The Enactment of Lesson Study by Science Teachers in England

Julie Ann Jordan

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Abstract

This study explored the enactment of Japanese Lesson Study (JLS), an increasingly common form of collaborative-research orientated professional development (PD). Research on PD in general and JLS specifically, suggests that these forms of PD are not often exhibited in school settings. To better understand the contextual factors shaping the enactment of such PD, the study took a situated, social learning perspective to examine Lesson Study (LS) within the context of recent reforms in PD policy in England.

The aim of this research was to gather the perspectives of science teachers explicitly seeking to do LS for their PD and to identify multiple interacting factors that appear to influence LS enactment. To contextualise LS, a clear distinction was made between PD, seen as an isolated event to professional learning, seen as the broader, often more informal means by which teachers enhance their knowledge, skills and practices. The study used Opfer and Pedder's (2011) model of professional learning and Wenger's (2000) notion of communities of practice to understand and to conceptualise teacher learning in LS.

Using a multiple case study methodology and design, the perspectives of 11 science teachers, in three secondary schools, were analysed using data from semi-structured interviews, field notes and artefacts, gathered in the early stages of LS. Analysis shows that variations in LS enactment were shaped by three underlying mechanisms: i) degrees of *alignment or dissonance* with the teachers' and school professional learning orientations, ii) *reification* of the teachers' and school professional learning orientations and iii) *brokering and boundary crossing* enacted by science teachers in the role of LS facilitators and participants. Study findings suggest that school leaders and PD leaders need to take account of teachers' and school professional learning orientations within the affordances and constraints of their local contexts.

Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation	Details	Description
JLS	Japanese Lesson Study	Representations of Lesson Study used in Japan or Japanese schools
LS	Lesson Study	Representations and modifications of JLS used outside of Japan
NQT	Newly Qualified Teacher	A first-year teacher who is completing an induction programme having finished their teacher training
RQT	Recently Qualified Teacher	A recently qualified teacher—typically someone who has been passed their NQT status by completing their 12-month induction
Ofsted	Office for Standards in Education, children's services and skills	England's school regulatory body which judges the quality of education provision
ITT	Initial Teacher Training	A university and school-based teacher training programme leading to qualified teacher status
AfL	Assessment for Learning	A pedagogical technique used by teachers to assess learning in the classroom
SEN	Special Educational Needs	Students whose learning may need support
CLR	Collaborative Lesson Research	Structures and practice of LS in Japan
AST	Advanced Skills Teacher	An excellent teacher who achieves the very highest standards of classroom practice
MAT	Multi Academy Trust	A multi-academy trust is a group of schools in partnership with each other, often but not always because they are geographically close to one another

Chapter 1 Introduction

This chapter introduces Japanese Lesson Study (JLS) as a promising form of collaborative-research orientated teacher professional development (PD) and presents the rationale for an empirical study in the context of recent PD reforms in England.

1.1   What is Japanese Lesson Study?

Originating in Japan in the 1900s, Japanese Lesson Study (JLS) is a form of PD designed to research pedagogy and evaluate teaching and learning methods, through lesson observations and critical discussions (Saito and Sato, 2012). Translated from the Japanese words *jugyou* (lesson) and *kenkyuu* (research or study), JLS is a systematic form of teaching improvement engineered through a cycle of stages (Figure 1.1). A typical cycle includes goal setting, investigation, the planning and observation of a research lesson, followed by reflection, evaluation and dissemination of outcomes (C. Lewis et al., 2003; C. C. Lewis, 2009).
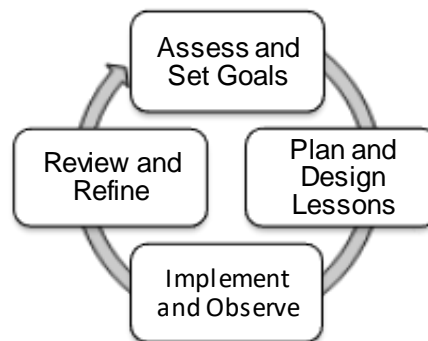
Figure 1.1 Typical JLS Cycle

(Adapted from Lewis et al., 2009)

JLS has been credited as the main vehicle for school improvement in Japan and has been adopted in countries across the world (Chokshi and Fernandez, 2004; Chokshi and Fernandez, 2005; Ming Cheung and Yee Wong, 2014; Yoshida and

Fernandez, 2004). Research studies carried out in Japan, China, Hong Kong, Singapore, the USA, Australia, the UK and Sweden, suggest that JLS offers a powerful model of PD, which can lead to improvements in both teacher and student learning (Cajkler et al., 2014; Dudley, 2010; Dudley, 2012; Godfrey et al., 2019).

Underpinned by the Japanese philosophy of *kaizen,* a cultural practice used in manufacturing, engineering and business, the process of JLS embraces the notion of continuous improvement, attention to detail and incremental change. Introduced during the Meiji period of modernisation (1868–1912), JLS was used to support the move to whole class instruction, the need to increase the number of teachers, and to develop a coherent national curriculum (Inagaki, 1995). Trainee teachers were required to observe and evaluate subject specific "critical lessons" designed by leading academics that were then distributed through networks of schools. In Japan, JLS is the main vehicle for the distribution and critical evaluation of teaching knowledge (Isoda, 2010). Two quotes one from a conversation with a Japanese teacher working in a school in England and another from an eminent LS academic, show how LS is deeply rooted in Japanese culture, held in the highest esteem and built into teachers' everyday working lives:

> *JLS is like your Ofsted[1]– it moves around from school to school, the difference is in our schools is we welcome and look forward to lesson study, as we know that we will all learn from it.*

(Yamaguchi, Personal Communication, October 2015)

> *The history of LS in Japan spans more than a century. For Japanese educators, LS is like air, felt everywhere because it is implemented in everyday school activities, and so natural that it can be difficult to identify the critical and important features of it.*

(Fujii, 2014, p.14)

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[1] Ofsted is the Office for Standards in Education, Children's Services and Skills who inspect services providing education and skills for learners of all ages.

Although JLS and its associated principles and structures are embedded in the Japanese school system, implementation is not always consistent and may not lead to improvements in educational outcomes (Oshima et al., 2006). Attempts to demystify the important features of JLS have categorised it in two ways: either a "practice based" approach to master specific teaching strategies or as a "research orientated approach" to foster collaborative classroom enquiry and evidence informed teaching (Inagaki, 1995). In England, JLS has been described naively as a "breathtakingly simple" tool for developing teachers' practice knowledge (Dudley, 2012). However, as more teachers and teacher educators across the world have tried to implement JLS for teacher PD and school improvement; this has been shown to be challenging to achieve. It has also appeared to be difficult to sustain JLS and produce evidence of impact (Chokshi and Fernandez, 2004; Dudley, 2012; Education Endowment Fund, 2018). Furthermore, JLS is seen to be a complex, collaborative process, subject to misinterpretation and reconfiguration (Chokshi and Fernandez, 2004; Elliott, 2009; Fernandez and Chokshi, 2002; Groves et al., 2016; Hadfield and Jopling, 2016; Seleznyov, 2018). As a result, there is a growing interest among researchers and practitioners, considering how JLS can be adapted and sustained in different contexts and how to demonstrate its efficacy for teacher PD and school improvement. Due to this complexity and challenge, researchers are attempting to distinguish and emphasise what is distinctive about JLS, as a form of PD. For example, Elliot (2019), Klammer and Hanfstingl (2019) endorse a need to link LS with variation theory and the importance of attending to students' subjective understandings of learning phenomenon during LS.

It is important at this point to note that in this thesis, I am an experienced LS practitioner and a researcher—hence I am deliberately using the term JLS to refer to the Japanese ideal and referring to LS when discussing models developed and employed outside of Japan.

The uniqueness of JLS is attributed to the collaborative and rigorous planning of a "research lesson" and the detailed associated "task design" (Fujii, 2016) which

are observed and evaluated in order to reveal and discuss student learning (C. Lewis, 2016; Takahashi and McDougal, 2016).

Typically, descriptions of JLS outside of Japan are represented as an enquiry cycle that begins with a group of three to five teachers, working together in subject specific groups to identify an overarching goal for student learning and carrying out in depth background research and discussion with academic experts—known in Japan as *koshis* or "knowledgeable others" (Takahashi, 2014). It is rare for JLS not to be carried out within subject specific teaching contexts; research studies most commonly reported in English speaking journals are often related to the teaching of problem solving and mathematics (Fernandez and Yoshida, 2004; Hoong et al., 2012; Isoda, 2010; C. Lewis and Perry, 2014; C. Lewis, 2016; C. C. Lewis et al., 2009; Ni Shuilleabhain and Seery, 2018; Yoshida and Fernandez, 2004; Yoshida, 2012).

The research lesson is then taught by one member of the group and observed by the other members, who collect evidence of student learning using enquiry questions and observation protocols. Following the research lesson, the teachers meet to share feedback in a post research lesson discussion meeting, often facilitated by a *koshi*. The research lesson is evaluated, revised and the outcomes of JLS cycle are disseminated and shared. This whole process may take place over several weeks or even months.

Stigler and Hiebert (1999) first wrote about the potential of JLS, for improving classroom practice, in the Teaching Gap, a book summarising the Third International Maths and Science video study of mathematics teachers. (TIMMS, 1999). The enduring high attainment of Japanese students, for problem-solving in mathematics, was credited to JLS practices. This stimulated academics and teacher educators, particularly in the USA, to try out JLS (Chokshi and Fernandez, 2005; Elliott, 2009; Fernandez and Chokshi, 2002; Fernandez et al., 2003; Yoshida, 1999). Since then, a rapidly growing resource of guidebooks and websites has been written in English, to support the introduction of JLS in countries outside of Japan. Adaptations of JLS have been researched and reported in the USA, and Europe as well as its use in Cambodia, Egypt, Ghana,

Honduras, Indonesia, Kenya, Laos, Malawi, Philippines, South Africa, Thailand and Uganda ((Fujii, 2014; Isoda, 2010; Seleznyov, 2018).

Throughout its history in Japan and, more recently, through its global spread, JLS has undergone some transformation. There is no widely accepted common definition of JLS but a desire, felt by academics, to develop a consensus of the key features and principles to maximise its impact and to establish a firm evidence of its efficacy (Demir et al., 2013; Groves et al., 2016; Hurd and Licciardo-Musso, 2005; Mutch-Jones et al., 2012; Podhorsky and Fisher, 2007; Rock and Wilson, 2005; Saito et al., 2008; Yoshida, 2012). More recently, there have also been attempts to adapt JLS in Higher Education (Cajkler et al., 2013; Demir et al., 2013; Lampley et al., 2018; Wood and Cajkler, 2018).

Given the global spotlight on JLS, it is perhaps not surprising that leading Japanese academics have been determined to articulate what is critical and fundamental about JLS. This has been aided by international collaborations and the establishment of a peer reviewed journal, entitled the International Journal of Learning and Lesson Studies. These developments represent a move to accept and learn from those seeking to adopt and adapt JLS at local, regional and national levels in different countries (Fujii, 2014; Seleznyov, 2019; Yee Wong and Ming Cheung, 2014). Alongside this, there is a growing evidence base (albeit it predominantly comprised of small-scale qualitative studies) showing its impact and a desire to understand the ways in which teachers may learn through participating in JLS. This study intends to extend this evidence base by considering the ways in which JLS is enacted in in secondary schools in England.

1.2   Policy Context for Lesson Study in England

There is a claim that the quality of an education system cannot exceed the quality of its teachers, since student learning is ultimately the product of what goes on in classrooms (OECD, 2010). In turn, it is recognised that PD plays a vital role in improving the quality of teaching, a view supported by policy makers in England:

It is vital that serving teachers have access to on-going, high-quality opportunities to update and refresh their skills and knowledge' and that evidence-driven, career-long learning is the hallmark of top professions.

(Department for Education, 2018)

JLS is gaining ground within the repertoire of teacher PD approaches being used in schools and teacher training institutes in England (Cajkler et al., 2014; Dudley, 2012; Godfrey et al., 2019; Seleznyov, 2019). This is despite a recent report that LS does not work (Education Endowment Fund, 2018).The introduction of JLS, over the last 10 years at least, has been set against a confusing backdrop of competing policy initiatives, a high stakes performativity culture, fragmentation of localised school improvement and frequent structural changes, within the English education system (Braun et al., 2010; Simkins, 2015; Simkins et al., 2019). However, despite this confusion, new opportunities and challenges have opened to remodel and redesign teacher PD programmes and reshape the PD and school improvement landscape. As Hadfield and Jopling state (2016) school improvement policy in England has "moved towards system level change and leadership set within a discourse of a self-improving system" (Hadfield and Jopling, 2016). A self-improving system requires schools to generate the capacity, expertise and relevant approaches to identify and meet their own improvement needs (Hargreaves, 2010). Forms of PD, which promote collaboration and the joint development of practice, such as JLS are advocated and endorsed, to support this vision, to improve school cultures and to build sustainable professional learning communities. David Weston, CEO of The Teacher Development Trust, a national charity for PD, and part of the research team commissioned to review international research on teacher PD (Cordingley, et al. (2018) openly challenged this report from the Education Endowment Fund. Weston (2016) argued that the study was flawed and did not represent or involve an authentic model of JLS.

JLS continues to be promoted by influential organisations, such as the Chartered College for Teaching[2] and is starting to become embedded and shown to work in initial teacher training (ITT) programmes (Cajkler et al., 2014; Wood and Cajkler, 2018). As such, JLS sits well within current teacher PD policy and the emergence of a self-improving school system in England (Simkins et al., 2019):

> *Teachers learn best from other professionals and that an 'open classroom' culture is vital: observing teaching and being observed, having the opportunity to plan, prepare, reflect, and teach with other teachers.*

> (Department for Education, 2010)

Furthermore, the more recent shift and attention towards" evidence-informed teaching" as an effective feature of education systems (Maxwell and Greaney, 2017) presents additional opportunities for JLS, as a way to introduce teachers to research and the processes of classroom enquiry.

Nevertheless, measuring and demonstrating the positive impacts of JLS, as with other forms of PD, has been challenging. Small scale studies and systematic reviews of JLS have shown promise (Yee Wong and Ming Cheung, 2014), but there are calls for more robust, quantitative measures for recording impacts and improvements in learning outcomes for students (Godfrey et al., 2019). Moreover, studies that critically examine the merits and potential of JLS, in different educational systems and school contexts, are scarce (Bjuland and Mosvold, 2015; Schipper et al., 2020a). However, whilst it is important to establish a firm evidence base for educational innovations such as JLS, it is also essential to consider the contexts and conditions for effective implementation. For JLS, to be embraced, embedded and sustained as a form of teacher PD, there is a need to consider how JLS and similar forms of PD can *weather* an unpredictable, incoherent and challenging educational landscape. It is then more likely that JLS can gain ground within and alongside the wider repertoire of PD and school improvement approaches in England.

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[2] The Chartered College of Teaching is the recognised professional body for teachers.

Notably, the structures and principles of JLS align well with the Standard for Teachers' PD introduced in England to raise the quality of teacher PD. The Standard outlines 5 key headline ideas:

1. Professional development should have a focus on improving and evaluating pupil outcomes.
2. Professional development should be underpinned by robust evidence and expertise.
3. Professional development should include collaboration and expert challenge.
4. Professional development programmes should be sustained over time. *And all this is underpinned by, and requires that:*
5. Professional development must be prioritised by school leadership.

(Department for Education, 2016).

Studies have shown (Section 2.2), that JLS can be designed to directly improve student outcomes, promote sustained teacher collaboration and active enquiry, and focus on specific subject and pedagogical matters—all of which are also aspirations for subject specific PD in England (Cordingley et al., 2018). However, evidence is less convincing of how and why JLS may support and sustain teacher engagement with research and evidence, which does require further consideration.

In summary, the policy context in England is favourable towards JLS, it appears to be in alignment with teacher PD policy, our vision for a self-improving system and to contribute to evidence informed teaching by offering a collaborative-research orientated form teacher PD and approach to school improvement.

1.3   My Professional Background, Beliefs and Practice

Early in my career, I worked as a science teacher in several large secondary schools. During this time, there were few opportunities for me to access or engage in programmes of PD that I believed would be of benefit to myself and

my students. Having recently been a research scientist, I sought to find ways that I could engage students in authentic scientific research, within the constraints of school science and, how to keep my science subject knowledge up to date. The PD I had access to, however, was related to meeting examination requirements or delivering whole school initiatives. It was not until I gained a role as a teacher educator and PD leader in a University that I began to realise that my situation was not unique. I became acutely aware of the lack of PD opportunities that seemed relevant and realistic to teachers and to the students they were teaching.

In 2004, a vision to improve the quality of science teaching through teacher PD, was realised through the investment into a national network of science PD centres, located in Universities , one of which was in my own institution. Largely driven by economic and political concerns, this commitment of time, money, resources to science teacher PD has been mirrored in countries around the world. However there are persistent concerns over the quality of science teacher PD (van Driel et al., 2012) and the wide variation in teacher engagement and participation (Boylan et al., 2018a). No doubt, these concerns are exacerbated by an imperative to demonstrate that PD leads to easily measurable impacts on educational outcomes and value for money. Moreover, with the emergence of a self-improving school system, school leaders and teachers have become highly accountable for the choices they make for teacher PD (Simkins et al., 2019).

Having secured a senior post as a director of a science teacher PD centre, I have since gained over 15 years' experience of leading, designing and quality assuring international, national and regional teacher PD programmes. And, as an academic working in Higher Education, I have a vested interest in understanding and researching new approaches to teacher PD. In my professional context, JLS is considered as an untested, but promising PD innovation, which is just one of many teacher PD and training models that universities and school leaders can choose to invest in. For my professional practice and research, therefore, it is important to take account of the different contexts in which JLS, or similar PD innovations, are being interpreted and translated, within the English educational system (Ball et al., 2011). Moreover, the intention is that this research will add to

the rich descriptions of JLS enactments outside of Japan to consider the opportunities and challenges of what can be both lost *and* indeed gained in its' translation in different settings.

Needless to say, understanding how to improve and sustain the quality of teacher PD is complex, even with a Standard for Teacher PD in place, but the reasons for this are complicated and rarely contextualised, in terms of the teachers involved, their schools and the students they teach. This has resulted in a lack of attention when understanding why and how teachers learn through different forms of PD, in different contexts and how this knowledge could inform PD policy and practice. Moreover, PD providers are often commissioned to develop and deliver short one or two day workshops—despite evidence that short one-off workshops have been shown to be less effective (van Driel et al., 2001). Unavoidably, there is a need to minimise financial costs and reduce the amounts of time that teachers are away from their students; however, there are other factors. It has been shown that barriers to PD engagement were not merely financial but attitudinal (Wellcome Trust, 2005). Since then, other studies have shown that material, social and cultural school conditions, as well as professional cultures, can play a part in teachers' professional learning (Hsieh, 2015). Furthermore, teachers' working conditions may not only affect their participation and engagement in PD programmes, but their capacity and capability to transfer their professional learning into practice too (Louws et al., 2017a):

> *Teacher professional learning is a complex process, which requires cognitive and emotional involvement of teachers individually and collectively, the capacity and willingness to examine where each one stands in terms of convictions and beliefs and the perusal and enactment of appropriate alternatives for improvement or change.*

> (Avalos, 2011, p.10)

It is essential that PD programmes are of the highest quality, and are realistic and relevant to teachers, to their students, and to the schools in which they teach. However, teachers not only need this quality assurance and relevance in their

PD, but the skills and knowledge to shape and lead their own learning, in ways that will positively impact on their students. To lead their own learning, teachers need to develop a sense of professional autonomy in deciding what to learn and when and how to purpose their PD. It is this *agentic* view that first attracted me to JLS as model for PD and this is echoed in Kennedy's categorisation of LS as "a transformative model of PD" that has the potential to promote teacher autonomy and agency (Kennedy, 2005; Kennedy, 2014).

Over the last 10 years, I have developed my own professional understanding of JLS, largely through practice by co-leading the design and delivery of a national programme introducing JLS to teachers in England. I have also had the opportunity to observe authentic JLS in a Japanese school and engage in discussions with Japanese academics to develop my own understanding, interpretation and impression of its distinguishing features. However, to fully consider the potential of JLS in England and, more importantly, which principles and structures are essential or otherwise, it is important to take account of factors that may influence teachers' perceptions, understandings of JLS and the different contexts for their participation and engagement in JLS.

Given its origin, rise in popularity and the relatively short history of introduction of JLS to England from Japan, as with other educational innovations, once in the hands of educators there is scope for adoption, adaptation, and transformation. We are already seeing a wide range of modifications being introduced and evaluated in other countries and educational systems (Cheng, 2019; Seleznyov, 2019). As a somewhat biased, *champion* for authentic JLS, I often hear school leaders and teachers talk about how they have modified and adapted JLS to meet their school needs, PD agendas and improvement plans. Here we can see why there is scope for reinterpretation and lack of fidelity to the structures and principles of JLS, which are claimed to be so powerful (Dudley, 2015; C. Lewis and Takahashi, 2013; Takahashi and McDougal, 2016). Debates about how JLS should be defined, and how to establish a shared international understanding and theoretical knowledge base of how JLS works, have created a "lost in translation" discourse and a drive to demonstrate the effectiveness of JLS outside of Japan

(Elliott, 2012; Fujii, 2014; Godfrey et al., 2019; Groves et al., 2016; Ming Cheung and Yee Wong, 2014). This quest for evidence of what JLS can do and show that it works is commendable, but the risk lies in overlooking the underlying reasons for variability and modification and the opportunities and challenges this may present. Fortunately, more contextualised studies, considering LS enactment, as part of a whole school or system wide educational culture, are emerging to stimulate this discourse and debate (Chen, 2017; Groves et al., 2013; Vrikki et al., 2017). Extending and adding to this debate, by researching JLS in science teaching in different local contexts and what this may mean for JLS implementation, and PD leadership more generally, and for my professional practice provides further impetus for the study.

1.4   Research Aims

The emergence of the self-improving system and the introduction of the Standard for Teachers' PD (Section 1.2) offered a discrete opportunity and vantage point from which to explore the contextualisation of LS as a form of science teacher PD, and at a time when teacher PD approaches are being questioned (Boylan et al., 2018b). This study was designed to gather the perspectives and experiences of science teachers who were explicitly seeking to do LS for their PD, with minimum interference from the researcher, describing LS enactment through their voices and reported actions. Drawing on socially situated learning theories, as will be seen Section 2.4, a deeper theoretical understanding, and a move closer towards causal explanations of how and why teachers may or may not learn in JLS may be gained. Furthermore, the study responded to calls to add to the descriptive knowledge base of JLS enactment and contextualisation outside of Japan (Hadfield and Jopling, 2016; C. Lewis, 2016; R. R. Perry and Lewis, 2009)to presents insights into the different ways that JLS may be interpreted, adapted or modified. This serves to highlight some of the challenges and opportunities of implementing JLS outside of Japan, to further develop my own understanding of successful implementation of JLS and collaborative-research oriented forms of PD and, to make recommendations for future research, policy, and practice.

1.5   Research Questions

To be theoretically grounded, it was important to establish some boundaries and fully focus this study. Research questions were developed from a review of literature on teacher PD and JLS (Section 2), results of a pilot interview with one of the science teachers and my own on-going personal experience of leading and introducing LS to teachers in schools in England. This study centred on the perspectives and experiences of science teachers' explicitly seeking to do LS, in three secondary schools in England.

The three research questions and the data collection approaches needed to answer them, were developed using Opfer and Pedder's (2011) conceptualisation of teacher learning, combined with constructs from communities of practice theory (Wenger, 2000). This study was thus designed to take account of teachers' individual and collective perceptions, their understandings of LS and their participation and engagement in LS.

- RQ1. What are science teachers' perceptions and understandings of LS?

This question was designed to reveal the components of the *teacher learning sub-system* by exploring teachers' perceptions and understandings of LS and the situations that led to their decisions to participate in LS for their PD. How and why did teachers get involved in LS? What were their impressions, expectations, and intentions? What did the teachers hope to achieve, how and why? How did LS relate to wider PD activities and experiences?

- RQ2. How do science teachers enact LS in their local school contexts?

This question was designed to reveal components of the *learning activity sub-system* by exploring the ways in which teachers participated and engaged in LS for PD. The learning activity sub-system was scrutinised through the structures and principles of Collaborative Lesson Research (CLR), a term recently introduced to capture the associated structures and practices which are thought to maximise the impact of using LS outside of Japan (Takahashi and McDougal, 2016). For example, did the science teachers identify a

purpose or a goal for LS, and if so, how? How did teachers approach the planning and design of a research lesson? Did teachers carry out any background research, as in the process of *kyouzai kenkyuu?* Was a written research proposal produced or an enquiry question? How did the teachers plan to observe a live research lesson, conduct the post lesson discussion, or involve a knowledgeable other? Essentially, this question explored the interaction and interrelationship of the teacher learning sub-system and LS as the *learning activity sub-system*.

- RQ3. How do school norms, ethos and workplace conditions feature in LS enactment?

