driel, Meirink, Van Veen, and Zwart (2012) used Desimone's (2009) analytic framework (Fig. 2) in order to examine how the effectiveness of PD programmes for science teaching had been measured in previous research.

From the 44 studies that met their inclusion criteria, Van Driel et al. (2012) found that four studies (9%) measured the effectiveness of the PD programmes based on the relationship between the intervention and changes in teachers' cognitions, i.e. knowledge ($1 + 2$ in the model, Fig. 2); three studies (7%) looked at the relationship between the intervention and changes in teachers' classroom behaviour ($1 + 3$ in the model); half examined the relationship between the intervention and changes in both teacher cognitions and classroom behaviour ($1 + 2 + 3$); and fifteen studies (34%) examined all four aspects of the model. However, they differed in the way they measured student outcomes with six studies (14% of the total of 44 studies) using achievement tests and nine using teachers' views on student progress.

The analytical model is therefore an intervention-outcome model. It conceptualizes teacher learning as features of the intervention leading to teacher learning outcomes (i.e. knowledge, skills, attitudes), which can then lead to changes in teacher behaviour in the classroom. However, it does not address the processes of teacher learning. Such PD programmes are thus 'black box models' because they do not make the processes between stimulus (intervention) and response (learning outcomes) explicit (Vermunt, 2013).