This question was designed to reveal the components of the *school sub-system* by considering the local secondary school contexts for LS enactment. Informed by Ball et al., (2012), this question explored the school context and conditions for LS that appeared to enable or constrain teachers' participation and engagement in the LS process itself. Essentially, this question explored the *school* sub-system system in relation to LS as form of PD for science teachers in their local school settings.

Framing the study and questions in this way bounded teachers' professional learning as a complex system, that Opfer and Pedder (2011) described as comprising of three nested sub-systems with potential for dynamic interaction and interrelationship. These three sub-systems were identified, and tentatively aligned to the three RQs as the:

- *teacher learning sub-system* system,
- the *learning activity sub-system* system and,
- the *school learning sub-system* system.

Chapter 2 Literature Review

2.1 Introduction

In this section, relevant literature is identified and reviewed to situate the study within an international context, inform the research questions and develop a theoretical and analytical framework. At this point it is important to point out three things. Firstly, that the acronym JLS is used to make direct reference to authentic Japanese Lesson Study, whilst LS is used an acronym to refer to the use of JLS outside of Japan. This is to make a distinction for the reader. Secondly, given the recent introduction of JLS in countries outside of Japan and surge in publications in English speaking journals, the scope of the literature review is manifested, to a large extent, through the rapidly growing literature base published since the start of this century. Thirdly, I recognised the need to maintain an unbiased and critical awareness, given the personal and selective nature of a literature review (Poulson and Wallace, 2004), alongside a determination to demonstrate LS efficacy within the research community. This potential bias was addressed by situating LS as model for PD within the extensive and broader literature on what is known about effective teacher PD.

This literature review is divided into four sections i) a review of a selection of empirical studies on the enactments of JLS for PD from an international perspective ii) a description and critique of the structures and principles claimed to make JLS effective outside of Japan iii) the location of JLS in the repertoire of PD models and purposes iv) a consideration of how to theorise and analyse teacher professional learning to inform the research methodology and to make an original research contribution.

2.2 Enactments and Impacts of Lesson Study

Since 2000, there has been a surge of professional and research publications related to using and adopting JLS in countries across the world as model for PD and school improvement. Various professional sources and research literature are available describing LS models and cycle of stages, involved including books

and guidelines and websites to support LS implementation. For the purposes of this literature review, 65 peer reviewed English language studies were located as being published between 2000 and 2018 using the search term "lesson study" and "professional development" or "professional learning" in the British Education Research Index. The titles and abstracts of each article were read and analysed, to select studies 46, where LS was used predominantly in schools in the UK, USA, or European countries. Seminal studies were also included, from key writers in the USA, Japan, and UK.

Many early research studies and publications written in English from 2000 to 2015, have set out to present the features and processes of LS in an effort to communicate what LS is and looks like (Chokshi and Fernandez, 2005; Dubin, 2010; Dudley, 2010; Dudley, 2012; Elliott, 2009; Fernandez, 2002; Groves et al., 2013; Isoda, 2010; C. Lewis, 2002; C. C. Lewis et al., 2009; Ming Cheung and Yee Wong, 2014). Catherine Lewis, a prolific and influential writer on LS in USA, has provided numerous rich descriptions of LS to illustrate how research lessons can be planned collaboratively and observed and reflected on over an extended period of time to meet teachers' shared goals for student learning. The majority of Lewis's studies have been carried out with mathematics teachers, reporting that LS enables teachers to take part in more authentic professional learning conversations and reflections, findings which still hold sway (Fox and Poultney, 2020). In this way, this then leads directly to changes in lesson plans, improved student outcomes, increases in teachers' knowledge and an enhanced sense of collegiality and community (C. Lewis, 2000; C. Lewis, 2002; C. Lewis et al., 2003; C. Lewis et al., 2006; C. Lewis et al., 2011; C. Lewis and Perry, 2014; C. Lewis, 2016; C. C. Lewis et al., 2009; C. C. Lewis, 2009). In 2009, Lewis claimed to have gathered the first local proof of the effectiveness of LS by providing an auditable trail of evidence that LS can be successfully implemented outside of Japan. Albeit, a small-scale study, it was carried out over 8 years with six primary mathematics teachers from different schools in the USA. Empirical evidence was gathered by videoing LS group meetings, observing research lessons, analysing research lesson plans, student work and by follow-up interviews with LS group

members. Findings from this study were used to construct a typical model for LS outside of Japan that had four stages; investigating, planning, carrying out and observing a research lesson, followed by reflection (Figure 1.1). In later studies, Lewis proposed a theoretical model of changes and pathways through which LS improves classroom instruction which includes i) changes in professional community; ii) changes in teachers' knowledge and beliefs and iii) changes in teaching–learning resources (C. C. Lewis et al., 2009). More recently, Cajkler (2015) reviewed over 200 studies (published in English) of LS, finding evidence to reinforce Lewis's theoretical model and pathways to impact. There is a growing consensus and evidence base, supporting Lewis's seminal theory showing that LS has benefits for teacher learning through collaboration and developing professional learning communities, promoting a sharper focus among teachers on students' learning, development of teacher knowledge, practice and professionalism and ultimately improved classroom instruction. These studies have been contextualised to some extent, but for the most part limited to the teaching of mathematics (C. Lewis, 2016) and lacking consideration of the role that teacher participation and engagement plays in LS enactment.

LS has been shown, in many other studies, to improve teachers' capabilities for asking questions focused on student learning and making judgements in the context of classroom practice (Chokshi and Fernandez, 2004; Chokshi and Fernandez, 2005; C. Lewis, 2016; Yoshida and Fernandez, 2004) and has been shown to influence the nature of collaboration between teachers (Cajkler et al., 2014; Dudley, 2012). To give a further example, a study of two teachers within a school-based math LS group in the USA, carried out over one academic year using field notes, lesson plans, observations and meetings as data, indicated that the teachers collaborated in "ways they had not done before" and "engaged in a new way of talking about mathematics teaching and learning" (Puncher and Taylor, 2006, p. 925). In a similar study, Rock and Wilson (2007), using data collected from teachers during discussion sessions, written reflections and interviews, reported an increase in teachers' professional confidence as a result of sustained collaborative work, suggesting that the joint creation of a research lesson had a motivating influence on one team to collaborate and resulted in an

increased desire for collaborative planning after participation in LS. In support of these findings, in 2009, Lieberman, again in the USA, investigated how LS could serve as a vehicle for developing teacher learning communities by demonstrating that participation in LS challenged traditional teaching and professional learning practices such as individualism (teacher isolation), conservatism (lack of risk-taking and innovation) and presentism (a focus on curriculum coverage and short term targets). Lieberman (2009) observed seven teachers, in a five-year study, in a middle school mathematics department in California, collecting and analysing video and audio tapes of LS planning meetings, interviews with teachers and lesson plans. In this study, it was claimed that teacher participation in LS reduced teacher isolation by "opening up" classrooms through collaborative planning, shared observations and by providing a safe environment for risk-taking and innovation and, crucially, providing a safe context for teachers to experiment whilst still being accountable for their students' learning. Lieberman suggested that LS helps to develop sustainable learning (2009), providing the conditions that enable teachers to interact with each other as they develop and redevelop their skills, knowledge, beliefs and philosophies of teaching and learning that, in turn, directly influences how they teach. This identity and community building work of LS seems to promote a sharper focus on students' learning than on teachers' performances. Linked to this Suzuki (2012), studied the professional discourse of Japanese teachers during LS in an elementary school in Japan, specifically focusing on the professional dialogue taking place in post research lesson meetings. Suzuki (2012) classified teachers' discussions as either "problem setting" or "problem solving". Through detailed analysis of teacher interactions, it was claimed that teacher professional discourse was predominantly "problem setting" indicating that teachers improved their capability to make choices, focussed on student learning in practical classroom situations. This was also found in studies in the UK, to emphasise the nature and intensity of teacher dialogue and social interactions in LS that culminated in teacher learning. Dudley (2012) showed that the use of LS in schools in England led to improvements in pupils' progress by supporting and embedding through the introduction of Assessment for Learning (AfL) by creating a culture of "joint risk-taking". Together

these findings begin to indicate that the nature of teacher change, or learning is not only in their knowledge of the subject matter and its teaching and learning, but in the development of their social practices, particularly—in the ways teachers talk about and reflect on their teaching and lesson planning, individually and collectively with other teachers and the collegial conditions that can be created.

To recognise the complexity of teacher knowledge development (Shulman, 1986), a study was carried out in three subject focussed domains with 10 teachers from the mathematics, humanities, and science departments of school in Singapore. Chong and Kong (2012) reported that it was the systematic, collaborative process of developing a research lesson that helped improve subject knowledge and build teaching efficacy, in terms of teachers' beliefs in their ability to teach effectively and use their collective knowledge. Remarkably, it appeared that conditions for successful teacher enquiry are fostered and promoted in LS —but only if isolated units of practice i.e. teaching episodes and strategies in the research lesson are examined in depth and a high level of scrutiny and critique of such strategies is applied (Yuk, 2012). Dudley (2013), likewise reported similar outcomes of LS due to the depth and breadth of collaboration that occurs throughout the whole process. Given that tacit practical knowledge of science teachers is thought not to *surface* easily and enabling teachers to *talk* about their teaching is seen as problematic (Loughran et al., 2004), this is an important distinguishing feature of LS as a form of science subject specific PD. LS may provide a way for teachers to *drill down* into subject specific pedagogy. Synthesising of these studies gives an insight into the range of teacher learning pathways, the subtle nature of teacher changes and practices, the non-linear and dynamic nature of teacher learning in LS, and most significantly, the importance of dialogue and social interactions (Wenger, 2000).

Lewis (2006) soon recognised that many of these early claims about the impacts of LS outside of Japan, including her own, were anecdotal, based on personal experiences and observations of LS taking place in Japanese schools in the USA. In 2006, there was a call, which currently persists, for more rigorous and systematic research to avoid the fate of LS as an unproven teaching improvement

innovation. The risk that the potential of LS will not be realised, if LS has not been fully understood or implemented well outside of Japan, also was sought to be avoided (Lewis et al., 2006). Moreover, current researchers acknowledge that the different interpretations of LS, and inevitable variations which materialise through its use in countries and cultural settings outside of Japan, make it hard to obtain evidence of the positive impacts of LS. There is also the possibility of *tempering* the underlying rationale and principles of LS (Chokshi and Fernandez, 2004; Chokshi and Fernandez, 2005) as JLS moves out of its own social, cultural, and historical context (Isoda, 2010).

Despite this prospect, there is a wealth of studies attempting to evidence the positive impacts and potential of LS outside of Japan. Gaining an overview of studies has been made easier more recently by the work of researchers (Godfrey et al., 2019; Seleznyov, 2018; Wood and Cajkler, 2018; Yee Wong and Ming Cheung, 2014) publishing in English speaking journals. More recent studies have tried to build a case for the use of LS as form of action research (Wake and Seleznyov, 2020), or to compare the merits of subject and student orientated modes of LS (Saito et., 2020) and, how to use LS to establish and sustain professional learning communities (Kirby et al., 2020; Schipper 2000b). But to miss establishing a convincing evidence base or consistent theoretical model, not to mention the different subject contexts and cultural settings that may shape its enactment, is a major oversight (Hadfield and Jopling, 2016).

Within the scope and scale of this literature review, however, there is evidence, drawn largely from small scale in-depth studies, that participation in LS has the potential to impact positively on teacher and student learning. Furthermore, participation in LS appears to influence school contexts and norms of practice (Schipper et al., 2020a). Teacher learning is supported through joint risk-taking, deeper reflection and in-depth, focussed teacher talk on student learning. Teacher participation in LS can produce and exchange teaching knowledge and beliefs (Dudley, 2010; Lieberman, 2009) and, shift professional norms particularly in the ways that student learning is individually and collectively anticipated observed and measured and discussed.

However, a major criticism and limitation of this literature base, is that the author(s), as researchers and academics, are often involved with coordinating the LS process, therefore determining the model and often training the participants in their chosen LS model and, presumably, encouraging progression through LS cycles. In the majority of studies, researchers report on LS successes and there are scant references to any challenges or problems of implementation (Bjuland and Mosvold, 2015). Although, there have been some critical reports of particular aspects of LS, for example, finding that teachers spend too much time on collaborative goal setting and planning the research lesson, with less time spent on planning for a lesson observation or actually carrying out a research lesson observation or post research lesson discussions—thought to be one of most valuable parts of the LS process (Fernandez and Chokshi, 2002). But studies have not addressed when or why this is the case. In a study carried out with secondary physics teachers, West and Volkmann (2008) reported that teachers did not see long-term research informed goals as important and the research lesson was selected purely on the flexibility and ease of teaching. One physics teacher reported a dislike of LS because it was too structured, rigid, time-consuming, and provided little room for teacher creativity:

> *LS erases teacher personality from instruction and demands that each team member delivers the lesson in exactly the same fashion*
>
> (West and Volkmann, 2008, p 234).

In an Indonesian study, facilitated by Japanese researchers, other challenges were identified—such as the "struggle" for teachers to shift from observing teaching to pupil learning (Saito et al., 2006)—suggesting that teachers may have a misconception of the purpose of LS and that basic features of LS are being overlooked. This echoes the concerns and debates that important features of LS are being *lost in translation* that there is a tension between the need for teachers to have sufficient flexibility within an LS cycle, time for LS practices and approaches to evolve and be effectively facilitated and led and the need to

maintain an explicit attention to robust and rigorous classroom enquiry (C. Lewis et al., 2006).

In their report on a challenging case in Norway, Bjuland and Mosvold (2015) highlighted that preservice teachers did not formulate a research question for their research lesson, nor focus on observing pupil learning and did not consider how to design tasks that would make pupil learning visible—essential features of JLS. Surprisingly, given the complexity of JLS, these researchers seemed to believe that participants and those supporting LS had simply *"missed the point of LS"*—suggesting that the fault lies with the teachers and mentors' understandings of LS*"*— despite being provided with a guidebook:

> *Lessons are planned in a way that makes pupil learning visible, but the student teachers as well as the mentor teacher in our study seemed to have missed this point. In close affinity with this, they also seemed to have ignored the focus on structured observation. In fact, they revealed that they had not discussed observation much at all in their group – although this was emphasised in the lesson study Handbook.*

(Bjuland and Mosvold, 2015)

Furthermore, Yoshida (2012) stated that teachers, even in situations where the principles of effective of LS are adopted, may not have the skills needed to observe cognitive aspects of student learning, for example to be able to identify common subject misconceptions, due to limitations in their subject and pedagogical content knowledge. Puchner and Taylor (2006) also reported that one teacher they observed struggled with a shift from working in isolation to collaboration— especially the act of exposing her practice and opening herself up for scrutiny. As such, although establishing teacher learning communities is promoted as a promising approach to educational improvement, our knowledge about what design features of collaborative learning are effective is limited. Research on JLS, however, has shown that when teachers are encouraged to focus on student thinking and teaching tasks, this promotes a deeper participation

in collaborative enquiry, which in turn is associated with positive outcomes (Akiba et al., 2019).

2.3   Features of Effective Lesson Study

Takahashi and McDougal (2016) have worked collaboratively for over 20 years to effectively transfer JLS from Japan to the USA and support its introduction into schools. Based on their own practices, observations and experiences they recommend a set of principles and practices that need to be maintained and prioritised for JLS to have a positive impact on teachers' and student learning outside of Japan (Takahashi and McDougal, 2016). Reframing JLS as Collaborative Lesson Research (CLR), five key principles and practices of effective LS outside of Japan have been proposed:

1. Identifying and developing a clear research purpose
2. Spending significant time on *kyouzai kenkyuu* (the reading of curriculum materials, research literature and resources)
3. Observing live research lessons
4. Supported by knowledgeable other or *kosh*i to plan, conduct and consider the findings from the research lesson
5. Sharing and disseminating LS outcomes

In particular, the role of knowledgeable others, translated from *koshi* and the process of *kyouzai kenkyuu* in LS is emphasised as in other studies (Fujii, 2014; Groves et al., 2016; Watanabe, 2002). A *koshi* in JLS is often a leading academic, known for their in-depth knowledge of subject specific teaching matter but also acknowledged for having the skills and sensitivity to know how to build trust and collegiality, promote sustained focussed teacher dialogue and reflections on pedagogy. *Koshis* are highly regarded, often measured in terms of "*research lesson*" invitations and publications—more importantly it is recommended that they are positioned as an outside expert in an LS cycle and do not directly take part in the cycle (Dubin, 2010; Watanabe, 2002):

The person who provides the final comment (and this same person may be consulted throughout the lesson planning phase), should be chosen for a particular expertise the LS group/school is focusing on. Often that means the person is from outside of the group/school. There may be some psychological aspects, too, in that people may be more willing to listen to someone from outside on certain topics.

(Watananbe, Personal Communication, 2014)

To give a sense of the expertise and experiences required to fulfil the role of a *koshi,* the structure of the final comments of three highly respected *koshis* supporting LS in mathematics in Japan and the USA were used to identify the range of knowledge and skills required and summarised in Table 2.1 as follows.

Table 2.1 Knowledge and Skills of a koshi (Takahashi, 2014)

Knowledge and Skills	Exemplified by
specialised knowledge of teaching mathematics	- a broad knowledge of mathematics related to the contents of the curriculum/assessment/age range - an understanding of the goals and the contents of mathematics education including a clear understanding of the entire structure of the subject
how to collect, evaluate, and use observational data	- an ability to judge if the teacher's questions address the goals of the lesson, if students' work helps them progress toward the goals of the lesson, and if the teacher provides students the opportunity to learn from each other.
how to select suitable observational data	- an ability to use observational data effectively for the final comments on the research lesson
how to assess student learning using knowledge about students' development of mathematics	- an ability to identify components of student thinking at the developmental stage, and expectations of the curriculum
to communicate effectively with teachers	- knowing the audience and adjusting the talk depending, for example, on the participants' level of knowledge of the content
to explain abstract theory and concepts in plain language	- using concrete examples from topics and lessons familiar to the audience
to synthesise important points from each post-lesson discussion	- explicitly directing LS to keep the school research program coherent and moving forward

Kyouzai kenkyuu is the study of, or research on, teaching and curriculum materials and is likewise often an overlooked component of JLS. *Kyouzai kenkyuu* is central to the design of teaching sequences, tasks for the research lessons, research questions and data collection (Fujii, 2016). Ideally, this process should address broad educational values, such as independent problem solving and involve drilling down to anticipate student thinking and responses to tasks and promote curriculum coherence—such as progression from one topic to another. Japanese teachers spend several weeks or even months selecting and designing the research lesson and tasks (Wang–Iverson, Personal Communication, 2014). Furthermore, Japanese research journals devote entire sections to this feature of LS. However, calls to make *kyouzai kenkyuu* more explicit in LS practice outside of Japan, have only been communicated in English journals and publications relatively recently.

> *Japanese educators place a strong emphasis on task selection, (but) this effort is largely ignored by non-Japanese adapters of LS, possibly because the effort involved may be almost invisible, in the way that 90% of an iceberg is invisible, with all of our attention going to its visible tip.*

(Doig and Groves, 2011)

It is also important to state that *kyouzai kenkyuu* is fully embedded in the Japanese teaching system not just in JLS process. "Every day" *kyouzai kenkyuu* is encouraged and expected in all lesson preparations (T Watanabe, personal communication, 2014). Teachers draw on the curriculum and textbooks or teaching manuals (authorised by the Japanese Ministry of Education) and published research lessons. Underpinned by the philosophy of *kaizen* and shifting the focus of classroom observation from what the teacher does to what the student learns, *kyouzai kenkyuu* often culminates in a national *LS open house*, when schools open up their LS practice to intense scrutiny and observation by peers and everyone has access to the planning and design of the research LS (Chichibu and Kihara, 2013; Fujii, 2014; Fujii, 2016). As such, LS is built into highly structured, national, regional, and school wide improvement process. It goes way beyond Lewis's typical model (Figure 1.1) and simplistic LS

cycles of often presented in guidebooks and on websites. There are distinctive and carefully refined protocol, principles and practices underpinning effective JLS as Japanese cultural practice with a history of over 200 years.

It is therefore not surprising that the translation of JLS beyond Japan presents significant challenges for teacher educators and PD leaders. Seleznyov (2018) started to address this, using a meta-analysis of 200 English research studies, to assess the degree of fidelity to JLS reported in accounts of LS implementation. Seleznyov (2018) concludes by distinguishing LS as a research process as opposed to simply a collaborative form of PD. This and other elements were found to be missing from many studies on LS—the identification of a research theme, the process of *kyouzai kenkyuu,* the focus on student learning and role of external expertise to mobilise knowledge in LS. However, the reasons for these JLS dilutions or omissions, modification or misinterpretations are not discussed in depth nor attention given the contextual factors such as school cultures, teacher attitudes towards research, their skills and capabilities to carry out *kyouzai kenkyuu* and the structural and material resources required for effective LS implementation to name a few. And as Murata (2011, p. 10) states, "in other cultural and structural contexts "modifications are expected and essential", but what is lacking is more research and theoretical basis to consider why and how that might be. Moreover, little has been done in terms of closely examining the reasons for these variations in LS implementation or attempting to take account of the contexts in which this occurs, and the opportunities this may present. This has created a research and practice dilemma that they need to be resolved if we are to move towards some form of consistent LS practice or theoretical model that can meet the needs of schools, teachers and their learners across the world (Saito and Atencio, 2013).

2.4   Theorising Lesson Study as a Model for Teacher PD

To go deeper into the research and practice of LS, this section considers the role and status of theory in trying to understand the contextualisation of LS as a promising form of teacher PD. As described earlier, the policy context for LS is

England is complex and unpredictable —LS is set within the self-improving school system (Section 1.2) and a repertoire of approaches and purposes of PD, many of which have overlapping features and components such as collaboration, active enquiry and expert knowledge (Kennedy, 2014). Therefore, it is important to locate LS within broader theories and models of PD and ways of conceptualising teacher professional learning. This begins by distinguishing between key and related terms used throughout the study:

- *professional development* (PD) refers to the events, activities or episodes that teachers are offered or choose to engage in, which have the potential to lead to professional learning
- *professional learning* refers to the means (mechanisms and processes) by which teachers enhance, refine their knowledge, skills, practices, and dispositions necessary to create and support high levels of learning for their students
- *learning orientations* refers to teachers' identities, their roles and expertise, values and beliefs in relation to PD and their professional learning
- *practice* refers to the ways teachers learn and make meaning through social interactions that may produce concrete or abstract artefacts such as teaching approaches or new perspectives on student learning

Professional learning, however, is the central concept and concern of this study, used to emphasise the complexity and multiple pathways and teacher learning processes that may or may not be embedded and moulded in teachers' everyday working practices. Therefore, to develop a better understanding of LS and teachers' learning, we need to consider how to uncover and illustrate this complexity. In turn, this may the then start to reveal the underlying mechanisms and processes and what is taking place as teachers start to participate in LS as a form of PD.

2.5 Contextualising Lesson Study as a Model of Teacher PD

This section of this chapter points towards the growing evidence base and publication of studies showing that participation in JLS can improve both student

and teacher learning outcomes. Some of these research studies also show that the implementation and subsequent interpretations of JLS are complex, problematic, rapidly evolving, often resulting in a loss of fidelity to authentic JLS through the dilution or misinterpretation of the structure and practices that are claimed to make JLS work outside of Japan (Takahashi and McDougal, 2016). However, despite these variations, when LS is introduced in other countries, studies have correspondingly shown that LS can also strengthen school professional learning communities and cultures (Cajkler et al., 2014; Dudley, 2010; Groves et al., 2013; Schipper et al., 2020a). As such, theorisations of LS and a consideration of the ways in which LS can be effective should not be separated from the contexts in which LS is being interpreted and translated by the schools and teachers involved.

Moreover, studies of science teacher PD programmes claim that consideration of the contexts of PD and any associated teacher professional learning is often overlooked, as are the views, values, beliefs and practices teachers of teachers taking part (Louws et al., 2017b; Pedder and Opfer, 2011; Pedder and Opfer, 2013). In addition, it is important to be aware that teachers are highly unlikely to be solely engaged in LS for their PD at any one time—they will be offered or engaged in various formal or informal PD activities and opportunities. Science teachers may be engaged in activities associated with curriculum change, assessment requirements and policy reforms, competing for attention and driven by priorities and external of agendas beyond their control. Hence, to contextualise LS, this first step in this literature review is to locate LS within the broader landscape of PD provision and consider how the features and components of LS may relate to the current consensus of what makes effective science teacher PD (van Driel et al., 2012).

Kennedy (2005, 2014) proposed that the landscape of teacher PD could be categorised along a broad spectrum of purposes (Table 2.2). For example, a one-off workshop in health and safety in science could be categorised as having a formal and transmissive purpose, as opposed to a course designed to support teachers to lead a challenging science department of inexperienced teachers,

which would need to be far more inclusive, versatile and transformative. Within this "spectrum of purposes of PD", Kennedy (2005) located LS as a "community of practice model", arguing that LS could be purposed to promote and increase the capacity for professional autonomy for teachers who participate.

Table 2.2 Spectrum of PD Models (Adapted from Kennedy, 2005, p. 248)

Model of PD	Purpose of Model		
The training model The award-bearing model The deficit model The cascade model	Transmission		
The standards-based model The coaching/mentoring model The community of practice model (LS)	Transitional	Increasing capacity for professional autonomy	
The action research model The transformative model	Transformative		

LS can thus serve a "transitional" purpose (Table 2.2), as a way of developing a consensus, for example, if a group of teachers are seeking to achieve different goals in different contexts and with different priorities. Indeed, this categorisation resonates with other research studies showing that LS can be purposed to improve relationships and working conditions (Chichibu and Kihara, 2013; Doig and Groves, 2011; Heong, 2012; J. M. Lewis, 2016; Schipper et al., 2020a). Such purposing and potential of LS has been shown to work in secondary schools in England (Cajkler et al., 2014; Wood and Cajkler, 2018).

2.5.1 Communities of Practice

The term communities of practice was coined to describe a learning theory that has a strong relationship to the social construction of knowledge (Lave and Wenger, 1991). Communities of practice theory and associated constructs can provide a framework and overarching perspective on teacher learning in LS, as a collaborative form of PD. For example, communities of practice theory could be used, retrospectively, to reframe a study that explored the potential of introducing LS to facilitate the wider transfer of the principles of Assessment for Learning (AfL). At a time when AfL pedagogies were meeting resistance with teachers and proving hard to implement, despite its evidence base, LS was used to promote teacher collaboration and reflection. Teachers from across 14 schools in England engaged in the development and observation of over 100 research lessons and, through facilitated focused professional dialogue, negotiated ways to introduce and use AfL strategies (Dudley, 2012). This study provided convincing evidence of the positive impacts of LS, evidenced in teacher reports and data on improvements in student progress. These positive impacts were attributed to the teachers' participation and sustained engagement in the LS process.

It could be argued thus, that introducing LS in this context provided the crucial conditions to establish and sustain a community of practice.; there was a group of people who shared a common concern, a set of problems, or an interest in a topic—*the domain,* which was explored through frequent opportunities for *mutual engagement* and sustained dialogue to build a *shared repertoire* of resources. This same observation was made in a study involving secondary teachers in schools in England, when LS was used to promote teacher collaboration (Cajkler et al., 2014).

Fundamental to Wenger's (2000) refinement and notion of communities of practice is that learning is seen as *meaning making* in a social context. Social learning and meaning making involves the dual processes of *participation* and *reification*, that then *shifts the identities* of members of a community who become more active and productive. In the case of LS, participation in LS may take the form of jointly planning a research lesson in a duality with the reification of

teachers' beliefs about student learning and how this could be measured or observed in the research lesson.

Furthermore, this iterative, social learning process and duality within the LS community may influence or *be* influenced by the teachers' individual and collective professional *identities* and *learning orientations.* For example, their identities as new or experienced teachers or as active and highly engaged professional learners. Of particular importance to LS as a longer term, collaborative and research orientated form of PD, therefore, are their individual and collective identities - as reflective practitioners, as subject specialists, as researchers and as highly engaged professional learners . As teachers *deepen* their participation and engagement in LS, these multiple teacher identities may shift and evolve as the teachers engage in different LS practices or as they take on specific roles or tasks. Teachers may then become more legitimate and more engaged members of a LS group or teacher professional learning community (Lave and Wenger, 1991). Theorising and analysing teacher learning in LS within community of practice theory, thus, starts with the premise that teachers' learning is part of a set of wider social practices and interactions by which these teachers are not only becoming better teachers, but better researchers, better collaborators and better learners. It follows, therefore that in relation to LS, teacher's identities need to be examined in terms of their past experiences, their knowledge, skills, beliefs, values and practices that *they* believe are of benefit for their own learning *and* for their students'.

This particular understanding of teacher identity invites new understandings of teacher learning, because it does not prioritise teacher identity solely in terms of their subject, career stage and opinions on student learning. This perspective forefronts teacher identity in terms of these science teachers' professional learning beliefs, values and attitudes and how they may play a role in their expectations, and orientations to different forms of PD and learning. Moreover, there is potential for a group of teachers embarking on LS to absorb and develop a collective professional identity, gaining a sense of belonging and alignment to

the goals of a LS group and the co-construction of ways to improve teaching and the outcomes of their students.

For some teachers, in some schools, achieving their professional goals through or research may be the norm. These teachers may be more willing or equipped to learn through these forms of social interaction. Learning in this way is part of the teachers' individual and collective professional identities. However, for other teachers, these forms of learning and social interaction may be rare or unsupported. It was therefore important for this study to design and choose a research methodology that could take into account the teachers' individual and collective identities and learning orientations. Furthermore, in their local contexts, there may be conditions and structures that afford or constrain social interactions and actions or create *boundaries* that need to be negotiated – such as how to identify a shared goal or how to engage in research. This is important in LS, and is later discussed, for as Akkerman and Baker (2011 p, 133) describe, this may create a "sociocultural difference leading to discontinuity in action or interaction".

2.5.2 Complexity and Non-linearity

In accordance with Strom and Viesca (2020), there is an ethical imperative to acknowledge that teacher learning is a complex, dynamic and non-linear process. As such, to rely on simplistic conceptualisations of teacher learning in research and in professional practice may have far reaching effects on teachers, their students and their schools. This careful consideration of the complexity, non-linear and unpredictable nature of teacher learning is consequently applicable to science teacher PD. Indeed, improvements are often said to fall short (van Driel, 2012) and the reasons behind this are unclear. For example, concerns pervade around the quality of subject specific PD, reinforced in the recent report commissioned by the Wellcome Trust (Cordingley et al, 2018), despite continued investment and entitlement.

Furthermore, it is important to recognise that the nature of teacher knowledge and how this can be developed is also extremely complex - there are many forms of teacher knowledge (Shulman, 1986). Effective PD for science teachers cannot simply be limited to supplying teachers with expert input and training as *deliverers* of new initiatives, it needs to be closely aligned to their practice, to their local contexts, and their professional identities and learning orientations. Teachers and schools can then gain maximum benefits from any opportunities for experimentation if they are given the space and time to reflect both individually and collaboratively on their experiences (Loughran et al., 2004; van Driel et al., 1998).

This is a view that has been argued and supported for many years (Borko, 2004; Desimone et al., 2001; Harland and Kinder, 1997). PD activities that involve active enquiry-based learning, collaboration, coherence with other teacher learning activities and classroom practice, sustainability and a focus on research informed subject knowledge are thought to be most effective (van Driel et al., 2012). As can be seen from the table below, such features of effective PD are considered and may potentially be enhanced in LS (Table 2.3).

Table 2.3 Features of LS in Relation to the Core Features of PD.

Core Feature of Effective PD	Distinctive Features of LS
Focus on research informed teaching and learning of subject matter	Development of a research lesson begins with *kyouzai kenkyuu,* often supported by a *koshi.* Teachers collect "research data" during live classroom observations and use this to inform practice
Active and enquiry-based learning	Enquiry questions developed and studied collaboratively in context of research lesson through *kyouzai kenkyuu*
Collaborative learning	Systematic approach to collaboration typified at every stage of a LS cycle
Coherence with individual, school, and local contexts	LS goal and research lesson proposal is determined by school and teachers, explored in a classroom-based context, and takes account into state curriculum and textbooks (*kyouzai kenkyuu*)
Appropriate duration and span	LS conducted over weeks and months
Capacity for teacher autonomy/leadership of PD	Teachers work collaboratively to determine the focus and purposes of the LS despite the specificity of textbooks and teaching strategies
Involves experts and facilitators	*Koshis*/knowledgeable others have extensive expertise and knowledge in the LS and the relevant subject matter

Thus, one can first say that LS is a collaborative-research orientated form of PD, that can be purposed to establish a community of practice, to promote and increase the capacity for professional autonomy whilst meeting our expectations of effective teacher PD.

The attempts to understand the processes and patterns of teacher learning in different forms of PD has also created a substantial literature base and generated a number of models and analytical frameworks (Boylan et al., 2018). Such models of professional learning can be examined and considered as analytical tools to better understand LS, the mechanisms and processes involved and how LS may be designed and implemented.

Boylan et al (2018) identified five significant models that have been deployed as analytical tools. Two of these are described as simple "path" or "linear models" (L. M. Desimone, 2009; Guskey, 2000), one as a cyclic model (Clarke and Hollingsworth, 2002) and one described as a "complex systems" model. The most dominant models appearing in the broader PD literature and landscape, used to inform PD designs and recently to evaluate LS, are variations of simple path or linear models (Godfrey et al., 2019; Seleznyov, 2019). The most common linear model, reported as cited over 1700 times (Boylan et al., 2018), being Guskey's (2000) four level model of professional learning (Figure 2.1).

Guskey's model appears to have had currency with PD evaluators and funders of science teacher PD (Wolstenholme et al., 2012)—perhaps as it is relatively easy apply and use to convince others of the impact a PD programme. This linear model assumes a direct, simplistic and causal relationship that develops over four levels triggered by teachers' participation in a PD event, their reactions to the PD, which culminates in changes in classroom practice and students' outcomes, which then results in changes in teachers' beliefs and attitudes.

| Professional Development | | Change in TEACHERS' CLASSROOM PRACTICES | | Change in STUDENT LEARNING OUTCOMES | | Change in TEACHERS' BELIEFS and ATTITUDES |

Figure 2.1 Guskey's Linear Model of Professional Learning

(Guskey, 2002)

Using Guskey's model in the design and development of PD builds a strong case for the requirement of PD to lead to impacts on student learning outcomes, through changes in teachers' classroom practices, *before* we see or can lever any changes in teachers' belief and attitudes. However, if one were to apply Guskey's model to LS, this model is limited and partial—there is an assumption that the PD programme is formal and bounded, such as a one-off workshop taking place outside of a teachers' professional setting. Furthermore, individual and collective teacher professional identifies, although acknowledged to some extent in this model (in the last domain), they are not taken into consideration at the start. In Guskey's model, instead, teachers' beliefs and attitudes are only seen as an outcome of PD and something that needs to be *changed*. Therefore, using only Guskey's model may not reveal the patterns or the complexity of teacher learning or help us to understand and to contextualise teachers' individual and collective learning in LS. Moreover, there is an inadequate reference, other than indicated by unidirectional arrows, to any processes or mechanisms that would support the assumed progression from one domain to another to another to justify or to start to reveal any causal relationships.

The limitations and oversimplification of Guskey's model to understand and theorise teacher learning were recognised and attended to by Clarke and Hollingsworth (2002), who proposed the Interconnected Model of Professional Growth (ITMPG). This is a more elaborate model and has been adopted in other LS and PD research studies more broadly, to map and predict teacher changes and growth patterns (Doig and Groves, 2011; Perry and Boylan, 2018). More recently the ITMPG model has been used to highlights the importance of curriculum materials in the effective enactment of teacher PD programmes (Moore et al., 2021). The ITMPG model builds on Guskey's and other linear models (L. M. Desimone, 2009) by suggesting that there are multiple linear pathways through which teacher learning may occur. This model has been used extensively in empirical PD studies, with over 1000 citations (Boylan et al., 2018b)

and as a framework for a critical review of science teacher PD programmes (van Driel et al., 2012). A distinct advantage of choosing the ITMPG to theorise teacher learning in LS is the identification of four distinct domains—the *external, practice, consequence* and *personal* (Figure 2.2). Of relevance to LS as a form of PD is the domain of *practice* or *professional experimentation.* Using the ITMPG model thus encourages PD designers and researchers to consider the situated nature of PD programmes. Teacher professional growth may then be considered as occurring *from* one domain to another through the processes of *enactment* and *reflection.*
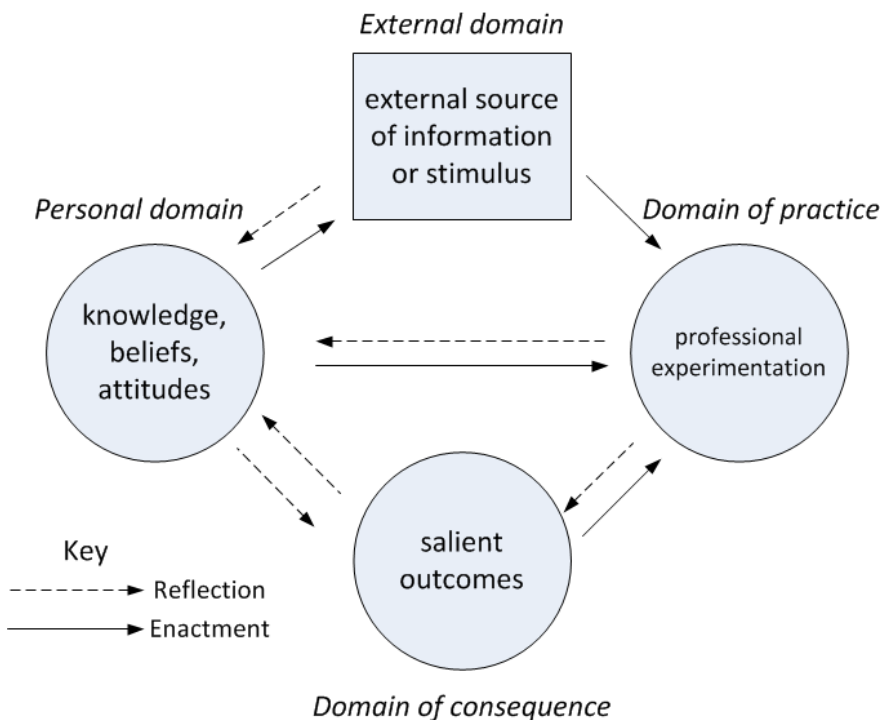
Figure 2.2 **Figure 1. Interconnected model of teacher professional growth (Clarke & Hollingsworth 2002, p.951)**

However, Clarke and Hollingsworth's notion of *enactment* is constrained in terms of the aims of this study and the ways in which *enactment* has been defined. Clarke and Hollingsworth (2002) define enactment as "putting into

practice the learning from PD or a changed belief" suggesting this is a straightforward and predictable process, alongside reflection which is understood as *"active consideration leading to inferences that causes change in beliefs and practice"*. However, *enactment* is defined and used in this study, to convey my belief that teachers are not only active but *agentic*. Teachers' as learners will have some autonomy and agency in the *enactment* of a PD programme and not simply in their decisions to put changes into classroom practice or what or how they teach. As such, any teacher learning processes and changes in teachers' growth, behaviours or beliefs cannot be fully predicted along causal pathways, or isolated and separated from the PD programme of experience. Therefore, LS as a form of PD, as with other innovations, is subject to *interpretation* and *translation* as it is enacted (rather than simply implemented as intended) in original and creative ways by teachers and their institutions and communities (Maguire et al., 2015).

As an alternative, Opfer and Pedder (2011) propose a systematic, dynamic, and non-linear conceptualisation of teacher learning. Developed from an extensive review of PD literature and elaborated through a series of studies and publications (Opfer et al., 2011; Pedder and Opfer, 2013). Attention is drawn not only to the PD programme and learning activities but to the existence of teachers' professional lives, beliefs, experiences and working conditions and how these may feature and shape their learning. The aim being to counteract the "process–product logic", which has limited the explanatory ability of other PD studies, by providing a heuristic device to explore and interrogate teachers' professional learning experiences. For this study, this complex conceptualisation of teacher professional learning is taken together with Wenger's concept of communities of practice and how LS may be purposed (Kennedy, 2014) (Table 2.2). This then acknowledges that LS is a collaborative-research orientated endeavour which involves opportunities for mutual engagement, joint enterprises and the development of shared repertoires and meaning making (Cajkler et al., 2014; Wenger, 2000a). The complexity, non-linear and socially situated nature of teacher learning in LS could then be illuminated by revealing the components of a complex system, which according to Opfer and Pedder's conceptualisation

comprises a set of three nested sub-systems that may interrelate and interact. This conceptualisation and theory of teacher learning was then operationalised as an analytical framework (Figure 2.3) to craft the research questions, approach to data analysis and case study design. It is, of course, also important to indicate that this system is part of much broader complex educational system (Section 1.2).
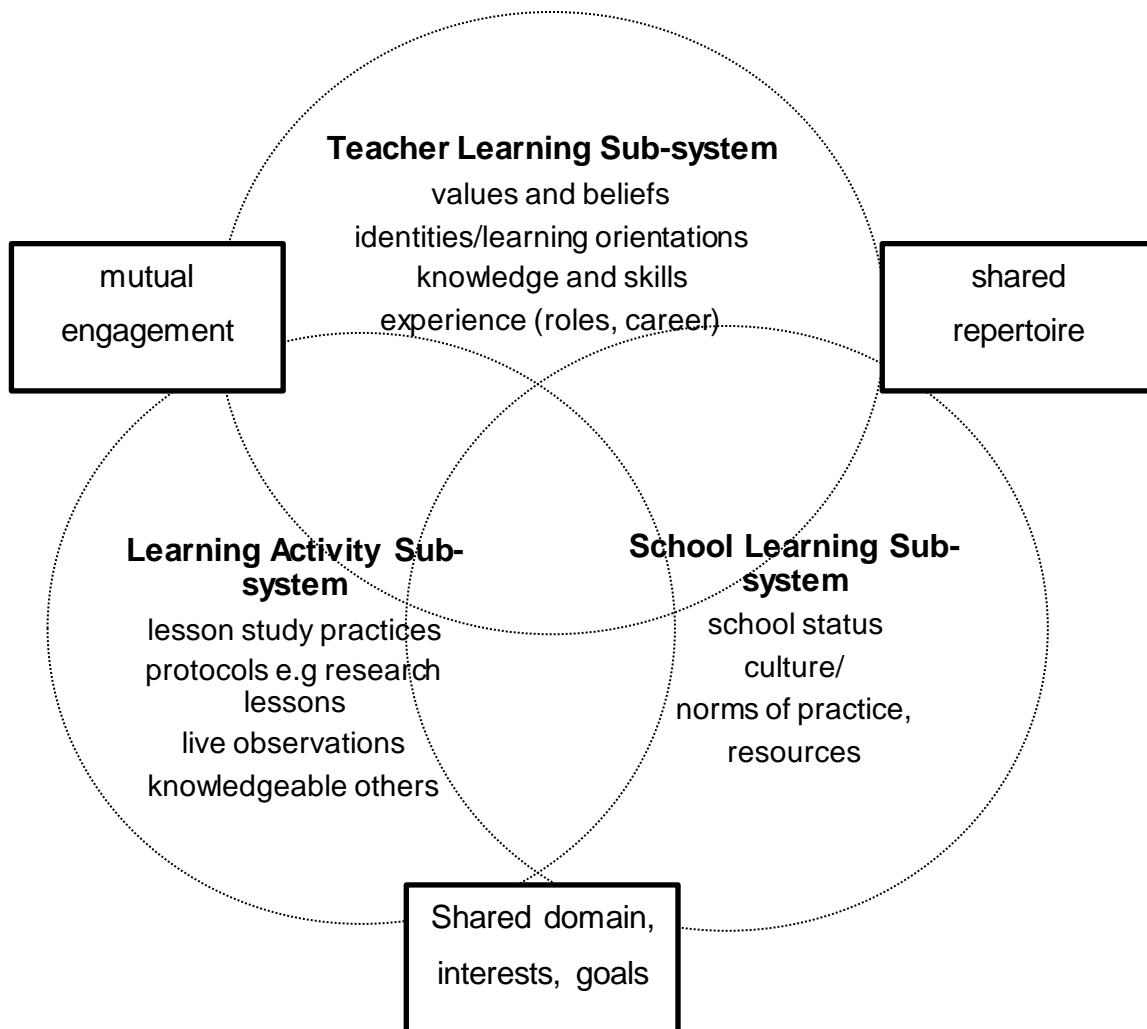
Figure 2.3 Analytical and Theoretical System for Teacher Professional Learning in Lesson Study

2.6   Further Justification of Research Questions and Approach

Rooted in a constructivist epistemology, Opfer and Pedder's (2011) conceptualisation and Wenger's notion of communities of practice was interpreted and elaborated as a set of constructs to build and operationalise a theoretical and analytical system for teacher learning in LS (Figure 2.3). This approach was used to provide a framework to inform the research questions (Section 1.5), research methodology and design (Section 3) and presentations of findings as multiple case studies (Section 4).

By exploring and filtering the enactment of LS within and across a set of nested sub-systems, it was possible to gather empirical evidence about the components of each sub-system and consider ways in which each sub-system was interrelated or may interact. For example, within the teacher learning sub-system, whether these science teachers' identities and learning orientations, values and beliefs in relation to PD and LS featured in the ways the teachers approached, responded to or participated in the various learning activities – the components of the learning activity sub-system. Similarly, the science teachers' values and beliefs about LS and their PD may have also be influenced by their local school contexts and professional learning conditions – the school learning sub-system. For example, if at the time certain PD practices were favoured or better resourced in their schools.

The research questions were deliberately broad at the start of the study, then narrowed through early data analysis and modified, dependent on the kinds of data that were collected and could be used to answer them. The intention was to use the theoretical and analytical framework to consider if this could provide a deep insight into each sub-system and illuminate ways in which the three systems interrelate and interact in teachers' enactment of LS. This approach is explained further in relation to each of the research questions.

2.6.1 Exploration of the Teacher Learning Sub-system

This sub-system represents the importance of teachers' identities, beliefs and values as critical to their practice and able to be developed dynamically through this practice. Teachers may hold pedagogical beliefs grounded in past and present teaching and PD experiences of what works or does not work for them or with their students. In turn, these beliefs may change as they engage in PD activities and teaching. In accordance with complexity theory, this views teachers' knowledge as simultaneous to the knower—one cannot exist without the other. Therefore, in relation to teachers' beliefs about their practices, which may involve exposure to various forms of PD, the teachers may hold certain values and beliefs which may be reflected in their motivations to participate and their perceptions of what would be beneficial PD for themselves and their students. These beliefs may be transient or ingrained and influenced by many things such as their experiences of teaching, career stages, roles, and aspirations. It is through an exploration of the teacher learning sub-system that one can explore teachers' learning orientations, perceptions, motivations, and aspirations of LS for their PD.

2.6.2 Exploration of the Learning Activity Sub-system

The sub-system represents the importance of different forms of PD and learning and how this may have an influence on how and what that teacher learns. For example, if a teacher has a high perceived value of one form of PD, which has developed through current and past experiences, it could be suggested that they are more likely to be motivated to participate in similar forms of PD. Therefore, when invited to participate in LS, teachers' views and beliefs may influence not only in their decisions to participate, but how they may participate and the ways in which teachers enact i.e. *interpret* and *translate* LS for their PD. Therefore, it is through an exploration the learning activity sub-system and the affordances of LS principles and practices that may reveal underlying mechanisms and processes and what teacher learning looks like in LS

2.6.3 Exploration of the School Learning Sub-system

The sub-system represents the importance of school norms, professional cultures, materials and resources which may influence teachers' capacity and capability to participate and engaged in PD or to implement new teaching ideas and pedagogies. For example, there may be collective beliefs held about how certain subjects should be taught or how students can be assessed. Such collective beliefs and ways of working may have profound effects on school norms and modes of practice. Furthermore, the status of a subject or a school within the educational system may give privileged access to resources and support or conversely increase the pressure and demands on teachers to achieve certain outcomes. Therefore, it is through an exploration of the school learning system that one can reveal and identify relevant any contextual factors and conditions in relation to teachers' participation and engagement in LS.

Chapter 3 Research Methodology and Design

3.1 Introduction

This chapter provides the rationale for the qualitative study of the enactment of Lesson Study (LS) as a form of teacher professional development (PD). It situates the study within an interpretivist paradigm, outlining the ontological and epistemological beliefs underpinning the research and theoretical conceptualisation of teacher professional learning described in Section 2.4. This shows how the research methodology and design took account of researcher positionality, the decision to use a multiple case study design and the theoretical and analytical framing of teacher learning system in LS as a complex system (Figure 2.3). The chapter also outlines the steps taken to gather data in a trustworthy, transparent, and ethical manner and the rigorous, systematic processes of data analysis and interpretation. The chapter concludes with a discussion of the limitations of the research methodology and design.

3.2 Research Paradigm

To study teacher learning with a view to contributing to knowledge, a research strategy was required that could consider the collaborative and socially situated nature of LS as a form of teacher PD. Contextualisation and collaboration was addressed by seeing the *enactment* of LS as a social process of reconstruction by teachers in the local policy and practice contexts of their schools (Ball et al., 2012). To deal with LS enactment in this way, required a constructivist epistemology that could consider the underlying beliefs, motivations that may shape the observable behaviours of science teachers explicitly seeking to do LS for their PD and enable the asking of emergent critical questions throughout this inquiry (Charmaz, 2017).

As such, the study relied on science teachers as key informants for understanding the ways in which LS was translated and interpreted in the places where the teachers worked. By drawing on naturalistic enquiry methods (Lincoln and Guba, 1985a), observations and interpretations were made of teachers' responses to

LS, and their decisions and actions in the early stages of their LS cycles, to produce rich contextualised descriptions of LS enactment as a social phenomenon.

My experience and knowledge of science teaching led me to believe that science teachers would be members of multiple communities of practice (Wenger, 2000a), within their subject areas, departments, schools and professional networks. Within a science department, for example, teachers would share some common goals, concerns, beliefs, and practices, such as how to maximise student progress, and would be likely to be engaged in PD activities to meet these goals. There would be some formal and informal opportunities for science teachers to develop their knowledge, skills, and expertise, to interact socially and learn from others. Per se, the science teachers would have some degree of choice in deciding *how* to participate in learning activities and *how* they may support their learning. Systematically gathering and analysing the perspectives and understandings of participating teachers could therefore provide a unique insight into their values under everyday workplace conditions. Furthermore, teacher accounts of LS could be augmented through the collection and analysis of concrete and abstract artefacts. These artefacts were seen as representing forms LS participation and as reifications of teachers' collective understandings, perceptions and beliefs during LS (Lave and Wenger, 1991).

To understand this world from this researcher and the science teachers' perspectives denotes there can be no single truth, rather multiple truths and realities constructed both collectively and individually. Each teacher's attitudes, beliefs, values, skills, and knowledge, in relation to LS and how they think about and act in their professional learning, will vary in different ways. To probe and explore science teachers' perspectives and what they planned to do with LS, therefore, required a research methodology that reflected and captured this subjectivity and complexity but could also seek out any and similarities.

If this research were to be carried out within a post positivist paradigm, it would be based on the principle that if science teachers engaged in LS for PD, this would have some measurable effect. For example, if collaborating in a more

structured way is accepted as a central feature of LS and effective PD (Cajkler et al., 2013), science teachers' may report improvements in subject or pedagogical knowledge and on student learning outcomes (Van Driel and Berry, 2012). However, as argued in Section 2.4, the theorisation of teacher learning as a complex system means that we cannot make or predict such direct causal links to their participation in LS, especially given its highly contextualised and collaborative nature (Hadfield and Jopling, 2016). Instead, we have to accept, by taking a social perspective on teacher learning, that these teachers' individual and collaborative learning environments, pathways and priorities are socially constructed, and each PD event or activity that a teacher engages in will be experienced in unique and different ways. There may be some predictable outcomes, such as a how to demonstrate a scientific experiment, but what and *how* teachers learn through their participation and engagement in LS cannot be fully predicted. Hence, my stance as a researcher aligns with an interpretivist paradigm, underpinned by my own beliefs and experiences of what it means to be a science teacher engaging in LS for their PD. Accordingly, the understanding of the enactment of LS by the individuals and groups of science teachers pursuing it for PD, will be reflected through my own experiences, thinking and interpretations (Charmaz, 2017).

Naturalistic enquiry, a general term synonymous with qualitative research methods and interpretivist research (Lincoln and Guba, 1985b), fits within this research paradigm and meets the aims of this study—to observe and understand the enactment of LS as a naturally occurring activity taking place in the complex and changing contexts of science teachers' professional lives. Quantitative research methods and a positivist paradigm, in contrast, would not produce such rich and in-depth descriptions of LS enactment, as the aim was to reveal the complex, non-linear and contextualised nature of teachers' learning in LS. Henceforth, naturalistic enquiry techniques, offered by Lincoln and Guba (1985), were used to rationalise the researcher role, positionality and the need for reflexivity while refining the focus for the enquiry and deciding where and from whom data could be collected and systematically analysed.

3.3   Researcher Role, Positionality and Reflexivity

In naturalistic enquiries, a researcher is closely involved and integral to the research process. This was achieved through my interactions with science teachers in their professional contexts, as they started to participate in LS cycles, and analysing data as soon as it was collected. Given my professional identity as a science educator and LS practitioner, it was fundamental to acknowledge, from the outset that my own values and beliefs could not only influence findings but also potentially add to the *credibility* and *transferability* of this research (Section 3.11). Researcher reflexivity is one of the pillars of high quality research (Berger, 2015) and brings attention to the contexts of knowledge construction at every step of the research process. However, as the main data collection instrument, my personal values, beliefs, experiences would mean that the findings would be subjective and lack some *generalisability*—I could never be fully removed from the enquiry. Furthermore, given my professional role as a University academic and teacher educator, there were issues around power in relation to my knowledge of teaching and LS. By recognising that as the researcher, I was also part of the social world under study, a research methodology was developed to gather data in situ, where science teachers worked, that addressed two key issues; the researcher role in LS research and the abundance of data collection opportunities that became available as teachers participated in LS cycles.

Research studies on LS frequently involve researchers and academics determining, facilitating, and coordinating the LS process (Section 2.2). These individuals and groups often select and introduce the LS model, determine the timings of each stage in a LS cycle, the protocols and LS resources to be used. Academics often take on the role of knowledgeable others or *koshis*. This academic support or *interference* may inevitably influence the LS process, the data collection, and its interpretation. To accurately study LS enactment without bias or interference, in its natural setting, required me as the researcher to *stand back*, not influencing or controlling the process. Moreover, science teachers are highly unlikely to be provided with this level of investment in LS or such sustained and structured support in the longer term. Thus, it was decided and explained

from the outset that I would be a non-participant observer in the LS process. I would not take part in any planning meetings, research lessons or post research lesson discussions, neither would I comment on the LS process; however, I would welcome any additional data or resources that the teachers provided. Furthermore, as the research aims and research questions in this study were not focussed on student learning, but located in teachers' reported perceptions, actions and experiences, this further justified the decision not to observe any research lessons or meetings. Distancing myself from these teachers' direct actions may *go against the grain* of naturalist enquiry, but it was not seen to hold any risk of not meeting the research aims of the study or answering the research questions.

3.4   Case Study Research

Given the versatility and variability of LS, the breadth of the research questions, interpretivist paradigm, and researcher positionality, a naturalistic enquiry methodology was required that could retain a holistic and real world perspective on LS enactment and deal with a variety of evidence. Case study research is well recognised and often used as a legitimate approach to this form of qualitative research study. However, as a research method there are debates about how to design and implement case study research. Furthermore, case study research is often critiqued in terms of generalisability (Adelman at al., 1980; Nisbett and Watts, 1984). To address this concern, I drew on Yazan's (2015) comparative critique of the foundational texts of three prominent case study research advocates - Robert Yin, Sharan Merriam and Robert Stake. Yazan's review draws attention to the need to consider epistemological positions underpinning when choosing and designing a case study research methodology.

Yazan (2015) proposed that Stake (1995) and Merriam's (1998) positions on case study research are closely aligned with interpretivist research studies, seeing knowledge as being "constructed rather than discovered" (Stake, 1995, p. 99) and emerging from peoples' social practices. However, although this interpretivist epistemology is in tune with my approach to this study and my beliefs (Section

3.3.), this research study is also firmly located and related to professional practice. I am a pragmatist who is guided and often more driven by practical considerations than by my ideals. For example, in this research study, the highly contextualised and socially situated nature of LS, meant that the boundaries between the context and the enactment of LS were blurred - I had little control or intention to interfere with the LS process. As such, Yin's (2003) more positivist approach to case study research as an empirical enquiry that investigates a contemporary phenomenon (the case) in depth and within a real world context, in my view, addressed this concern over the need for generalisability.

On top of this, three other factors were considered, to justify a Yinnian approach to this case study research (Yin, 2018):

- *the form of research questions;* these were of a *how* and *why* nature, rather than *what* and *when,* and were exploratory, seeking to observe LS enactment as the process unfolded

- *the control over behavioural events:* for this study there was no need to be in control of the LS process or manipulate any variables, quite the opposite; as discussed in Section 3.3, the researcher needed to stand back to observe *how* and *why* teachers responded to LS, without causing interference or influencing

- *the focus on a contemporary phenomenon as opposed to an historical event;* in this study the focus is on LS enactment as a complex, dynamic, social phenomenon that occurs over a period of time rather than as a one off isolated event

A choice of case study research methodology was required that could try to answer the how and why questions about teachers' perceptions of LS and their, participations and engagement, over which as the researcher I had little control (Yin, 2018). Moreover, the case study was *bounded* to groups of science teachers in secondary schools in England seeking to do LS for their PD, focussing on teachers' constructed accounts within the contexts of their schools and everyday working conditions. The case study was also bound to a particular theoretical and

analytical framing of teacher learning as a complex and socially situated system and phenomenon (Figure 2.3). It is this *bounded* nature and methodology that set a case study methodology apart for this qualitative research study: one that could be adopted and advance the socially situated and contextualised framing of LS as form of teacher PD.

3.5   Research Timeline

Current school improvement policies and reforms in England have created a fragmented, incoherent teacher PD landscape and an abundance of PD opportunities (Section 1.2). Hence, I sought to identify three secondary schools, based within a reasonably sized geographical area in England, in which groups of science teachers were explicitly seeking to do LS for PD. Time could then be spent in each school to gain sustained access to science teachers, whilst being flexible to accommodate their time pressures and working demands. Given the cyclic nature of LS and the pattern of a school year, a timeline was produced to recruit schools and teachers in the summer term of 2015, to gain informed consent and gather data as LS cycles started to take place (Table 3.1). A period of six months was set aside for data collection from the start of the Autumn 2016 school year, thought to be the most likely time within which teachers would start and complete LS cycles.

Table 3.1 Research Timeline

	Date	Actions	Intended outcomes	Data Collection Method
Selecting the Cases	April to June 2015	Recruit schools—visit schools, meet gate keeper, Hold briefings about research study	Three schools recruited Schedule of school visits and data collection points agreed	Field notes Consent forms
	July 2015	Select three schools/science departments engaged in LS	Informed consent gained from all participants	
Case Study Design	September 2015	Conduct pilot interview with on science teacher	Early cycle and late interview schedules designed	Pilot interviews Field notes
Data Collection and Initial Analysis	October to Dec 2015	First school visit Meet with LS facilitator	Data analysis Templates designed	Field notes Pilot interviews

	Date	Actions	Intended outcomes	Data Collection Method
		Conduct interview 1 with facilitator and participants		LS artefacts, e.g. lesson study guides and research lesson plans
Data Collection and Initial Analysis continued	January to June 2016	Second school visit Meet with LS facilitator Conduct interview 2 with facilitator and participants		
Data Analysis and Interpretation	June 2016 onwards	Write individual case studies Multiple Case Study Design Cross Case Analysis	Findings summarised and articulated as individual case studies Cross case comparison and analysis completed	Individual case studies and literature themes producing analytical memos

3.6   Recruiting Schools and Research Participants

An invitation (Appendix A1) to participate in the study was sent out through the researchers' professional networks and contacts by email. Six science teachers in six different schools responded to the email invitation. This was followed up with an email and telephone communication to outline the purpose of the study, commitment required and to gather details on each school setting and experience with LS. Two operational criteria were used to select three secondary schools:

1. *Essential*—schools were willing to participate in the research study for a period of six months, and there was a group of three to four science teachers currently taking part in LS or planning to start LS cycles
2. *Desirable*—schools had some previous experience or familiarity with LS, and there was evidence of senior management supporting teachers to participate in LS and this study. This was to minimise the risk of participant drop out and possible demands on researcher expertise in LS.

Using these operational criteria, two schools were excluded from the study as they had no previous experience of LS and were seeking support to implement LS for the first time. These schools were offered support for implementing LS after the study had been completed (see Section 3.11). A third school did not respond to the follow-up communications.

Once the three schools had been selected, it was important to establish a trustful relationship with gatekeepers and science teachers and to set the tone for the study. This was achieved by visiting each school to further outline the purpose, scope, and timescale of the study, to answer any questions and meet science teachers and to gain informed consent from each teacher (Appendix A2 and A3). Being conscious that many of the science teachers were volunteering to take part in LS, it was also important to reassure participants that data collection methods would not be onerous, demanding, or intrusive. Access to science teachers and the schedule for interviews had to be negotiated with each gatekeeper while

allowing some flexibility, dependent on timings of the LS cycle and to ensure that an unfolding, interpretive approach could be used from the outset.

3.7   Multiple Case Study Design

To fully explore the contextualisation of LS as a model for science teacher PD, a *multiple site* case study design was used to explore LS enactment in three different secondary school settings. Each individual case study site was bounded by a framework theorising and analysing science teacher learning in LS as a highly contextualised form of PD, operating within a complex system and social structure of three interacting sub-systems (Figure 2.3). These three sub-systems were regarded as *non-hierarchical* professional learning contexts that could be observed both separately and collectively through their relationships and interactions:

- *the teacher learning sub-system*—exploration of the context created through the teachers' individual and collective understandings and perceptions towards LS and its associated structures and practices
- *the learning activity sub-system*—exploration of the context created through the teachers' actions and decisions during the LS process
- *the school sub-system*—exploration of the context created within the school setting that appeared to enable or afford LS enactment

The three individual case studies were intended to provide in-depth, rich descriptions of LS enactment in three different settings, which could then be compared and contrasted through a cross case analysis, to explicitly answer the research questions and consider variations LS and teacher learning.
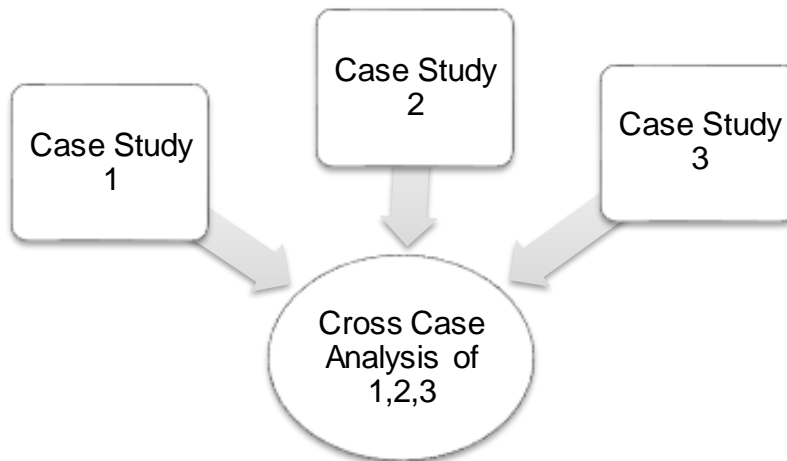
Figure 3.1 Multiple Case Study Design

3.8   Research Setting and Participants

The three schools selected using operational criteria (Section 3.6), fortuitously provided a range of secondary school contexts in terms of age range, school status, catchment area and geographical locations in England. The three case study sites were an 11 to 18 secondary school recently reopened as an Academy and in the process of becoming a Multi Academy Trust: an inner city, 13 to 18 University Technical College, specialising in technical qualifications in engineering and science and a rural, 11 to 16 secondary school. In each school setting, science teachers were working in a department led by a Head of Science.

Out of the 11 teachers interviewed, three had been assigned by their schools to organise and coordinate the LS process, identified in this study as *LS facilitators.* Each LS facilitator had a middle management role, either as an Assistant Head teacher, Head of Science or having responsibility for leading teaching and learning schoolwide or department wide. Each LS facilitator agreed to act as a gatekeeper for the study, inviting other teachers to take part and allowing access to teachers for interviews. LS facilitators also provided most LS artefacts. As the focus of this study was not on subject specific PD, it was not necessary to recruit teachers from similar science subject domains (e.g. biology or chemistry) nor age

phases (other than secondary); they also did not need to be restricted to subject specific LS groups. At this point, it was also anticipated that membership of the LS group could fluctuate so this was accommodated, as necessary. During the data collection phase, one teacher withdrew from the LS cycle and research study and one LS facilitator and gatekeeper moved schools; these impacted on the final data set. Details of the research participants' subject specialisms and teaching experience is shown in Table 3.2 below.

a.

Table 3.2 Secondary Schools and Science Teachers Participants

Secondary School	Number of Teachers	Years of Teaching Experience	Subject Specialism
Overton Academy	3	One teacher with more than 10 years and two teachers with 3 to 5 years	Chemistry - 1 Biology - 1 Physics - 1
Treebank Secondary	4	Three teachers with 1 to 2 years, one teacher with over 12 years	Chemistry – 3 Physical Education - 1
Ashgate College	4	One teacher with over 5 years, the other three teachers with 2 to 5 years	Chemistry - 3 Biology - 1

3.9 Data Collection Tools and Timeline

Case study research relies on multiple sources of data being collected and analysed, guided by theory and a set of propositions (Stake, 2006; Yin, 2003)

which have been outlined in Sections 2.4 and 2.5. A range of qualitative research methods, such as observations, focus groups and interviews, could be used here to create rich descriptions and interpretations of LS enactment. However, the methods chosen would have to be used unobtrusively in different contexts where little is known about the people being investigated or the local setting, allowing one to "generate or inductively develop a theory or pattern of meanings" (Creswell, 2013). Therefore, the study required a methodology that could take account of multiple, variable and unpredictable factors throughout the research process, such as whether science teachers were working in subject specific or cross-curricular groupings and the model of LS being used and explore the three sub-systems separately and together. To do this, three data collection methods were chosen to address each of the research questions (Table 3.3): field notes, semi-structured interviews, and artefact analysis. And, as outlined on Section 3.5, given the versatility and variability of LS, the data collection timeline had to echo the natural rhythm created as teachers participated in LS cycle, without being intrusive. Figure 3.2 is used to convey the research timeline and variation in data collection points necessary for observing LS enactment over time. Table 3.3 indicates how each of the data collection tools was used to gather data to answer the research questions.

3.9.1 Field Notes

Having gained informed consent and access to science teachers, handwritten field notes and a research diary were added to throughout the data collection phase. Field notes were chosen as a data collection tool as they could be written in situ and away from the situation in an unintrusive manner (Cohen, Mannion and Morrison, 2000). Field notes also offered a form of unstructured observation of the social context (Kirk and Miller, 1986) of the school and LS setting that could be drawn upon at later date adding to the *theoretical validity* of the study (Section 3.12. Field notes were written about each school context before, during and after each school visit. Notes were made on anything that stood out in relation to the research questions, for example first impressions of the school environment and their science departments. This was so I could picture each local school context

clearly during data analysis and case study writing creating thick descriptions (Geertz, 1973) of the contexts and of LS enactments.

3.9.2 Semi Structured Interviews

Bearing in mind that LS is so variable (Section 2.2), the research questions could not be too tightly configured at this stage in the study. However, the semi-structured interview was chosen as the main data collection instrument, as a *window* into teachers' perceptions and understandings of LS. Semi-structured interviews offered a data collection method where there was scope for the researcher to be both an active and encouraging listener and to take part in conversations without being too leading or direct (Carspecken, 1996). This required careful planning and preparation of interview schedules right down to the detail of opening statements, pacing and prompts and structured themes (Silverman, 2005; Atkins and Wallace, 2012). The semi structured interviews were used as a way to gather not only facts, and to access teachers; beliefs and motivations, but also as the central tool to surface and identify any artefacts that were representative of the teacher's beliefs, understanding, values actions and decisions during LS. This intensive, but flexible interviewing approach was designed to permit an in-depth exploration of topics and go beneath the surface of an ordinary conversations as needed and by asking to clarify details (Charmaz, 2016).

In order to carefully plan the semi -structured interview schedule, permission was sought to pilot a semi-structured interview with a science teacher working in one of the schools (Overton). Piloting was used to assess interview length, try out questions and prompts, refine research questions and explore approaches data analysis. Together, initial school visits and interview piloting provided the verification that a case study research methodology, using field notes and semi-structured interviews offered a way of uncovering teacher realities (Miller and Glassner, 2011) as a way to explore LS enactment to meet the research aims and to answer the research questions.

Two interview schedules were designed—one to be used in the early stages of a LS cycle (INT1) and one to be used later towards the end of a LS cycle (INT2). Supplementary questions were added for use with science teachers acting as LS facilitators (Appendices B1 and B2). Each interview was designed to last 30 to 45 minutes and scheduled to take place at a time convenient to participants with minimum disruption to the school day. Early interviews (Appendix B1) were used to deepen trust with research participants and gather additional background information by talking with teachers about their routes into teaching, exploring the focus of the LS cycle, its purpose, and their expectations. Follow-up interviews (Appendix B2) were produced after initial analysis of early interview data and towards the end or after a LS cycle was completed. This was anticipated as 12 weeks from the start of each LS cycle, based on conversations with LS facilitators. Follow-up interviews were designed to explore teachers' participation and engagement in LS, reveal how the LS process unfolded and to delve deeper into teachers' perceptions and understandings as they participated in LS. Follow-up interviews were also used to explore and extend any initial analysis, corroborate initial findings, and triangulate with other data. For example, if teachers referred to a particular challenge of LS or related their participation in LS to aspects of teaching and learning or wider practice, these could be further explored. Both early and follow-up interview schedules were adhered to carefully as far as possible (with every question being asked or supported by prompts). However, if a teacher response needed more explanation or appeared to offer a rich insight into their perceptions, decisions, or actions, in relation to LS, discussions were opened further. For instance, by asking a participant to expand on something such as "can you tell what you mean by linking with Master study?" or "can you tell me more about what you mean by wanting to have someone else in the classroom?" Using this instinctive discussion technique meant that there was sufficient flexibility for two-way dialogue with teachers while still maintaining some consistency in data collection overall. Although, this proved to be far easier in early interviews compared to the follow-up interviews, because the three school-based LS groups had progressed through LS cycles at different paces and in different ways (Figure 3.2). This meant that follow-up interview schedules

had to be adapted in situ, to some extent, as some planned questions became irrelevant or inappropriate. Besides, as participants began to volunteer their LS resources and outputs, it was more productive and valuable to refer to these *LS artefacts* during interviews as another *window* to LS enactment. Unfortunately, it was not possible to carry out a follow up interview at Ashgate College as the LS facilitator moved schools and it was not possible to gain further access to teachers.

In summary, semi-structured interviews were designed to be used with some consistency yet flexibility to enable the gathering of rich contextualised data that could be compared across schools and research participants. All interviews were audio recorded with prior permission of each participant and transcribed fully after each interview.

3.9.3 Lesson Study Artefacts

Yin (2003) emphasises that in case study research it is necessary to collect data from multiple sources to improve the *validity* of analyses. Furthermore, as the theorisation and analysis of teacher learning in LS was framed by Wenger's (2000) communities of practice theory and complex thinking (Opfer and Pedder, 2011), it was important to recognise that a LS group may establish and maintain itself through social interactions. These social interactions may be mediated within and across each learning sub-system and as common understandings are turned into meaningful artefacts – such as a research lesson plan or a tool to assess student understanding. Therefore, findings from the data gathered and analysed through semi-structured interviews and field notes would be more *reliable* if validated by *artefacts* that LS participants were prepared to share with the researcher or talk about in interviews, emails and during school visits.

As such teachers were invited to share any outcomes, ideas and resources that had or were being produced through their participations in LS. These artefacts were gathered either directly during school visits and during interviews, sent on to the researcher by email or identified and *extracted* and interpreted by the researcher form interview transcripts and during analysis. LS artefacts

predominantly took the concrete form of LS guidebooks, protocols, schedules, planning templates and posters disseminating LS outcomes or promoting LS (Table 4.1.2 and 4.3.2). As either concrete or abstract artefacts and sources of secondary data this allowed for some tracing and interpretation of teachers' reported enactments of LS. For example, the existence a clear research goal was indicated in posters and protocols but also in teacher accounts and reflections. Detailed descriptions of LS artefacts, their purposes and significance, was then included in the individual written school case studies (Chapter 4). In this sense, I considered these artefacts during analysis as devices that mediated teacher learning and were representations of participation and reification during LS.

Table 3.3 Data Collection Tools and Research Questions

Research Questions	Field Notes	Early and Follow-up Interviews	LS Artefacts
RQ 1. What are science teachers' perceptions and understandings of Lesson Study?		✓	✓
RQ2. How do science teachers enact Lesson Study in their local/school contexts?		✓	✓
RQ3. How do school contexts feature in the enactment of Lesson Study?	✓	✓	

Academic Year 2015-16 – *School Recruitment*					Academic Year 2016-17 – *Data Collection and Analysis*						
April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar

Overton Academy   **Lesson Study Cycle 1**

Treebank Secondary   **Lesson Study Cycle 1**   **Lesson Study Cycle 2**

Ashgate College   **Lesson Study Cycle 1**

INTERVIEW 1 OVERTON

INTERVIEW 2 OVERTON

SCHOOL VISIT OVERTON

SCHOOL VISIT TREEBANK

Field notes, email communications, artefact collection

SCHOOL VISIT ASHGATE

INTERVIEW 1 TREEBANK

INTERVIEW 1 ASHGATE

INTERVIEW 2 TREEBANK

Figure 3.2 Research Timeline and Lesson Study Cycle

3.10   Data Analysis

The research perspective on teacher learning in this study is influenced by social learning theories that acknowledge the significance of social interaction and social learning systems (Wenger, 2000). The approach to data analysis took account of this theoretical perspective by framing the research questions and analysis of LS enactment as taking place within a highly contextualised and collaborative social process occurring across and within three interacting and interrelated sub-systems. This deep, contextualised knowledge of LS enactment was captured by analysing the multiple realities communicated by science teachers during interviews and evidenced in field notes and LS artefacts. To elaborate on and extend Opfer and Pedder's' (2011) notion of non-linearity and complexity, rich descriptions of the characteristics and components of each the teacher learning sub-system, the learning activity sub-system, and the school learning sub-system were produced.

This section illustrates an iterative four stage approach to data analysis (Sections 3.10.1 to 3.10.4) and coding process, used to systematically search, examine, and synthesise data drawing on common qualitative research principles and protocols and theory (Lincoln and Guba, 1985). Stages such as preparation and familiarisation with data, the application of open and axial coding processes through to thematic and theoretical analysis is described and illustrated using examples in tables and figures.

3.10.1 Preparation of and Familiarisation with Data

A catalogue system was developed and set up an in password protected area. Cataloguing was used to get a sense of the whole data set obtained and what was realistically possible in terms of in-depth and rigorous analysis. A folder was created for each secondary school containing subfolders within which individual teacher data could be deposited as audio recordings, transcripts, field notes and artefacts. Immediately after a school visit, interviews were transcribed verbatim as word documents, acknowledging that within a naturalistic enquiry language is

considered to provide a key insight into socially constructed worlds. This also meant that teacher accounts were recorded with minimal interpretation at this early stage. Limited editing was used to organise and separate out researcher questions and prompts or to highlight any significant gestures or utterances. This guaranteed that participant responses were captured in a form that could be examined, revisited, and compared constantly across schools and participants as data were generated and analysed.

The following steps were then used to become familiar with interview data specifically:

- rereading of transcripts and re-listening to audio recordings of each individual interview
- highlighting sections of text that appeared to relate to the components and characteristics of each learning sub-system (Section 2.4, Figure 2.3) and or were thought to carry significant meaning in relation to the research questions
- identifying key quotes, patterns, similarities, and differences and focussing on aspects of LS as a social phenomenon e.g. collaboration, challenge.

The following steps were then used to become familiar with LS artefacts:

- cataloguing according to when the artefact was shared, by whom, and why and giving descriptions of context/purposes where possible and noting any relevance to the research questions (Table 3.6)
- annotations on interviews when artefacts were referred to by participants or there seemed to be a connection.

The full data set included 15 semi-structured interviews, 7 LS artefacts from Overton Academy and 5 LS artefacts from Ashgate College and a set of field notes for each school.

3.10.2 Reduction and Interpretation of Data

This early stage of analysis drew on the theoretical and analytical framing of teacher learning in LS as complex system comprising of three nested sub-systems (Figure 2.3). For example, early analysis of the features and components of the teacher learning sub-system was started by seeking out and identifying any data that gave an indication of teachers' understandings of or motivations to participate in LS for their PD. Similarly early analysis of the school learning sub-system started by seeking out and identifying any data that gave an indication or impression of the school's ethos and values in relation to teacher PD and conditions that may support teachers' learning.

3.10.2.1.Open Coding

At this early stage of data analysis, the development of a coding strategy was guided by types of phenomena that could be coded e.g. behaviours, strategies, and attitudes (Burnard, 2006) and by defining coding as the analytical process through which "data are fractured, conceptualised, and integrated to form theory" (Strauss and Corbin, 1998, p.3).

To ensure *trustworthiness,* I identified and retained excerpts of participant's own words as text as they had appeared in interview transcripts or as artefacts. This was to ensure that that my own interpretations as the researcher could stay as close to the intents and meanings of the participants. Codes produced at this stage produced were loose and tentative, but to be systematic the processes of in vivo, descriptive, process and structural coding, as outlined in Table 3.3 below were used to reduce and breakdown the raw data.

Table 3.3 Open Coding Concepts and Process

Coding concept	Process
In vivo	coding of transcript excerpts and text based on a participant's own words
Descriptive coding	summarising the content of the text into a description – code name captures primary topics/content of data
Process coding	word or phrases that captured actions (evidence of enactment) looking for textual data that end with "ing".
Structural coding	sections of text categorised according to the RQs or the three learning sub-system components e.g. teacher values, roles, learning activities, local practices
Pattern coding	coding for patterns in data, grouping similarly coded text and phrases within and across interview transcripts

This process of systematically assigning early *apriori* codes to segments and extracts of texts from interview transcripts and artefacts in this way, was repeated as data was collected from each school setting. Figures 3.3 and 3.4 below show examples of the open coding process applied to two extracts of text from different parts of an early interview transcript from a teacher at Overton school. Any new codes generated at this stage were identified as *aposteriori*.

that, in some way, than you did in your other school?

Sure, okay, thank you. How did you hear about 'Lesson Study', then?

beliefs

motrdic

RQ1

RQ2

and biology, because they're just as important as physics.

Lesson Study I heard from one of my colleagues, and they had quite a good sales pitch prepared. What I found very positive about it and very refreshing about it is that I often find, with the way the education system is implemented and the way that ideas are put forward, it seems to be on the whim of politicians. It seems to be implemented with lots of observation bias from lots of personal experience.

I really liked the idea of doing something that was grounded in academic research, that would have a process whereby we take an idea, take a hypothesis; we test it, we evaluate it, and get that more concrete idea of what works and what doesn't work.

ornntche to LS

values

achai resting

So, you mentioned the idea of a sales pitch; did this come across in the sales pitch, then, that it was that kind of process?

values

The key points that I took from it was it was an academic study. I think, for a system that is all about education, there aren't enough academic studies done for the size of the workforce and the impact that it has.

I would say a lesson study, I think, should be a requirement of schools to have that level of discussion about what

achai/pncess

Figure 3.3 Example of Open Coding showing of In vivo, Descriptive and Structural Coding of Interview Transcript
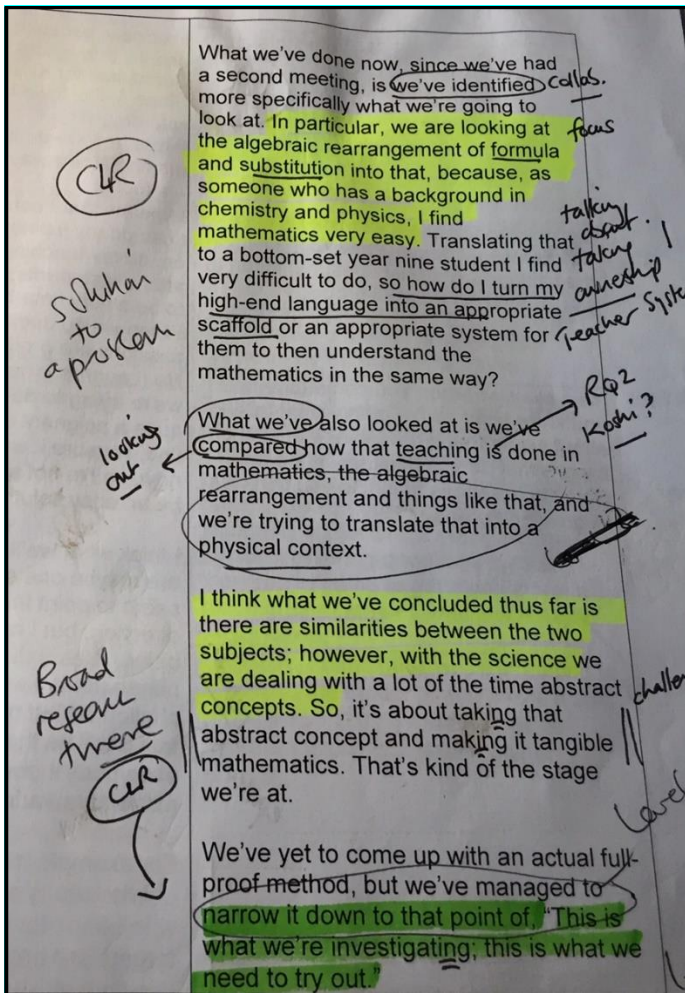
Figure 3.4 Example of Open Coding Showing Process and Pattern Coding of Interview Transcript

An example of the outcomes of open coding carried out across all early interviews transcripts is shown in Table 3.4. This table shows how the process of open coding started to reveal patterns and differences in the teachers' responses regarding their decisions to take part in LS and their expectations. At this point, whole segments of texts, sentences and phrases that appeared to carry significant meaning in relation to the research questions were highlighted and underlined. I could then further ensure *reliability* and *trustworthiness* in the findings, by accurately retaining and representing the participants' voices and actions when writing the individual school case studies and cross case analysis.

Table 3.4 Teacher Learning Sub-System Analysis—Example of Outcomes of Open Coding

Teacher (*using Pseudonyms*)	Data extract—in vivo phrases highlighted (*motivations for LS*)	*a priori* codes	*posteriori* codes
Overton Academy			
Lucy	*I think the nice thing about Lesson Study is, it goes Ok, so let's take all of the <u>lesson judgements and whether or not you're a competent</u> teacher out of the equation, and look at <u>why you are teaching the way you're teaching?</u>* <u>*(INT 1)*</u>	- **develops pedagogical understanding** - **observing teaching**	- **non-judgemental** - **teaching competence**
Joe	*I really liked the idea of doing something that was <u>grounded in academic research that would have a process whereby we take an idea, take a hypothesis: we test it, evaluate and get more of a concrete idea of what works and what doesn't work.</u>(INT 1)*	- **develops pedagogical knowledge and understanding** - **research process**	- **tests out ideas scientifically** - **collaborative process**

Teacher (*using Pseudonyms*)	Data extract—in vivo phrases highlighted (*motivations for LS*)	*a priori* codes	*posteriori* codes
Kate	*I think the trouble we have is, you're <u>constantly being observed</u> for various other reasons and you get a bit bored with it. So this, I think, <u>is a lot more constructive in the observation</u> and you are <u>focussed on the kids. (INT 2)</u>*	- observations - focussed on student learning	- teacher engagement - productive form of observation - unclear purpose
Treebank Secondary			
Ivan	*The benefits for me would just be having somebody<u>, one of my peers, in my lessons, and being able to discuss</u> with them how it could be improved without that background of me <u>being judged against anything. (INT2)</u>*	- collaborative process - classroom observation	- non-judgemental - feedback on teaching by peers or others

Teacher (*using Pseudonyms*)	Data extract—in vivo phrases highlighted (*motivations for LS*)	*a priori* codes	*posteriori* codes
Carole	I was interested in it anyway because <u>I've just finished my master's in education, so I'm quite interested in all of this little research type things.</u> *For me, it's just professional development, really, and experience in, I suppose, managing the curriculum without actually teaching it.* (INT 1)	- research process	- curriculum management, - fit with role - master's study - personal development - gain experience
Mike	<u>*I thought it was a way I could give something back, really, by working with others,*</u> *and for this study and your study, and results and data, and hopefully, for my own professional development, really.* <u>*I could learn off others at the same time.*</u> (INT 1)	- collaborative process	- reciprocity - personal development - research value
Adele	*Well, you rarely get the opportunity to see other people teach, and <u>the way that they do that,</u> and the resources that they have, and the systems they've got in place.*	- classroom observation - share pedagogical knowledge	- lack of opportunity to observe peer teaching - systems

Teacher (*using Pseudonyms*)	Data extract—in vivo phrases highlighted (*motivations for LS*)	*a priori* codes	*posteriori* codes
	Looking at that is really useful for any teaching and any sort of practice." (INT 2)		- wider application
Ashgate College			
Shona	*It helped me a lot because I am currently finishing off my Masters in Education. It's actually due in on Friday. So it was quite nice seeing if what I was doing matched up to what they were expecting as a whole school and vice versa. "* (INT 2)	- school goals	- connections with higher academic study - checking own performance
Lea	*I hope that the students benefit from it. Not just this cohort, but the future cohorts to come. I don't really know how to put it into words. I think to become a better teacher is probably the best way to summarise it. I just want the students to do well, and I hope that lesson study will help me to help the students do well.* (INT 2)	- improving teaching and learning	- benefits wider practice - student focussed

Teacher (*using Pseudonyms*)	Data extract—in vivo phrases highlighted (*motivations for LS*)	*a priori* codes	*posteriori* codes
Mohammed	*I think with this <u>you have a lot more flexibility, where you yourself can actually influence the way in which the learning actually takes place, and how it takes place, rather than just following a formulae method,</u> which is just, again, I'll use the word 'robotic'. As a teacher, <u>it's for me to understand what works and what doesn't work with students,</u> because not only am I trying to make the students better learners, but it's for me to understand, what is a better learner?* (INT2)	- develops pedagogical understanding - help students/ become a better teacher - understand student learning	- flexibility - more influence on student learning - personalised learning
Frankie	*"Lesson Study is used to <u>professionally develop someone themselves</u> rather than driving agenda, and I think Lesson Study <u>can't be linked to performance management</u>. If it is, then it loses that impact, because <u>then people don't feel like taking risks</u>.* (INT 1)	- teacher focussed - anti- performativity	- personal development - decoupling with performance management - risk-taking

3.10.2.2.Axial Coding

To identify and make links and connections across the whole data set, axial coding was used to identify and group codes into categories. Categories were assigned by drawing connections and linking codes to identify patterns, similarities, and differences and to further reduce the data set as a whole. Categories were also assigned by looking for word repetitions or common phrases such as "non-judgemental" or how certain words and phrases were used by teachers in context. For example, individual teacher references and the ways they talked about "classroom observation" and "student outcomes" and their intended meanings. Categories were then refined and *verified* by constant comparison with all other parts of the data to explore and identify variations, similarities and differences.

In addition any text that was deemed to not be relevant was crossed out for clarity—for example, if teachers talked at length about a topic that was not pertinent to the aims of this study and the research questions. Data reduction from codes to categories was used repeatedly to gain an indication of strength of feelings, commonalities or differences in teachers' views, beliefs, understandings, and actions. Table 3.5 shows the process of moving from codes to categories in relation to teachers' motivations for participating in of LS.

Table 3.5 Analysis of the Teacher Learning Sub-system—Codes to Categories.

Open codes	Categories
fit with role fit with other PD plans connecting LS with practice	coherence mutual benefits
choice over focus decide on what/how to teach decide on what/how to learn	Control making decisions
working with others learning from peers giving something back share and solve problems	collaborative joint enterprise peer validation
trying things out non-judgemental everyone taking part developing relationships	safe and secure building trust taking risks sharing accountability
testing what works (in classrooms) looking at students learning understanding teaching	researching pedagogy building evidence building knowledge

As field notes, interview transcripts were being analysed, exploration of each the sub-systems was enhanced by the process of cataloguing and mapping of any concrete artefacts, such LS guidebooks and templates, which provided some supporting evidence of the teachers' actions and their intentions either as LS facilitators or as participants. Initial cataloguing of artefacts was based on the

researcher's analysis and in relation to the significance to research questions, as shown in the Table 3.6.

Table 3.6 Cataloguing of Lesson Study Artefacts

LS Artefact	Source	Description	Purpose/Use	Significance to Research Questions
ATF 1, Overton – LS Guidebook	Lucy, School A, Interview 1	20-page workbook for participants to complete and refer to	To support participants in planning, carrying out and completing LS cycles	RQ 1 evidence of LS model, facilitator intentions, emphasis on teacher enquiry focus
ATF 1, Ashgate – An Introduction to LS	NTEN website, accessed 07/12/2015	Power point presentation produced by external PD provide	To introduce NTEN model of LS, outline process	evidence of LS model e.g. Scaffolding the diagnostic phase, and producing enquiry questions

A detailed example of this stage is shown below using a LS artefact, provided by Linda, the LS facilitator at Overton. Linda wrote a welcome letter (Overton, ATF3a) to promote LS across a chain of schools and to encourage teachers to attend LS taster sessions. The text in this LS artefact was coded and cross referenced with interview transcripts from the LS participants and from Linda, as the facilitator. One can see from the coded text in the LS artefact (Figure 3.5a) – that Linda refers to other teachers as being able to "witness the next stage in the LS process and eavesdrop on the sorts of conversations that teachers are having". This provides evidence that Linda believes that LS should be a collaborative and dialogic process. When this data extract is considered and compared with an interview extracts from Katy as a LS participants, we can see how this Katy also valued collaboration through social interactions and dialogue with peers. In Katy's interview, this implied by a desire for collaboration by saying that" *you need that initial burst where you all sit down and come up with whatever the target is*" (Figure 3.5b).

**Figure 3.5a and Figure 3.5b Axial Coding of LS Artefacts
and Interview Transcript from Overton School**

As field notes, interview transcripts and artefacts continued to be analysed together, this also meant that each school data set could be interrogated by cross referencing to the features of Collaborative Lesson Research (CLR) (Takahashi and McDougal, 2016). The features of CLR was used tentatively as a benchmark of effective LS. A summary of the outcomes of this step is in Table 3.7.

Table 3.7 Evidence of the Features of Effective Lesson Study

Features of Effective Lesson Study	Description and Details (adapted from Takahashi and MacDougal, 2016)	Overton	Treebank	Ashgate
Clear Research Purpose	Focussed on understanding the teaching of specific subject content	✓	✓	✓
	Desired outcomes for students identified	✓		✓
Kyouzai kenkyuu	Careful study of academic content (literature review) and teaching materials	✓		✓
	Looks at learning trajectories related to topics, between grades	✓		
	Review of standard and curriculum, exploration of other national curriculums	✓		
	Research into pedagogical issues (e.g. misconceptions around the topic)	✓		
	Considerations of possible tasks or materials to use with pupils	✓	✓	✓
A written research proposal/lesson	Detailed research lesson proposal document that includes enquiry questions, lesson outline and task design			
	Strong focus on collecting data on how pupils respond to research themes during observations			✓
A live research lesson and post lesson discussion	One member of the team teaches a lesson that is observed by the whole planning team and additional people Post-lesson discussion as soon as possible after the lesson and moderated by an objective person		✓	
Knowledgeable others	Extensive support provided to the team in planning and post lesson discussion from someone who has deep knowledge and understanding of the subject matter, curriculum, and students	✓		
Sharing of results	Sharing of research proposal/outcomes more widely with other teachers, schools, and communities	✓		✓

3.10.2.3. Thematic Coding

Thematic coding was then used to understand the contextualisation of LS by considering and trying to identify any interactions and interrelationships between each of the learning sub-systems. Thematic coding involved marking or identifying passages of text that were linked by a common theme or idea. This allowed me to develop a framework of thematic ideas about teachers' perceptions, participation and engagements in LS (Gibbs, 2007). This reflective and inductive approach was taken to identify and propose emerging themes that were important to the research questions and represented some level of patterned response or meaning within the data set. Predominant themes emerging in relation to the categories chosen in each sub-system are outlined in Table 3.8 below.

Table 3.8 Emerging Themes and Learning Subsystem Features

Teacher Learning Subsystem	
Theme: professional autonomy and agency	**Theme: collegiality, collaboration**
Categories • desire to lead own PD • make decisions • choose focus/priorities • coherence, • follow through actions • change own practice	**Categories** • non hierarchical • non-judgemental • shared accountability • peer validation
Learning Activity Sub-system	
Theme: improved educational outcomes	**Theme: research process, engagement, confidence**
Categories • student benefits • teacher benefits • Material benefits (better teaching resources/lessons)	**Categories** • diagnosing issues • academic study • teacher epistemologies/identities • past experiences with academic study • evidence based process • systematic/rigorous • building knowledge and understanding • reflecting on practice

School Learning Sub-system	
Theme: leadership and support for LS	**Theme: social structures**
Categories • campaigning/lobbying • guiding/scaffolding • Coordinating • modelling • recruiting • managing resources • managing learning • expertise • investment	**Categories** • internal networks groups • external networks/brokers • learning communities • open/closed classrooms • events/opportunities • shared goals

3.10.2.4 Theoretical Coding

The final and fourth stage of analysis involved comparing and contrasting each case study against emerging themes to produce analytical memos. The writing of analytical memos was guided by reengagement with the theoretical and analytical framing of the study (Figure 2.3). For example, by exploring emerging themes from the perspective of the teacher learning sub-system, one could propose ways in which the science teachers' perceptions, understandings, skills and knowledge were related to emerging themes within the learning activity sub-system. That is, as Opfer and Pedder (2011) have proposed, these teachers' professional identities and learning orientations may have featured in or shaped the teachers interactions with the learning tasks, activities and practices associated with the intended LS model and expected of them. Alternatively, one could look at the learning activity sub- system from the perspective and influence of the school learning sub-system —the school ethos and values towards classroom research or the influence of school priorities or the resources that may have supported teacher's participation in LS or act as boundaries and create discontinuity or disruption to their social interaction.

Writing of analytical memos was also organised and supported through four dimensions of educational contexts that are thought to matter in enactment (Ball et al., 2012) such as the school professional culture, status and material context and catchment. The example below (Figure 3.6) illustrates how an analytical memo was used to start to identify and record different patterns in the ways the teachers' learning orientations started to surface repeatedly in terms of their students' learning. Memos (~ 30) were handwritten on colour coded cards and then used to stimulate and organise case study writing.

Observation: Teachers talking in different ways about how LS may improve their teaching, some referring to students directly, others when and how they want to learn/others thinking about own learning in past

Why/What? What, where is the focus for their, learning, any common triggers, patterns?

Relevance to RQ? What is going on? How are they making decisions? How are they responding? Being motivated?

Figure 3.6 Overton Memo—Teacher Learning Sub-system

3.10.3 Writing of Individual Case Studies

A consistent writing structure was produced to draft an individual school case study (Section 4). This included:

- a brief description of the school status, role in the school led system or designation, teacher biographies and backgrounds and history of LS
- sections guided by the research questions and the theoretical and analytical framing of teacher learning
- descriptions of the characteristics and components of each sub-system
- a summary of each case with distinguishing features highlighted.

Reimmersion with each school's data set enabled further in-depth and reflexive analyses of the teachers' perceptions and understandings of LS, the ways in which the LS process unfolded over time and the contexts for LS enactment. Each individual case study then had more clarity and coherence and could be compared and contrasted (Charmaz, 2016) to illuminate any relationships and interactions within and across each learning sub-system.

The three individual case studies provided in-depth, rich descriptions of LS enactment by science teachers in three different secondary schools settings (Section 4) to directly answer the research questions, by forming the basis for the cross case analysis. .

3.10.4 Cross Case Analysis

The cross-case analysis was used to mobilise knowledge and findings from each individual case study and to reconnect with the literature and conceptualisation of teacher learning in LS. Analytical memos were also used extensively to connect with any new literature and my current reflections and professional practice in LS. This enabled making tentative conceptual leaps from the in-depth immersion with the data. This step was fluid, flexible, reflexive and challenging, but it meant that I could look at the data as whole from different perspectives and in different ways. Using analytical memos, also acted as an aide memoire, helping to build an accurate picture of LS enactment across the three different school settings and to write rich and detailed descriptions of LS enactment (Gerrtz,1973). This final stage of analysis was the most time consuming and immersive phase of data analysis. An example of this analytical and critical thinking process is shown in Figure 3.7.
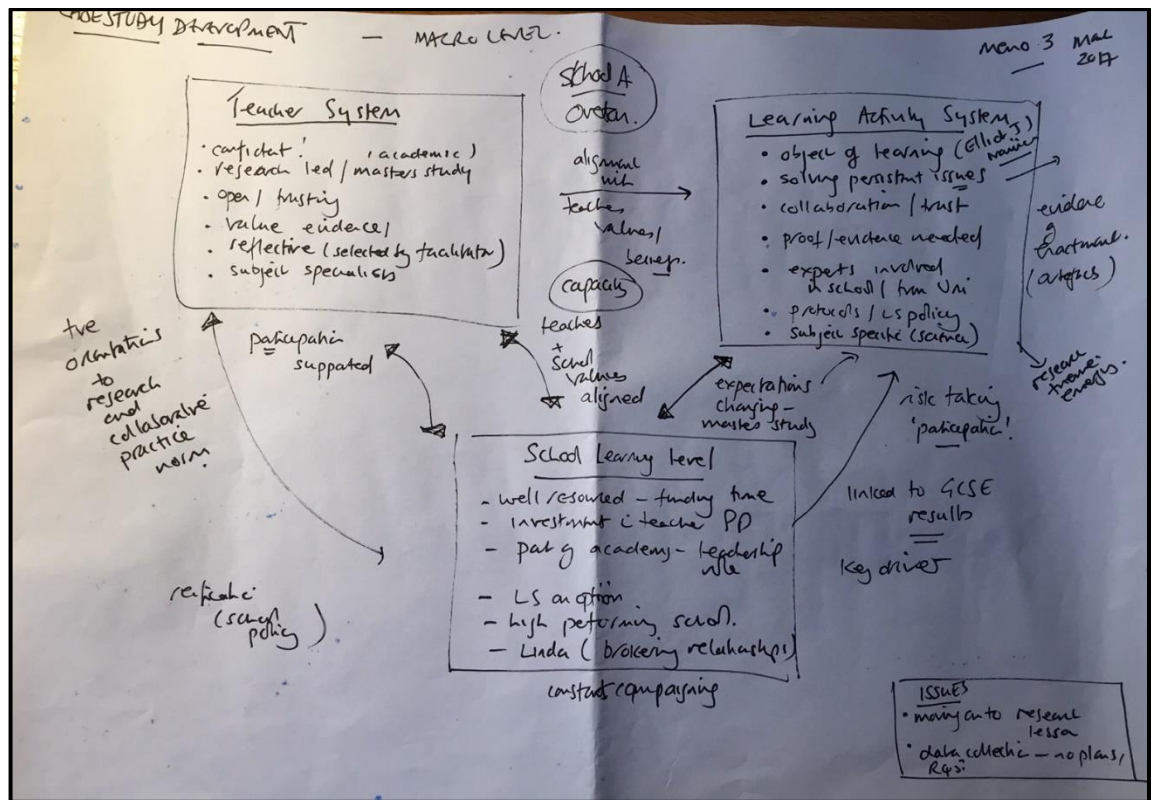
Figure 3.7 Conceptual of the Teacher Learning System (Overton School)

This process enabled the theoretical comparison and contrasting of cases, and in doing so, produce new understandings and knowledge about LS enactment. Looking at the emerging themes meant that I could identify interactions and interrelationships across the three learning sub-systems of teacher learning in LS.

When writing this cross case analysis as the main findings (Section 5), to be systematic, this was structured by tentatively linking each research question to one learning sub-system. The first section of the cross case analysis looks at the *teacher learning sub-system*, to identify any common patterns and similarities in teacher's understandings and perceptions of LS (RQ1). The second section examined the *learning activity sub-system*, through the reported decisions and actions of the teachers during and forms of enactment represented in the LS artefacts (RQ2). The third section took account of the *school learning sub-system* (RQ3), to explore the local conditions that may have afforded or constrained LS enactment.

3.11 Ethical Considerations and Access

The ethical considerations related to the carrying out of this research are laid out in Table 3.8. Ethical approval was given by the University of Leeds (Appendix A4) following their ethics policy at the time. Examples of the email invitation, information and consent forms are included in Appendices A2 and A3. Steps to mitigate and address any ethical issues were considered and addressed. By adhering to the University of Leeds ethical policy and the British Educational Research Associations guidelines for educational (BERA, 2014), it was unlikely that the physical participation in this research would cause any harm to participants. Any harm that could arise was related either to drawing from science teachers' time so they could take part in the research (low risk) or the potential inclusion of any controversial statements, made by teachers in case studies, that could be attributed to individuals. This was addressed by ensuring that data collection was not intrusive or burdensome and the process of anonymity using pseudonyms. All participants are anonymised, and teacher and school identities are protected throughout the study to remove the risk of data being linked back to the schools and individual teachers; this will continue in any subsequent publications or dissemination.

It is important to stress that this research was not intended to evaluate classroom practice, make judgements on or about students or assess teachers' performance. All participants were informed that this was part of a doctoral study that required a close examination of the enactment of LS in a natural setting. The research was designed to not restrict opportunities for participants to reflect on their practice, but more for them to share their experiences and interpretations of LS in a creative and supportive manner. Teachers and schools were advised that they could ask questions or withdraw from the study at any point during the data collection period and completion of study.

I endeavoured to make involvement in the study of value for individuals, for their PD. The outcomes of this study can be shared as a narrative of LS in action in

different secondary school settings that can be made accessible to research participants on request. Data is stored electronically in a password protected area and hard copies of transcripts and LS artefacts and kept in a locked cupboard. A copy of all interview transcripts and audio recordings is available on request. As the intention was not to observe the teachers in the classroom or to interview any students, there was no requirement to seek student or parental consent, as is often the case in educational research settings.

Given my experience in leading LS and to make sure their involvement in the study was of value, if participants asked for advice on LS, I agreed to send guidance and resources after all the data had been collected. Although, withholding this advice and knowledge was challenging and created tension in some situations.

Table 3.9 Ethical Considerations and Access

Principle	Considerations	Steps to address issues
Beneficence	The benefits of this study will be that researcher as a practitioner of LS will have a better understanding of appreciation of the factors that may influence the successful implementation of LS in schools in England.	The study will be used to inform the design of PD programmes and be disseminated through networks, peer reviewed journals and professional practice.
Integrity	The rationale, for the focus on LS as a form of PD, is based on research evidence of the effectiveness of teacher PD and LS. It is understood that I am accountable for how this research was undertaken.	The research did not take place until approved by research supervisors.

Informed Consent	Participants were informed of the aims and methods, of the research, and its anticipated outcomes and benefits.	Participants were provided with a detailed information sheet and had the opportunities to ask questions or withdraw from the study at any point during the six-month data collection period.
	Consent was gained from every participant and recorded.	
	Participants were informed that interviews would be audio recorded, transcribed and quotes may be used in the study and in dissemination activities e.g. conferences and publications.	Teachers signed a form consenting for their responses and artefacts to be used in the study.
Confidentiality/ Anonymity	All research conformed to data protection legislation at that time.	All stored data is held in the researchers own secure network and not on personal computers.
	Any details that would allow individuals to be identified will not be published, or made available, to anybody not involved in the research.	All interviews and artefacts were anonymised at the point of collection.
	All reasonable steps were taken to ensure that confidential details are secure.	

3.12 Validity and Reliability

In naturalistic research studies, validity can be addressed by providing in-depth and rich descriptions of social phenomena—in this case, LS enactment in a natural setting within the specific, bounded contexts of science teachers' professional lives (Bogdan and Biklen, 1998). Seeking validity while seeking *truth* and *trustworthy* findings, meant that the research methodology and design had to be rigorous, systematic, and underpinned by theory. aa

In the data collection phases, *interpretive validity* was acknowledged and evidenced by the researcher's actions and decisions to build and maintain trust with participants by being flexible, open, and honest (Section 3.6). This was achieved by fully outlining the research aims and process, commitment required from participants, collaboratively planning a realistic timeline, and working ethically, while adapting research methods to fit with, rather than, disrupt the natural setting. As such, data collection was situated and could be interpreted within the social settings so that participants' voices, meanings and intentions were analysed as data was collected and prioritised and through informal *respondent validation* in follow up interviews. Participants' quotes were retained in their original form, as were LS artefacts, when coded, analysed and presented in the case studies (Section 3.10) . The intention was to allow the reader to feel as though *they were there, could hear the participants* and *could visualise* their actions and decisions in relation to LS enactment.

Theoretical validity was addressed by locating the study within contemporary thinking and models of professional learning to construct an analytic framework (Section 2.4, Figure 2.3) *and,* by acknowledging and valuing the concepts and ways of thinking about teacher learning used by participants to describe their understandings and experiences. This was required to reveal and explore the complex, non-linear and dynamic nature of teachers' learning. It was also necessary, considering the duration of the study, for the researcher to continue to connect with what is already known about LS and teacher PD. Engaging with the most recent research in LS, helped to recognise the limitations of making

direct causal links between participants' opinions and actions, linking to subsequent impacts on their practice. This meant that the findings would be relevant, realistic and of value to other researchers, to other PD and LS leaders and to other teacher educators.

Triangulation was also considered in the research design, to safeguard validity. The use of more than one data collection method meant that data could be collected and interpreted from different perspectives and at different levels, for examples as individual school case studies or as part of broader as a cross case analysis. Consequently, the researcher could look at the same things—for example, peer collaboration in relation to the learning activities involved in LS or, from the perspective of the school setting and conditions for teachers' learning. Using different theoretical lenses in this way, the different sub-systems of the teacher learning system in LS could be explored and in different combinations (individual, groups of teachers, groups of schools), was also intended to rectify and mitigate against the lack of prolonged time that the researcher could spend in the field.

Reliability was measured and considered in terms of the consistency of using different data collection tools, over time, with different individuals, teacher groupings and in different schools (Section 3.9). It was important that the data collection tools used could collect and capture teachers' perceptions, understandings, experiences and reported actions in a reliable and trustworthy manner. The principal challenge here was how to guarantee that findings would not emanate from data having been influenced *solely* by researchers' beliefs, predispositions and how these may change during the research process. This challenge was addressed by adopting the cognitive process of *bracketing* (particularly before, during and after interviews). The researcher attempted to make clear and put aside thoughts, ideas, presuppositions and personal biases about the topic, for example, recognising a personal belief and conviction that students' learning should be observed, as opposed to the teaching, during research LS. Researcher bias is a key issue in interviews (Larsen, 1958); therefore, the use of semi-structured interviews, keeping to an outline script with

prompts (Section 3.9.2) and the process of mentally bracketing thoughts and assumptions had to be used and sustained through data analysis and interpretation, to minimise any such bias. Experiencing the process of bracketing also reaffirmed and reinforced my decision not to take part in the LS cycles, or offer any guidance on the LS process during the data collection phase. The temptation to seek answers that supported the researchers' preconceived notions of LS enactment could then be resisted. Reliability was also ensured by considering the *confirmability* of findings. A detailed audit trail, through data collection, data analysis, testing emergent themes with data or back in the field, interpretation and theory building is made visible (Section 3.10) as is the revisiting of research questions and the analysis of LS artefacts. Documenting this process adds to the *dependability* of the study and the findings—this research study could be conducted by another researcher and data collected and analysed in similar ways to explore other teachers' experiences of LS for PD in other secondary schools, in England or beyond

This systematic process of data analysis and interpretation, along with attention to detail and depth, meant that the thick descriptions of LS enactment in other settings could be communicated through the words and voices of science teachers. Furthermore, carefully presenting the biographies of teachers, school histories and interpretations of LS, with minimum researcher involvement and interference in LS, meant that the case studies *standalone*—they can be reinterpreted and transferred to similar situations. Albeit, that other researchers, with different backgrounds and less familiarity with this natural setting, may not interpret the data in the same way and come up with the same or similar themes and arguments. The *credibility* of this research study, therefore, will be its explanatory power to make sense to other PD leaders, researchers, and LS practitioners in similar situations; it will not lead to generalised theories. For example, do others think that this account is a good reflection of what happens in practice?

3.13   Limitations of Research Methodology and Design

There are components of this research methodology and design that impact and influence the interpretation and application of findings. Firstly, the study cannot uncover cause and effect relationships—for example, saying that if a teacher desires more *collaboration* with their colleagues that this will improve the quality of their teaching or improve student outcomes. This study can only seek to approach the proposition of relationships or the nature of interactions between different phenomena. Secondly, the study does not attempt to measure the depths or intensities of different factors, such as degrees of teacher participation or motivation to engage in LS or, to predict the outcomes of LS with any precision. Therefore, the decision to adopt a naturalistic inquiry methodology to understand LS enactment, in which the researcher observed, described, and interpreted the experiences and actions of science teachers, means that the findings would lack some generalisability. However, the methodology and findings will be of value to other studies of LS and similar forms of collaborative-research orientated PD carried out in different local school contexts. Finally, the study could only report on ways in which the schools' norms, ethos and workplace conditions featured in the early stages of a LS cycle, by focussing on school histories with LS and the ways in which teachers became involved and responded to LS as an innovation in PD. A study such as this is also time consuming and demanding, the researchers need to be flexible, responsive, able to think under pressure, willing to learn, reflexive and remain present throughout.

Chapter 4 Case Studies

This chapter presents three case studies of Lesson Study (LS) enactment for the purposes of teacher professional development (PD) intended to improve the quality of science teaching in three secondary schools in England (Sections 4.1, 4.2 and 4.3). Using the theoretical analytical framework (Section 2.4) and the features of effective LS (Section 2.3), rich, vivid narratives of LS enactment are presented, and organised in relation to the three research questions (Section 2.5).

- Teacher Perceptions and Understandings of LS
- Teacher Enactments of LS
- School Norms, Ethos and Workplace Conditions
- Case Summary and Distinguishing Features

4.1   Overton Academy

Drawn from the perspectives of four secondary science teachers, one of whom was the Head of Science who undertook the role of LS facilitator, this case study illustrates how LS was piloted in a high performing secondary school and built into the annual PD programme for a chain of schools. With sustained senior leadership support, guidance from a University academic and access to higher academic study at Master's level, the Head of Science introduced, adapted, and evaluated LS as a model for improvement. The Head of Science attributed improved Ofsted inspection ratings and better student performance to teachers' participation in LS. The implementation of LS was led in a strategic manner, over a period of five years, ensuring that the LS process was rigorous, evidence informed and well resourced. Science teachers' enactment of LS and the subsequent evaluation of the process and outcomes culminated in the production of a bespoke LS model and policy for school (Table 4.13, ATF 1). Certain local principles and practices were prioritised to foster collaboration and collegiality in LS groups. Before the start of this study, the science teachers had varying degrees of experience and exposure to LS. Data were collected from mid-

September 2016, when the LS cycle started to February 2017, when teachers were still in the early planning stages of planning a research lesson and refining their research focus (Section 3.8, Figure 3.2).

Overton Academy is a secondary school based in the East of England with over 1200 students on roll between the ages of 11 to 18. Since 2010, in response to the emergence of the self-improving system, in line with policy reforms, the school has undergone many changes in terms of its remit, leadership and workforce. In 2011, the school opened as an Academy[3], three years later, Overton became the leader of a Multi-Academy Trust, gaining a strategic role in improving and maintaining high educational standards across a chain of schools and supporting the development of the teaching workforce.

LS was first piloted at Overton Academy in 2010, in the science department, by the Head of Science who had been introduced to LS as part of a government funded scheme promoting teaching as a Master's profession. Since then, over 20 teachers from different subject disciplines at Overton have selected LS as the main pathway for their PD (Table 4.1.1). Once teachers had expressed an interest in LS, they were matched into small groups of three to four teachers with colleagues from similar subject areas or interests. Each group included a teacher who had had some previous experience of LS. Teachers were provided with a 20-page workbook entitled *Lesson Study @ Overton Academy* (ATF 1). This workbook outlined the intended LS model and provided a set of protocols and templates to guide, scaffold and capture the LS cycle as the Head of Science intended. Termly targets and milestones were set, and teachers were expected to complete one full LS cycle within an academic year.

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[3] An academy is an independent state-funded school funded directly by the government (rather than by a local authority as maintained schools are.

Table 4.1.1 Overton LS Groups and Teaching Foci

Year	LS Group	Participants	Teaching Focus
2011/12	A	Head of Science (Linda) 3 science teachers	isotopes
2012/13	B	6 science teachers (including Linda and Katy)	forces
2013/14	0	*no LS took place*	n/a
2015/16	C	1 science teacher (including Katy), 1 art, 1 English	subject specific vocabulary
2016/17	D	3 science teachers	developing problem solving skills
	E	4 science teachers (including Joe and Katy)	mathematics skills in GCSE science
	F	1 English teacher, 1 drama teacher, 1 science teacher	scaffolding and enquiry-based learning

At the time of data collection, 10 teachers were involved in LS, split across three LS groups, D, E and F (Table 4.1.1). Of these, three science teachers gave consent to take part in this study. The research participants included Linda, the Head of Science, who was facilitating LS and supporting all LS groups, along with Katy and Joe who were working in LS group D. These teachers had each worked in other schools and, in Katy's case, in a former role as a research scientist. Linda was not directly involved in a LS cycle, although she had previously, but was now leading and coordinating LS across the school and introducing LS to other schools. Hence, Linda was identified in this study as a LS facilitator, gate keeper and key informant. Katy had proactively supported the piloting of LS in the science department, was engaged in higher academic Master's study and had recently completed a specialised module on LS. Joe was new to the school (less than two years) but was a confident physics teacher, participating in LS for the first time. Joe and Katy's LS group had been meeting weekly during timetabled PD sessions since the start of the academic year in September 2016, to plan a research lesson. At the end of the data collection period, in February 2017, their LS group were still planning a research lesson. The teachers had not yet carried out any live lesson observations and, hence, not yet engaged in any post research lesson discussions.

Table 4.1.2 Overton Teacher Biographies

Teacher Pseudonym	Subject specialism	Teaching Experience	Status	Remarks
Linda	Chemistry	11 years	Head of Science	LS facilitator,
Katy	Biology	5 years	classroom teacher	retraining after a career as a scientist
Joe	Physics	4 years	classroom teacher	Joined the school two years ago, had worked in two other schools

During the data collection phase (Figure 3.2), teachers were invited to share information and resources related to LS. These were identified as secondary *LS artefacts* (Table 4.1.3) and were provided to the researcher either as hard or electronic copies by participants. Each LS artefact was retained in its original form, catalogued, and referenced in relation to this case study. Linda mostly provided artefacts that had been developed since she introduced LS and produced through participation in higher academic study.

Table 4.1.3 Overton LS Artefacts

Catalogue Number	Artefact	Description	Accessed
ATF 1	Lesson Study Workbook entitled *Lesson Study @ Overton Academy*	20-page workbook outlining the LS model, objectives, timetable, requirements for lesson planning, observations, measurement of outcomes, action planning at each stage	Provided and produced by Linda, Head of Science and LS facilitator
ATF 2	Master's Assignment entitled *Introducing Lesson Study*	6000-word assignment produced for higher academic study, exploring how LS could be introduced and integrated into the academy's PD provision	as above
ATF 3a and 3b	Welcome letter and PowerPoint presentation entitled *Lesson Study @ Overton – what we have learnt so far*	Printed resources produced for LS taster sessions, presented to whole school at the start of the year to explain what LS is and offer a taster LS experience	as above
ATF 4	Booklet entitled *Teach Meet*	A5 booklet providing information about best practice and networking events, speaker profiles and the content of the session on LS	as above
ATF 5a and 5b	LS Poster entitled *Variation Theory based approaches to Teaching Subject Specific Vocabulary with different practical subjects* LS Poster entitled *Developing Problem-Solving Skills through Lesson Study*	A3 posters produced by LS groups to capture and disseminate LS outcomes. Posters include an introduction, method, results, conclusions and references	5a Provided by Katy (2013/4) working in cross-curricular LS group C 5b Provided by Linda but produced by maths teachers in 2015/16

4.1.1 Teacher Perceptions and Understandings of Lesson Study

The account that follows is an analysis of Linda, Katy and Joe's perceptions, and understandings of LS in the early stages of the 2016/17 LS cycle *and* since their previous individual involvements with LS (which varied from zero to five years).

All three teachers at Overton were positive about LS. Linda, was the most passionate and fully committed to LS, seeing LS as an innovation that could benefit individual teachers' teaching practices, and the learning of their students, and wanting to make it work. She was first introduced to LS by an academic during her Master's study. In her assignment (Table 4.12, ATF 2), Linda measured success in terms of teachers' positive responses to LS and to raised student attainment in GCSE science examinations:

> *So, yes, three years, year on year improvement in results.*

> (Linda, INT 1)

After seeing this success, Linda proactively promoted LS to the whole school by offering taster sessions and inviting colleagues to observe her own research lessons (Table 4.13, ATF3a and 3b). Eventually, in July 2016, she gained senior leadership support and to include LS in the PD offer to all schools in the academy chain (Table 4.13, ATF 4) which she promoted at best practice and networking events.

Linda believed that LS has a particular purpose —this vision for LS was clearly and boldly communicated on the first page of the Lesson Study @ Overton Booklet (ATF 1, p1). Linda described how LS could be used to develop teachers' pedagogical knowledge and understandings—particularly in the teaching of topics that she described as being "persistently challenging to teach and for students to learn" (INT, 1):

> *I liked the idea of being able to develop the pedagogy of what we're doing…*
> *Not much work, I feel, goes into developing what we're teaching and how*
> *we're teaching it and why we're teaching it.*

However, Linda was also realistic and somewhat sceptical about how and when LS should be used, questioning whether LS was an appropriate form of PD for all teachers and whether it would be welcomed as an innovation by everyone (ATF 2). This was based on her beliefs about teachers' and their professional identities; Linda described how she thought that teachers needed to be *receptive* to LS. She thought that it was important for teachers to not only understand the nature of LS but also what teachers would be required to do and why:

> *I think where you've got teachers who are not reflective practitioners—that can be difficult to get them to understand what it actually is. And so, I think in terms of introducing it to staff, you have to be mindful who you are tasking with it and why you are tasking it to them.*

Conscious of the concerns, skills and experience of her colleagues and the challenges of introducing LS, Linda carefully targeted likeminded and reflective teachers to be *early adopters* of LS. She described such teachers as "being in a certain professional space and willing to try out new things" (INT 1). She also recognised that she would need to convince senior leaders of the potential of LS. She wanted senior leaders to also understand the essential components and principles of LS, the support, the resources, and the commitment of effort and time that would be required. Linda explained how she sought to gain *buy in* by inviting senior leaders and teachers to observe her own research lessons and through taster workshops designed to explicitly model different parts of a LS cycle. Linda was determined to build trust and confidence in her colleagues to take part. (ATF 3a and 3b):

> *We've done a couple of things, we had a teach-meet in January this year, and we had one last year, where we did like a little seminar session where teachers could come along and just find out what it was. So, we've introduced them to the concept before they really sort of got on board with jumping in there and doing any of it.*

Linda described how she engineered meetings between senior leaders, former LS participants and an academic from a local University (ATF 2). This was her key strategy in gaining *buy in* for LS and campaign for practical support and resources for LS, such as *protecting* colleagues' LS meeting and planning time on a regular basis. Linda wanted her colleagues to have the same opportunities as she had had through higher academic study, access to research, expertise and academics she identified as "knowledgeable others*":*

> *I invited them along to a meeting with our "knowledgeable other", Professor X. Also present were two members of the senior leadership team, one for Teaching and Learning and one […] Director of Specialism and another colleague who was undertaking a Master's at the time. This approach worked well in getting a group of teachers together to complete a LS cycle and in gaining the attention and interest of senior leadership.*

(ATF 2, p8)

Linda came up with creative solutions to protect time for colleagues. She found ways to use what she described as "gain time*"* when students are on study leave (INT 2) and she received approval to allocate part of the science department's budget to sponsor other colleagues to engage in Master's study.

Against this backdrop of proactivity and tenacious campaigning, Linda was mindful of the fragility of LS. On several occasions, she referred to a "risk ", meaning that certain practices and principles could go unnoticed by colleagues, maybe undervalued, or simply overlooked. To counteract this, Linda produced a 17-page workbook setting out the protocols and policies for LS at Overton (Table 4.13, ATF1). The workbook outlined the purposes, objectives, and the intended model for LS, as well as the "ground rules", a set of protocols and writing templates for carrying out each stage of a LS cycle. Linda even attempted to explicitly direct teacher discussions, in planning meetings in ways that were not seen as judgemental (Figure 4.1.1). Evidently, Linda wanted to position LS outside of school performance regimes and measures, encouraging teachers to

avoid dialogue that referred to Ofsted, for example, and school inspection practices (ATF 1, p4). Furthermore, Linda emphasised collegiality, equality and shared contribution (ATF 1, p6); attention to evidence-informed practice (ATF 1, p4) and improving student outcomes, as the underpinning principles and practices of LS (ATF 1, p9, 10, 12).

Ground Rules

1. No one is an expert.
2. Every group member has a perspective and has to contribute.
3. Be grounded in research[—]do not reinvent the wheel.
4. Every group member has to deliver the lesson.
5. Observation[s] are of students and how they engage [] in the collaborative planned lesson.
6. DO NOT use formal observation sheets or OFSTED language when discussing the lesson.

Figure 4.1.1 Overton Extract from Lesson Study Booklet

(ATF 1, p4)

Linda was a determined and steadfast *pioneer* of LS at Overton. She was prepared to adapt and refine LS, learn through her own research, practices, and experiences, listen to colleagues and constantly lobby for support and engagement in LS (ATF 3a, 3b, 4). Implementing and participating in LS had played a central part in Linda's own professional learning and practices for over five years, and she brought her own perspective and values to the innovation. Linda had concluded that for LS to be effective, it needed to be regarded and undertaken as a collaborative, non-judgemental and rigorous process. In this way, LS could help teachers understand more about their students' learning and how this related to teaching:

> *I think the nice thing about Lesson Study is, it goes "Ok, so let's take all of the lesson judgements and whether or not you're a competent teacher out of the equation, and look at why are you teaching the way you're teaching? What is teaching? What is learning? What does that learning really look like?"*

> (Linda, INT 2)

The LS artefacts shared by Linda, and as will be seen later in the reflections by Katy, could be regarded as an accumulation and symbolic representation of Linda's beliefs and, to a lesser extent, her colleagues' perceptions of LS, acquired through their experiences. Linda's efforts to introduce LS in own her school and beyond showed how much she valued voluntary participation, positioning LS outside the demands and pressures of teacher performance while emphasising the need for adequate resourcing and senior leadership support.

This proactive *anti-performative* positioning of LS was cited as one of the reasons why LS appealed to Joe and Katy as a pathway for their PD. Katy, a biology specialist, who had a recently changed career from a research scientist, was an early LS participant—described here as an *early adopter*. Katy fully supported the initial pilot and introduction of LS into the science department, explaining how she was confident in her teaching subject matter but was drawn to LS by the prospect of being observed in what she described as a "more constructive and enjoyable manner*" (INT 1). Katy was frustrated about being repeatedly observed in ways

that she did not value or find productive, seeing LS as a more effective way of finding out how and why her students were learning:

> *I think the trouble we have is, you're constantly being observed for various other reasons and you get a bit bored with it. So, this, I think, is a lot more constructive in the observation and you are focussed on the kids.*

> (Katy, INT 2)

Katy also embraced Linda's values and vision for LS—that it would be a collaborative, non-judgemental, non-hierarchical, and productive process. She and her colleagues would share responsibility, which meant that LS would be *risk free:*

> *The principle of our LS is we'll all plan the lesson together and we'll all observe the lesson being done. There's no hierarchy in this group; it's all on the same level. That way, if the lesson goes wrong when three other people are observing you, you all have to take a shared responsibility, because it's something you've planned together.*

> (Katy, INT 1)

> *I'm just coming in to have a look and see what's going on and, you know, there's none of this judgement and performance level put to it.*

> (Katy, INT 2)

When asked specifically why she preferred a LS approach to classroom observation rather than the current school practices, Katy talked about how it would provide opportunities to observe and to focus on student learning specifically without distractions, providing time and structure for deeper reflection:

> *I think it's the reflecting on it and going back to it, because I think the planning the lesson together is good, and I think sometimes we don't do enough of that, but I think it was then actually sitting in and observing and it's focussing on the pupils and what they were learning, rather than other things in the classroom.*

Having participated in LS for three years, Katy believed that LS had improved her teaching; she had also been able to connect her participation in LS with her other professional learning practices and interests. She described how working more closely with Joe and Linda in LS had afforded her wider benefits—particularly towards her higher academic studies as she gained more access to the knowledge and skills of her peers:

> *I am looking at enquiry-based learning, so I have actually got Joe and Linda; the same people helping me do it… I['ve] got them doing this as a side-line, when I realised, they were quite up for it.*

(Katy, INT 2)

Katy's perceptions of LS were bound up in beliefs that LS could be used to improve teaching collectively and in more rigorous and targeted ways. She saw LS as a way for teachers to have access to research and evidence and to develop more consistent pedagogical practices across the department:

> *So, I think if I wasn't doing it, I'd just be doing the same old thing, and sort of doing a little bit of things, but not doing it in such a targeted way.*

(Katy, INT 1)

Katy also talked about how LS had widened her horizons, increasing her confidence to trying out new ideas:

> *I think I tend to try new stuff anyway, but I think it has made me do more … made me more confident in doing more, because even when you've got people in observing you, you think it doesn't matter because we all know it's a trial.*

(Katy, INT 2)

In contrast to Linda and Katy, Joe had no previous LS experience and was taking part in LS for the first time. Joe described himself as a capable science teacher,

who tended to work by himself, indicating he had a high sense of self-efficacy and confidence in his teaching:

> *I like to think that in my science teaching, I'm quite creative and I like to think that I'm quite engaging, mainly because fundamentally I'm a show off…when you are demonstrating an experiment or introducing an idea for the first time, there can be a real sense of wonderment to it, to share that with young people I think is very precious indeed.*

(Joe, INT 1)

Joe had responded to invitations to take part in taster sessions. He opted for LS for a specific reason—for his teaching to have an evidence base. His understanding of LS, what was involved and could be achieved, reaffirmed his beliefs that teaching should be an *evidence informed* profession. Joe believed that before making significant changes in education, new approaches should be tested systematically and critiqued, as opposed to being implemented in an ad hoc manner or by those *outside* the system:

> *LS, I heard from one of my colleagues, they had quite a good sales pitch prepared. What I found very positive and refreshing about it is that I often find, with the way the education system is implemented and the ways that ideas are put forward, it seems to be on the whim of politicians.*

(Joe, INT 1)

Joe understood and valued LS as a rigorous research process that almost followed the *scientific method.* Joe saw LS as an innovation that could be used to empirically test out and evaluate teaching strategies revealing how different strategies may or may not work:

> *I really liked the idea of doing something that was grounded in academic research that would have a process whereby we take an idea, take a hypothesis: we test it, evaluate and get more of a concrete idea of what works and what doesn't work.*

(Joe, INT 1)

By having such a scientific process in place that everyone could follow, Joe thought that LS could be tailored to meet different needs whilst *testing out* teaching strategies in different classrooms with different groups of learners:

> *For me it is select an idea that you feel could do with some development in your teaching, so in doing so you are making it a relevant CPD point for you. In a small group, we come up with a way that you can examine that particular idea, and then work out how each of you could then deliver that and test that to see if your way of addressing the difficulty is appropriate or not.*

> (Joe, INT 1)

By participating in LS and its associated approach, Joe could target areas of his teaching that he believed needed to be developed, he could work collaboratively and engage in PD to develop his practice without this being too intrusive or requiring too much commitment:

> *Yes, I think we've made a good step in the right direction. It's a nice CPD for me because it is one that can run in the background; it's not something that's going to dominate my work life.*

> (Joe, INT 2)

Despite being in the early stages of a cycle, Joe seemed convinced that his beliefs and values about evidence informed teaching would be realised. By the second interview, Joe was even more enthusiastic about LS, describing how LS had provided a powerful "thinking tool". Furthermore, LS could be used to address his personal frustration that changes in education are introduced without an evidence base—seeing there was a need for teachers to have deeper, more critical conversations and about their teaching:

> *I think LS, should be a requirement of schools to have that level of discussion about what is working and what isn't working…if something does work and you can tangibly prove it, and then it can only be to the benefit of education as [a] whole and individual students.*

> (Joe, INT 2)

As Joe continued to participate in LS, he talked about how he had started to value the views and ideas of his colleagues more and change his perceptions of them. In accordance with Linda's view that teachers needed to be in a certain professional space for LS, Joe was grateful that he had been able to work with colleagues, whom he now described as "open" and of a similar mind set:

> *I was anticipating a little classroom project that would develop an area. But the reality is that it's changed the format of my thinking. What's really nice is, because a lot of my colleagues are involved in this as well, it appears that they are open to these new ideas, and open to this kind of practice. When that is effectively half of the department I work in, there's a real positive culture there.*

<p align="right">(Joe, INT 2)</p>

And, like Katy, Joe described how he was able to connect his experiences and learning in LS to other areas of his practice:

> *For example, with my sixth form, I've very much taken the Lesson Study format [in] the way I've approached them. I've identified that we're having an issue in terms of attainment at our A level courses. What I've done is I've researched strategies and I've been practicing them with my sixth form to see if it yields any results.*

<p align="right">(Joe, INT 2)</p>

Overall, the three teachers interviewed at Overton were positive about LS and had high expectations for their own teaching, their department and their learners. They each saw LS as a flexible way to inform and improve their teaching in ways that could improve student outcomes and support their wider PD interests and activities. However, teachers questioned the merits and sustainability of LS especially, given it was a new approach and not yet proven to work in the wider education system. For Joe, this echoed his beliefs that any educational innovation needed to be empirically tested and justified, whilst Katy thought for LS to work, teachers needed to experience the process itself, fully, in order to understand how it might work in their settings:

I think that LS does have a lot of positive things to contribute to the profession, I think it has to demonstrate that before it is taken up on a big scale.

(Joe, INT 2)

And I think in terms of how we did it in the science department before, that [sic] was a big learning curve for all of us, because I hadn't even gone through a process of it up until then.

(Katy, INT 2)

Linda, on the other hand, clearly saw this coming—she had recognised that teacher participation needed to be sustained and shown to work, which helps to explains why she was so determined to demonstrate the impacts of LS in both the shorter and longer terms. The next section of this case study considers this challenge in more detail:

LS has an appeal to English teachers, but it does not take long before they begin to realise the significant inherent differences between it and more traditional experiences of CPD. For these teachers to remain invested in this approach, a shift in mind set is required which not everyone is necessarily prepared or able to do.

(Linda, ATF 2, p 3)

4.1.2 Teacher Enactments of Lesson Study

This section of the case study describes how LS was enacted at Overton. An early observation was the accumulation of LS artefacts produced through the piloting and evaluating LS in the school for over five years (Table 4.3). These LS artefacts are seen to verify science teachers' accounts, provide further evidence of teachers' perceptions and understandings of LS, showing how these may have featured in their decisions and actions.

On the first page of the LS workbook, it clearly states that the purpose of LS is "to support teachers in the teaching and learning of persistent challenging topics through action research" (ATF 1, p 1), providing evidence that the LS process was designed with a clear research purpose. There was an expectation that teachers should carry out and focus their research on solving and understanding how they could better teach "persistently challenging topics". As teachers started the LS cycle, the first thing they were required to do was identify and agree on an "object of learning"—a teaching and learning topic that could be investigated. Teachers were encouraged to use time protected for LS to agree on their chosen object of learning and gather evidence for the existence of this teaching issue and the associated learning needs of their students (Figure 4. 1.2). This first step in the LS cycle was planned to take place over the first six weeks of the school year (ATF1, p 7), using the LS work booklet, protocols and templates as scaffolds.

The Cycle

1. Decide on the object of learning (teaching challenge)
2. Share ideas including some background research. Involve a knowledgeable other.
3. Carry out an initial assessment of where students are in terms of their starting points related to the object of learning.
4. First teacher delivers the lesson. All other participants observe the students.
5. Debrief and evolve lesson for the next teacher to deliver.
6. Check students' progress through assessment (test or interview).
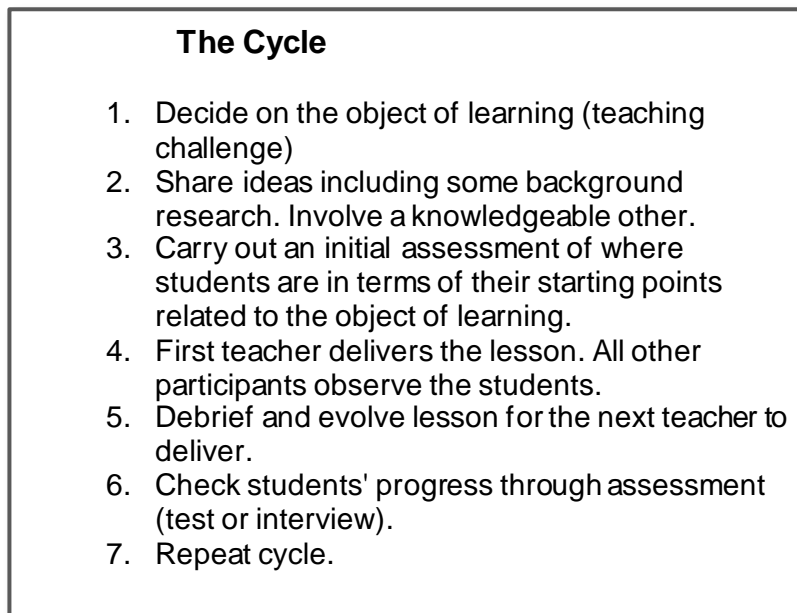7. Repeat cycle.

Figure 4.1.2 Overton Extract from Workbook

(ATF 1, p 4)

At the time of the study, Joe and Katy were members of LS group 4 (Table 4.12) which had met six times to discuss the focus and agree on an object of learning for their LS. Both reported that their discussions had been productive and collegial; they had collaboratively identified a shared teaching challenge and research focus:

> *We are working in a small group; my group [is] all science teachers, so we wanted to find a topic for LS that would benefit us as science teachers.*

> (Joe, INT 1)

> *We have identified it's an issue, you know, all of our pupils have, even the ones, who are top set maths don't translate that skill into a science lesson because, they don't make the link.*

> (Katy, INT 2)

Joe and Katy explained how each member of the LS group had individually identified a challenging topic, shared this with the group and, through collaborative discussions, agreed on a focus that was of relevance and concern to everyone. There was no evidence, other than Joe and Katy's reports of conversations and reflections on past student performance, that the teachers had systematically gathered any baseline assessment of student learning or needs, as they were expected to (ATF 1, p7 and 9). Instead, the teachers had chosen to use the protected time to discuss and share teaching concerns with each other, relying on each other's opinions as to what would equate to a persistent teaching challenge and count as an object of learning. Both Joe and Katy reported that this step was easy and satisfying. There was common concern about student under performance in a particular aspect of their final GCSE examinations:

> *We had a meeting a few months ago, to kind of establish, what idea we want to look at? What we concluded is that we found that particularly GCSE students really struggle with the mathematical concepts in science. So[,] we*

wanted to address how do we teach the mathematical concepts in science so that that they are yielding better results?

(Joe, INT 2)

The four members of the LS group wanted to understand how they could improve their teaching across the department and hence raise student performance in GCSE examinations. After agreeing on the research focus, the LS group decided to scrutinise the GCSE science curriculum specification and past examination questions. When asked about what the group had achieved or learnt from this process, Joe gave an example and explained how this enabled them to refine their focus, surface student misconceptions and identify the learning needs of specific student groups:

> *Take a very easy, tangible concept: for example, force = mass x acceleration. It's a very easy thing for someone to grasp and then show that, as you increase acceleration, the resultant force gets bigger. Then try to relate that to a more abstract and obscure concept: for example, Ohm's Law, voltage = current x resistance—that's three abstract concepts that the kids are having to process and then understand the mathematics to go with them.*

(Joe, INT 1)

The follow up interview was carried out 12 weeks after the early interviews, expecting that teachers would be following the time frame in the LS work booklet (ATF 1, p5). It was presumed that the teachers would have produced a detailed research lesson, identified a data collection approach, and perhaps carried out a lesson observation. However, Joe and Katy reported that the group were still in the process of refining their focus and research theme. They had decided to compare the content of the GCSE science curriculum with the GCSE mathematics curriculum and consult colleagues in the maths department. The teachers finally settled on the teaching of specific mathematics concepts in science which Joe described as "the algebraic rearrangement of formula" as their object of learning and research focus:

I think the issue that we've identified is essentially, when they've (referring to students) got numbers and Xs and Ys, they recognised it as algebra, that's all it is. But as soon as you put words and things in there, they don't follow the process.

(Joe, INT 2)

The group then decided to invite a member of the mathematics department to their next planning meeting and approached a maths colleague to act as their "knowledgeable other":

We got a member of the maths department to come and speak to us and to show us how they teach algebra. They talked us through the whole process. We haven't done any lesson observation of the maths department, but we have had a back and forth where they have demonstrated their teaching style to us and then, in many ways, treated us like students.

(Joe, INT 2)

The involvement of maths colleagues in their LS planning seemed to be pivotal for the teachers' learning. This provided an opportunity to have discussions with a teacher of mathematics, who modelled how he taught mathematics. Joe talked about how this exposure to mathematics significantly informed his thinking and had stimulated discussions in the group about how to promote better student understanding and learning of mathematics in science:

Joe valued what the group had achieved together, the advice of other colleagues and having the time to compare maths and science curriculum materials:

To an extent, I think, more than anything, we were approaching our teaching of mathematics from a place of ignorance. I think by actually examining it and trying to find out that extra bit of information, that's what's helped us.

(Joe, INT 2)

There was no evidence, at this stage, of teachers looking at academic literature, but what can be see here could be regarded as a critical aspect of effective LS which is often overlooked, the process of *kyouzai kenkyuu*—the careful study of teaching materials to inform the design of a research lesson, to consider student progression to support task design with the support, guidance and expertise of a "knowledgeable other" who is not a member of the LS group (Section 2.3):

> *So, with our focus being maths skills, we wanted to work out what the priority with maths skills was going to be and what's going to be a good technique to teach that. In terms of the research that we did, we looked at the national curriculum for maths and science. We looked at the changes that have happened in the GCSE syllabuses and how they've shifted to a more maths-heavy focus. In doing that we've really tried to nail down exactly what mathematics specifically to examine.*

(Joe, INT 2)

Although not observed directly, the intended next stage of the LS cycle was for the group to produce a written research proposal as a culmination of the process of *kyouzai kenkyuu* (ART 1, p6). The work booklet clearly signposts this as the next stage, providing a template as a writing frame. Teachers are required to make references to "action research", to expectations and evidence; to present the background, methodology and the outcomes of LS cycles as research posters (ATF 5a and 5b). Katy was keen to stress the importance of this stage and the need to complete a full cycle, proudly sharing a poster that been produced from two other LS cycles she had been involved in (ATF 5a, Figure 4.1.3). This shows evidence that the intended model of LS at Overton would include the sharing of results and dissemination of findings.

Figure 4.1.3 Overton Lesson Study Poster

(ATF 5a)

In fact, at this point, Katy was concerned that the group had not moved on to the next steps in the cycle. Katy explained that previously, as completing a LS cycle was a requirement of Master's study, this created the incentive that was missing this year. Moreover, this requirement helped to ensure that research lesson was evidence based, the group teachers had sustained access to research journals and there was a definite end point:

> *I think because it was for our Master's last time, we were a lot more focused on getting it finished. Because there was a definitive end point that we had to get it written up for.*

<div align="right">(Katy, INT 2)</div>

> *I've spoken to Linda about it (getting access to research), we've identified as an issue, is you are very limited as a teacher in terms of getting access to other people's research. I'm not sure what we'll do next year when I lose that. I've still got the access at the moment.*

<div align="right">(Katy, INT 2)</div>

Nevertheless, although, the LS group had not developed a research proposal at this point, as Joe described earlier, he accepted that LS there needed to a clear research purpose in mind and a plan to develop a lesson, which would be observed:

> *I find mathematics very easy. Translating that to a bottom set year nine student I find very difficult to do, so how do I turn my high end language into an appropriate scaffold or any appropriate system for them to understand mathematics in the same way.*

<div align="right">(Joe, INT 2)</div>

4.1.3 School Norms, Ethos and Workplace Conditions

This final section of this and all case studies identifies and suggests ways in which the norms, ethos and local school conditions may have featured in science

teachers' enactment of LS. There is emphasis on local school structural and materials conditions that were relevant to LS enactment.

Teachers at Overton Academy were working in a successful secondary school that had acquired a strategic role, a high status, and the resources for improving and maintaining educational standards across a chain of schools. Having such a privileged status, access to resources and expertise, as part of a thriving of Multi Academy Trust (MAT)[4], appeared to offer advantages for teachers. For example, school leaders and teachers are well placed to combine expertise and knowledge to work on broader challenges and solutions together, such as teacher recruitment and retention and raising student attainment. LS was, of course, only a small part of any solution to raise student attainment but being introduced into an already collaborative workplace environment meant that LS could be well resourced. For example, the Head of Science was successful in gaining protected time for LS. Participation in higher academic study was valued and was fundamental in developing teachers' expertise and knowledge of LS at Overton, as was sustained access to a local academic with expertise in LS. Moreover, the formal link with higher academic study was a driving force for completing cycles, disseminating outcomes, and gaining *buy-in* with teacher leaders. This generated the impetus and drive to pilot and to introduce LS, besides the need to provide evidence of its impact before offering LS to more schools.

Consequently, the school had acquired a history and culture of *doing LS*, some things had worked well, were valued, and reinforced by the LS facilitator and participants. These stemmed from teachers' early perceptions, experiences and understandings, the reported positive impacts on their practices and professional setting. When led strategically and implemented in this way with the backing of senior leaders, the LS facilitator was able to lever resources and support to sustain an option for teachers to participate in LS for over five years in.

However, this is not to say that the conditions for LS at Overton were optimal. In her Master's assignment, Linda drew attention to recent reforms in the English

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[4] A multi-academy trust is a group of schools in partnership with each other, often but not always because they are geographically close to one another.

education system: the greater emphasis on performance management for teachers, related to pay; closer scrutiny of student work by inspectors and significant changes to the way schools are evaluated. The most significant change was surrounding student performance at GCSE grades (ATF2 p4 to 6) and may have affected the ways in which LS was enacted, for instance how the ways science teachers had quickly agreed and settled on a shared research focus:

> *This notion has concerned me at various stages of the implementation of LS, as will be shown below, it has not been an easy journey thus far[,] which has led me to question whether LS is the right fit for the Academy or even Great Britain or whether we are simply "jumping on the band wagon".*

> (ATF2, p4)

In the early piloting of LS, there was no protected time for teachers to participate in LS; but Linda had been given funding to cover her own lessons to complete her Master's study. She decided to redirect this funding to release time for colleagues to collaboratively plan and observe lessons together. Once senior leaders LS has been persuaded about the potential of LS, Linda was given the autonomy to use department planning time for LS and found creative ways to make LS work. She was instrumental in making LS work for her school:

> *You need to have overview of people's timetables, be able to speak to the right people to get those things in place to make it possible for three people to be off at the same time. To logistically be able to facilitate it. You need to be creative because I think to be able to make it work… To think outside the box about how you could get three teachers in the room at the same time, without it costing the school a massive amount of money or having a massive detriment on the classes they would step out of, that sort of thing.*

> (Linda, INT 1)

Many of the principles and practices that need to be maintained and prioritised for JLS to have a positive impact (Section 2.3) appeared to be present at Overton, enhanced by the presence of an enthusiastic LS facilitator, access to research and resources, senior leadership support and a strong desire for collaboration amongst teachers. But it was also clear that, for LS to be sustained and supported in the longer term, there would need to be more evidence that LS can have a positive impact:

> *We need to devise a method for quantifying the outcomes of LS in order to provide more concrete evidence regarding its effectiveness as a CPD strategy*

(ATF4, slide 12)

4.1.4 Case Summary and Distinguishing Features

At Overton Academy, LS was designed and introduced as a systematic, but flexible, collaborative-research process that was supported, structured, and guided. Opportunities were provided for teachers to gather an impression of what was expected of them; participation was voluntary. The three science teachers interviewed at Overton were positive about the potential of LS to improve teaching and student outcomes. They believed that LS could be tailored to meet both their individual, and collective professional learning in a systematic and evidence informed way. Science teachers worked together to negotiate and agree on a shared focus, centred on a persistent teaching and learning issue that had come about due to changes in the GCSE science curriculum. An object of learning was identified and refined through the examination of teaching materials, curriculum, and assessment materials and by consulting with a teacher of mathematics, seen as a *knowledgeable other*. The teachers were then starting to prepare to develop a research proposal and enquiry questions and proceed through the next stages of a LS cycle.

A distinguishing feature of this case in comparison to the two other case studies is the determination and tenacity of Linda, to introduce and facilitate LS in a collaborative and collegial manner way. A striking feature pervading in all

teachers' accounts was that LS had to be a collaborative and non-judgemental process. This was testament to the ways in which LS was introduced and the environment where teachers' professional learning was valued and prioritised. The vision for LS was evidenced in interviews and artefacts shared by science teachers. From the outset, Linda engaged with research about LS to develop her own understanding, knowledge, and skills for leading and facilitating LS. She was prepared to question its merits and kept in close communication, developing fruitful partnerships, with a local University and an academic with expertise in LS. Her beliefs about LS for teachers' professional learning were represented and reified in a policy and set of principles and practices for LS at Overton. After 5 years, the school continued to offer LS in their annual PD programme, on a voluntary basis. Despite being only able to observe LS enactment at the early stages of a LS cycle, the intended model was visible and showed many indications of the features of effective LS, such as the detailed examination of the curricula, mirroring the process of *kyouzai kenkyuu*—the intention to engage with academic literature and share the outcomes of LS, the involvement of expertise from outside the group in the form of expert teachers of mathematics as a *knowledgeable other* (Section 2.3). The science teachers recognised the challenging nature of LS for PD, expressing the need to learn and develop an understanding of what it meant to do LS and to gain evidence of its effectiveness for improving educational outcomes. The key to their participation and motivation to stay involved was to collaborate solve teaching and learning issues in ways that could be transferred to their wider practice and be of benefit to more students. None of the teachers reported that it enabled them to work more collaboratively, perhaps an indication that this was the norm, but that LS had deepened this collaboration and the nature of their reflection and professional dialogue.

4.2   Treebank Secondary School

The following case study illustrates how LS was introduced into the science department of a secondary school in the North of England. Four science teachers, early in their teaching careers, and one non-specialist science teacher volunteered to take part in LS for the first time. This case study describes how LS was introduced to science teachers in a somewhat unplanned and ad hoc manner. Lacking many of the features that identify the process that teachers were involved as typical of a JLS cycle (Figure 1.1), one could argue that what the science teachers were involved in was not LS. However, as the science teachers started to take part, they attempted to make sense of the LS that was offered for their PD, in a setting where there seemed to be few opportunities for teachers to collaborate and talk about their teaching. After agreeing to participate, one of the science teachers stepped up to coordinate LS, although having no previous experience of training in LS, and the responsibility for the implementation and facilitation of LS was devolved from the Head of Science. Despite the lack of guidance, resources and direction, two of the teachers, as LS participants and one teacher as a LS facilitator found ways to take advantage of participating in LS. The non-specialist teacher was interviewed early on but dropped out during the first cycle (November 2016) and was absent from the school for most of the data collection period. At the time of data collection (October 2016 to March 2017), two LS participants had taken part in and experienced two short LS cycles that had each been conducted over two to four weeks. This case reveals the science teachers' early perceptions and understandings of LS and how they began to interpret LS for their PD.

Treebank School is an 11 to 16 secondary school based in the North of England with a diverse catchment area including affluent, rural, and disadvantaged communities. A high proportion of the pupils are identified as Pupil Premium[5] via a government scheme which enables schools to draw down additional funding to

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[5] Introduced in 2011, the pupil premium is a sum of money given to schools each year by the Government to improve the attainment of disadvantaged children.

enhance the educational outcomes of disadvantaged pupils. The school did not hold any system leadership status, such as being an Academy nor was it affiliated to a Multi Academy Trust. A key priority for the school was to close the gaps between the achievement and attainment of students from a wide range of abilities and socioeconomic backgrounds.

LS was first introduced as a pilot study, in the science department at Treebank School in 2013, by the Head of Science who had attended a course on LS, delivered at a regional science teacher PD centre. Since the pilot, two years previously, LS had not been used again and there were no reports of any evaluation of its impact or evidence of LS outcomes. No LS artefacts or written information of documents or resources was shared with the researcher. At Treebank, therefore, the intended LS model could only be inferred from conversations with the LS facilitator and from teachers' reported actions and descriptions in interviews.

The three science teachers, Ivan, Adele and Carole, involved in LS at Treebank, were at early stages in their science teaching careers, each with less than three years teaching experience (Table 4.2.1). Ivan had only recently completed his initial teacher training (ITT) at the school and had been in the process of gaining fully Qualified Teacher Status (QTS). The fourth teacher, Mike, had taught Physical Education (PE) for 12 years. Due to redundancy, Mike had been offered a role in the science department and was teaching outside of his specialist subject area. Carole was coordinating LS for the department and is identified in the study as the LS facilitator, gatekeeper and a key informant. Each science teacher reported that they had agreed to participate in LS on request from the Head of Science.

Table 4.2.1 Treebank Teacher Biographies

Teacher Pseudonym	Subject Specials	Teaching Experience	Status and Responsibilities	Remarks
Carole	Biology and SEN	2 years	Recently Qualified Teacher (RQT)	Volunteered to coordinate lesson study—key informant
Adele	Chemistry	2 years	Recently Qualified Teacher (RQT)	Worked as a supply teacher in NQT year
Ivan	Chemistry	1 year	Newly Qualified Teacher (NQT)	Career change from industrial chemist
Mike	Physical Education	12 years	Standard Scale	Transferred to science department due to redundancy

4.2.1 Teacher Perceptions of Lesson Study

The science teachers' first impressions of LS were acquired through discussions with the Head of Science in departmental meetings and in one-to-one conversations. Teachers expressed an expectation that taking part in LS would benefit their teaching and there where be more opportunities for collaboration. Noticing that her colleagues' involvement in LS would require some coordination, Carole offered to facilitate LS. Her interest and confidence in this undertaking stemmed from her recent participation in a Master's programme:

I was interested in it anyway because I'[d] just finished my Master's in education, so I'm quite interested in all of these little research type things.

<div align="right">(Carole, INT 1)</div>

Carol drew comparisons of the LS process with elements of her academic experience, such as working ethically, to justify her capability to support others in carrying out LS:

My focus of the Master's was more the pastoral side, and looking at motivation and engagement, rather than teaching and learning. But I think the process is quite similar, where we need informed consent, and everything has got to be anonymous. So, I think it's quite similar as a project, but the focuses and the aims of the project are very different.

<div align="right">(Carole, INT 1)</div>

At no point did Carole refer to taking part in any LS cycles. She described herself as a confident, highly motivated and ambitious teacher, outlining her intentions to use LS to elevate her role in the science department. In her second interview, Carole reported that she had been promoted. Her reasons for supporting teachers to do LS were framed through her career aspirations and a desire to learn to and demonstrate that she could manage and lead the science department "at a distance":

For me, it's just professional development, really, and experience in, I suppose, managing the curriculum without actually teaching it.

<div align="right">(Carole, INT 1)</div>

Carole believed that if she helped her colleagues to plan lessons together to then be jointly observed, this would improve the quality of teaching materials. These collaboratively developed teaching materials could then be shared across the department and could be used with in different ways:

In terms of, I think for the department, we're going to get good quality resources that a number of colleagues have had an input into. So, I think that

they'll be varied, they'll be differentiated, they'll be interesting. So, I think that
will impact on teaching and learning across the department.

<div align="right">(Carole, INT 1)</div>

As a facilitator of LS, Carole started to build her own image of LS. She saw the LS process as a simple cycle of events that could be repeated in two to four weeks. Each teacher in a group would take turn to teach a jointly planned lesson which would then be observed. They would then reflect on this lesson and try to improve it. The lesson was then improved and ready for sharing:

Probably, we're only going to do it where, say, one teacher teaches it, the
other one observes, they reflect, they alter it. The other teacher teaches it
and does the same again: alter the lesson again. Then we're going to put
that in a file to be used in the department.

<div align="right">(Carole, INT 1)</div>

There was no evidence to suggest that the lesson would have any research purpose nor intentions to observe student learning. Carole thought that if teachers worked together in this way it could serve another purpose—it could improve working relationships in the department seeing the purpose of LS as much broader. Carole did not suggest that relationships in department were poor, but she recognised that her colleagues were relatively inexperienced, relatively new to the school or department. LS would provide a chance for these teachers to work together and to share ideas in a school environment that offered few opportunities for this:

So, I think it's good for improving relationships between colleagues because
they [will] collaboratively plan. It's good for sharing ideas.

<div align="right">(Carole, INT 1)</div>

The three teachers participating in LS, Ivan, Adele and Matt, each gave different reasons for participating in LS. Ivan was in the process of gaining Newly Qualified Teacher Status (NQT), he saw LS as providing an opportunity for him to continue

to be observed and receive feedback from other teachers. He described how he valued peer observation as a learning process that he had experienced positively during his initial teacher training and placement at Treebank. In particular, he wanted to continue to receive feedback from more experienced teachers and he wanted to observe other teachers teaching similar topics with other students. Ivan also thought that if he took part on in LS, his teaching could be observed in a non-judgemental manner, with opportunities to follow up on and improve lessons collaboratively:

> *The benefits for me would just be having somebody, one of my peers, in my lessons, and being able to discuss with them how it could be improved without that background of me being judged against anything. Just a simple, "This is how we could do it better," and then going to be able to see if they can do it any better, and taking something from that*

> (Ivan, INT 1)

Convinced by the conversations and descriptions of LS with Carole and the Head of Science, Ivan thought that the LS would be a non-judgemental, relevant and meaningful learning process. Furthermore, lesson observations would reveal more useful information about student learning as opposed to the existing lesson observation practices at the school, which were centred on meeting school targets:

> *If it's a judgmental lesson observation, I guess I would look at the school criteria for lesson success. That's always in your mind because that's what you're going to be judged against, even though they're supposed to be developmental lesson observations.*

> (Ivan, INT 1)

Ivan thought that his colleagues would look at lessons in a different way, focussing more on immediate student learning and observable behaviours:

> *If it's one of my peers for the lesson, the study that we're doing, I just think they're going to think, "Have the kids learnt? Have they behaved*

themselves? Do they know more now than when they came into the classroom? Have they behaved themselves, and have they enjoyed it really, or have they just sat there, not listening and not taking anything in, and learning nothing?"

<div align="right">(Ivan, INT 2)</div>

Mike had recently joined the science department at the start of the academic. year due to staffing resources cuts in the Physical Education (PE) department. He was the most experienced teacher of the group, having over 12 years of experience of teaching. However, at risk of losing his job, Mike had been asked to teach science. He seemed anxious about his teaching situation, and there was a sense that Mike felt obliged to take part in LS for the benefit of the department rather that for himself. He saw his participation in LS as an opportunity to "give something back" by supporting less experienced colleagues *and* contributing to this research study:

> *Well, she [the Head of Science] was looking for volunteers. Somebody had to. I thought it was a way I could give something back, really, by working with others, and for this study and your study, and results and data, and hopefully, for my own professional development, really. I could learn off others at the same time.*

<div align="right">(Mike, INT 1)</div>

Any learning that Mike might gain, he thought, would be incidental, tentatively suggesting that "just working with others" at this point, and being able to observe sciences teacher, would be beneficial:

> *In my position, currently, being in science, just working with anybody else in the department, I enjoy, or I need for my current situation. Yes, just different ways of how other people teach science as well, different scenarios in classrooms and ways of tackling things.*

<div align="right">(Mike, INT 1)</div>

Adele had recently gained NQT by working as a supply teacher in several schools. Discussions, showed she was also unsure about why she had chosen to take part, providing further evidence that the teachers were trying to make sense of LS, without any clear direction or set of structures to follow:

> *What I'm gathering is that somebody teaches a lesson while somebody observes. Then they discuss the lesson afterwards; decide what went well, what could be improved in terms of the learning. They come up with a new lesson plan that's like a modified version, then teach the modified version with the person who did the observing teaching the lesson, and vice versa, and seeing afterwards if that made any improvement.*

<div align="right">(Adele, INT 1)</div>

When asked, Adele could not offer any personal or professional reasons or rationale for why she had volunteered to participate in LS; her responses hinted at a lack of interest in what was happening, casually mentioning that there was a possibility that she may "pick up new teaching strategies, ideas and resources". Adele, and likewise, Mike seemed far less attentive and committed to LS compared to Ivan and Carole; albeit this could only be deduced from the reticence to talk in detail, in interviews, about what was involved or how LS could be beneficial. Though, it must be said that in the follow up interview, after Adele had participated in a LS cycle, she was more enthusiastic, describing the benefits of observing another teacher and sharing teaching strategies and resources through a two-way dialogue. Mike, however, dropped out early in the first cycle:

> *Well, you rarely get the opportunity to see other people teach, and the way that they do that, and the resources that they have, and the systems they've got in place. Looking at that is really useful for any teaching and any sort of practice.*

<div align="right">(Adele, INT 2)</div>

At Treebank, there was a shared belief and expectation that taking part in LS would provide some sort of benefit for the department, in terms of improving individual lessons, opening classrooms and increasing opportunities for peer collaboration. The teachers' early perceptions of LS echoed claims in the literature—that teachers may develop misconceptions of the purposes of LS (Section 2.2). For example, the idea that LS is designed to develop the perfect the lesson. At Treebank LS was being used to improve individual lessons and encourage teachers to work together through a cycle of joint lesson planning and observations with the "reteaching" of a lesson occurring within less than two weeks:

> *My understanding is that we, as a group, I guess, the crux of it is to have a lesson, and see if it can be improved. Teach a lesson, then talk about it, see how we can improve it, and then another teacher teaches the lesson again.*

> (Ivan, INT 1)

> *I see it, from the way it's been sold to me; you collaboratively plan a lesson with a colleague. One person teaches it, and the other person observes. Then you sit down again and look for ways in which it could've been improved and look to build on the successes from the first lesson into the second lesson.*

> (Mike, INT, 1)

There were no explicit references or perceptions that LS could be used for any other means. Teachers were looking forward to working in a collaborative and non-judgemental way, having some ownership of classroom observations to jointly plan and improve their lessons—since there was little opportunity for them to do this in their professional setting otherwise.

4.2.2 Teacher Enactments of Lesson Study

The Head of Science strongly encouraged science teachers in her department to take part in LS, taking the time to outline the process in department meetings and

have one-to-one conversations. Once a group of teachers had volunteered or had been "picked" as stated below, facilitation of LS fell to Carole. From that point, evidence of her involvement was scarce, other than informal conversations with Carole about how things were going. There were no structures, resources or other support in place to support the teachers' participation in LS. Left in their hands, these four teachers, who had no previous experience of LS, worked intensely and creatively to fit two LS cycles into their scheduled teaching timetables, finding their own time to meet, plan and reflect:

> *We've got three other members of staff taking part, just because they volunteered. They were quite interested in being involved as well. So, we're just focusing on year seven lessons at the minute. They also got picked because they teach the same ability grouping on each side of the time table.*

> (Carole, INT 1)

There was no evidence of LS training, guidebooks, protocols or notions of effective LS. Neither was there much indication that Carole, as the LS facilitator, was aware of any of the features of effective LS (Section 2.3). There was no requirement for teachers to identify a research purpose or goal for the LS other than to collaborate and produce better lessons. The teachers were not provided with any *protected time* to meet to plan or observe lessons. They reported that they tried to "grab" time in between teaching to meet for short periods of time— only 10–15 minutes. There were no reports of extensive discussions about student learning or how to identify or address any specific teaching challenges. Nor were there discussions linked to the whole school priority of that teaches described as "closing the gap". Furthermore, the teachers had no scope or incentive to determine a research purpose, although they associated LS with research; they perhaps lacked confidence that they had the skills and knowledge to do this.

Consequently, LS at Treebank was driven and shaped by pragmatic circumstances, such as the need to fit within tightly defined cycles, timetables and year groups. There was a speculative suggestion that teachers could use LS

to compare teaching groups of different abilities, perhaps looking to align with the whole school priority, but no structures, support or resources were in place to achieve this, although there were attempts to use school data and information on ability groups to determine which pupils they focus on:

The whole-school priorities are basically closing the gaps with pupil premium and non-pupil premium students. But then we're looking at closing the gap with the higher end pupils as well: pupil premium, non-pupil premium, SEN, EAL. So that's the whole-school focus. Then we've got differentiation and stretching the higher end pupils. That's a whole-school push at the minute.

(Carole, INT 1)

Yes, well, when Carole looked at the timetable, because they're split into three bands, so you've the A Band, which are the higher achievers, B and C Band are mixed ability, we tried to get them based on the data so it was roughly comparable as you could get.

(Adele, INT 2)

The teachers fulfilled Carole's requests to complete two LS cycles, teaching groups that were of a similar ability. Once the first LS cycle had been completed, teachers moved directly on to plan another lesson and LS cycle with another group.

So, Mike and Adele, they'll observe each other and collaboratively plan, because they've got 7B1 and 7C1, so they're a very similar ability. Then Adele and Ivan will do the same. So, this is the timetable so far, and how it's been going.

(Carole, INT 2)

I've been with Miss Smith [pseudonym]. We've looked at our Year 7 classes. I've taught one lesson where it's been on breathing, should we say, within the structure and function of body systems, one lesson on breathing. I taught it and then Miss Smith observed, and we'd talk about it afterwards, about

what we could do differently, and how we could change it, and then Miss
Smith did a lesson that I observed.

(Ivan, INT 2)

From the very beginning and as the LS cycles progressed, teachers questioned the process of LS. They were unsure of its thoroughness, whether it was about judging and comparing each other's lessons and how any impacts could be measured:

Originally, I think I asked, "Do we have to have some sort of assessment by
the end of the lesson to show who's progressed the most, and whose lesson
was the best?"

(Mike, INT 1)

Both Adele and Mike were concerned about how to compare the effectiveness of one lesson, in order to plan another. They saw the abilities of their students as fixed at different levels and needed to show progress in one lesson:

I wasn't sure if we would be able to demonstrate progress between those
lessons, if they were different groups or different sets. Or if we were to try to
teach the same lesson, but better, and show further steps, I don't know how
we'd show it just in one lesson.

(Mike, INT 1)

After each end of the lesson, you're then judging what impact that has to
have on your teaching for the next lesson. It's hard to plan when you're going
to do that lesson this time next week. Roughly, the idea is there but it doesn't
always happen.

(Adele, INT 2)

It was clear that, by the follow-up interview, the teachers were struggling to do LS. Mike in fact, decided to drop out of the process entirely. This decision was reported as being due to time pressures and a preference to working on his own:

Mike thought it was okay, but he said that it was taking up too much of his time, because he's just come from PE, so he needs to spend extra time doing his own sort of planning, and things like that, for science.

<p align="right">(Carole, INT 2)</p>

In addition, Adele and Ivan were both concerned about the *intrusive* nature of LS with their teaching and the potentially negative impacts on pupil learning and the *flow* of the learning:

The logistics of fitting in that particular lesson with your own planning and your own timetable to fit around, sometimes the topics have gone a bit out of order… so, the movement through the topic hasn't been as smooth and as logical. Some of the kids have been lost at some of the points, because we've had to jiggle things round.

<p align="right">(Adele, INT 2)</p>

The decision, made by Carole and the Head of Science, to focus and compare specific teaching groups, was not being well received by LS participants, neither was it achievable:

We've found it quite difficult to actually organise the logistics of it across the groups, as well, because although they're supposed to be the same group, there are very different challenges and students in there. So, the needs of the class are very different, so you can't always translate it across.

<p align="right">(Ivan, INT 1)</p>

Carole recognised these challenges, providing encouragement and support at a crucial point:

I think I've tried to encourage them to keep going with it. When Mike decided he didn't want to do it, I think those two thought, "Well, you know, it is taking a lot of our time up as well". So, I had to drive it in that way and try to encourage them that it is worth doing for their professional development, which it is a good opportunity for that.

She persuaded Adele and Ivan to continue to work together, to find ways to observe each other's lessons and take more control of the process, which seemed to work for example, Ivan took the lead on the development of the first iteration and observation of a lesson:

> *I planned the lesson, and then she watched, and then we talked about how we could do it differently. Then, she went away and planned what we said we'd do differently, and taught it with a few slight changes to me, much better.*

> (Ivan, INT 2)

Encouraged by the sense that these two teachers had started to work together as she had hoped, Carole reported that teachers had started to develop stronger working relationships—both in terms of interactions with each other and with herself. She regarded this as a positive early outcome of LS, which motivated her personally to try to sustain the teachers' engagement and participation despite challenges:

> *The main thing for me is seeing those two getting along, building relationships, and actually enjoying doing it. Being proactive in their approach, and coming to me, and asking questions, and me seeing that they're actually into it and enjoying it, that's what's made me want to keep on going, and see what the impact actually would be.*

> (Carole, INT 2)

Carole decided to step back and take a more flexible approach to coordination of the LS, giving the teachers more ownership of each cycle whilst trying to stay in control at a distance:

> *I think, if I tried to, sort of, come in too strong, and tell them what they should do, and they should do this, and how they should be doing it, it's not enjoyable for them. They would feel like they're not getting much out of it. It would just be another extra chore at work, I think.*

Consequently, Adele and Ivan worked together to improve a lesson on human breathing using a simulation of the movement of oxygen and carbon dioxide molecules around the body. They used this teaching strategy with another group of students:

> *For instance, one of them was a very low ability Year 7 set. Various people were being oxygen, various people were being carbon dioxide, and blood cells, and all sorts. One thing I did was, I didn't have any labels for them. "You're an oxygen molecule". They just had to remember, "I'm oxygen". "I'm carbon dioxide".*

(Ivan, INT 2)

Although this may be a minor change, both teachers felt that this change had helped their students to learn, made the lesson flow more easily, and Ivan felt he had learnt something from Adele:

> *One thing we agreed upon afterwards was that they should have labels. Miss Smith [pseudonym] had the idea of just using simple Post-it notes for them, of different colours, and then changing them round. That was one thing that she did, and that worked better. That was one thing I learned, yeah.*

(Ivan, INT 2)

The model of LS introduced at Treebank lacked many of the principles and practices that are recognised as LS (Section 2.3)—evidence of LS enactment was far from the ideal. This was simply a case of teachers working together to plan and observe each other's lessons. Nevertheless, teachers perceived this as a change in practice and reported the benefits in their learning. Carole believed that this was due to the deeper Sub-systems of reflection on practice and taking the time to think about student learning:

Well, I suppose in our everyday teaching, we plan the lessons and deliver them. We wouldn't necessarily reflect or take time out to reflect on the lessons. Obviously, if the lesson comes up again, and you're teaching that to another class, or you come across that lesson again, you would reflect then, and maybe alter it slightly, to fit with that class. But I don't think that we necessarily take time out to reflect on how a lesson has gone, and look at the teaching and the learning, and what the pupils got from it.

(Carole, INT 2)

Adele shared this view, explaining that LS had enabled her to reflect in a more systematic way. By looking closely at one lesson and then being able to act directly on that reflection and feedback, it provided a form of *reflective immediacy* that could be put into action:

Because after the observation, it's sort of done with, and then it's up to you to take that further, if that makes sense. Whereas that [the lesson study], you're doing something with that feedback—you're not following up on those notes until your next learning walk or observation, or whenever.

(Adele, INT 2)

When asked about the impacts of their participation is LS, Adele, appreciated the opportunities she had had to look at student learning in other classroom contexts, being able to transfer what she had gained directly to her own practice:

Getting those ideas and seeing how things work, and seeing how the kids respond to certain things, might give you[r] ideas on how you can take that and adapt it for your own groups, and that's not an opportunity you get often.

(Adele, INT 2)

For Carole, she attributed the experience that she had gained as a LS facilitator to securing a promotion as she had intended for her personal professional development and career:

Well, the impact is I've been promoted since I've started this, and I did use this as an example of me leading change in the department. So, I think it's had an impact there.

(Carole, INT 2)

A growing sense of autonomy and agency from the teachers was detected in the follow up interviews at Treebank. These science teachers appeared to be more interested in how they could collaboratively develop their practices. Adele's participation in LS appeared to have reinforced her beliefs that both the teacher and the student play an essential role in learning, and teachers need to have ownership of their teaching and what happens in their classrooms. Whilst for Ivan, it reinforced his beliefs that peer observation was the most valuable form of PD for his own professional learning, at this early stage in his career:

Everyone's different in the way they deliver lessons. I couldn't pick up somebody's PowerPoint and deliver it, because it wouldn't have the same impact at all. Even if it's just like a skeleton lesson, or a basic idea or flow of the lesson, well, you can take that and then adapt it to yourself, adapt it for your own.

(Adele, INT 2)

Probably one of the main reasons was that it wasn't a judgmental thing. It was purely in there, so that it felt more like a collaborative thing. It wasn't somebody in there judging my teaching ability. It was somebody looking at how the lesson could be made slightly different.

(Ivan, INT 2)

However, the teachers still questioned the merits of LS, its legitimacy as way of improving teaching learning that could be measured, still trying to make sense of its for themselves and their practices:

The only thing I was a bit concerned about was the fact that you're changing quite a few variables each time, because you're changing the teacher and you're also changing the class. I was thinking, "How do we know which

ones?" Otherwise, I know it would be very difficult to do the same lesson, with the same class, with the same teacher.

<div align="right">

(Ivan, INT 2)

</div>

Adele and Ivan wanted to learn more about the LS and how it could be more effective and manageable in the future and how they could develop their skills to carry out LS effectively:

I think we would have to do it a few times for us to get better at actually doing the actual process itself, and more skilled. I think it was a new thing for all of us. I think to get more skilled in the actual process would be to repeat it a few times to start with.

<div align="right">

(Ivan, INT 2)

</div>

We just need to make sure we're absolutely clear on what lesson we're doing and when, and if it actually worked. We could do with planning the whole of the cycle, really, with what lesson we're going to be doing on what day, as best you can.

<div align="right">

(Adele, INT 2)

</div>

Carole also started to think about how LS could be conducted more rigorously, embedded in a wider school strategy, and used on a larger scale to gather evidence of impact:

I would like to do it on a wider scale and have more teachers involved, more classes, and more year groups, because I think we'd be able to measure the impact much more then, and get a quantitative summary of how it's impacted.

<div align="right">

(Carole, INT 2)

</div>

Carole's expectation that the teachers' participation in LS would result in the production of higher quality teaching materials was not realised. Other than the redesign and reteaching of the biology lesson, teachers did not report any outcomes of this nature or share any artefacts with the researcher to suggest that this had occurred. But Carole started to build on her experience of leading LS,

becoming aware of the challenges and opportunities of leading the PD of other teachers, even with more experienced colleagues such as Mike:

Yes, I think it's caused me to think about how I approach staff members that may be older than me, more experienced. How to approach the situation in the correct way to get them to on-board and do something that I want them to do.

(Carole, INT 2)

4.2.3 School Norms, Ethos and Workplace Conditions

At the time of study, Treebank School was not designated as a Teaching School or Academy, statuses that can be given if a school is regarded as outstanding, designated by current government policy at the time. The school had a high proportion of students identified as disadvantaged and a wide range of abilities. Each science teacher described Treebank as a challenging school to begin your career or work in as a science teacher. They were expected to teach lessons that catered for a wide range of student abilities, and there appeared to be few opportunities for colleagues to collaborate and work together to plan and develop their teaching. There was no additional time or funding to support their participation in LS, for example to release teachers to plan and observe lessons together. The teachers had to use their standard teaching preparation time. They did not refer to any external networks or training opportunities; there were no artefacts shared with the researcher, such as research lessons, plans, LS guidebooks or protocols. This suggests there was little in terms of local structures and resources to use or build on for LS. Furthermore, from close analysis of interview scripts, one could also argue that the science teachers may not have known each other very well. Adele uses the terms "guys" repeatedly and Ivan refers to Adele in a formal manner by using her surname:

We took similar year seven groups. So, I've got a higher ability group and a lower ability group. One of the guys who had the lower ability group, we'd observe each other with our groups, and modify the lessons and observe

each other again. Then I do the same process with the other guy, who had
the higher ability one.

(Adele, INT 2)

As such, the school workplace conditions were not highly conducive for introducing LS. There were also indications that the school was under financial and other pressures resulting in redundancies, high rates of staff turnover and low retention rates—which may explain why the average years of teaching experience was so low in the LS group. Adele and Ivan had only recently trained as teachers, so their past views, values and beliefs, about how teaching and learning could be improved, were predominantly formed in their initial teacher training (ITT) and their limited teaching experience in the schools in which they had worked.

The school's relatively low status position in the educational system may have been manifested in the ways in which LS was introduced and supported. For example, there seemed to be lack of investment and interest in these science teachers' PD; implementation of LS was soon delegated to classroom teachers, and there was limited senior leadership involvement with no obvious accountability. The school/department's apparent lack of commitment or consideration to provide resources for LS, such as protected time, or to provide opportunities for LS participants to carry out and engaged with research, or to share results, alongside the lack of expertise in LS of the facilitator, meant that there were few structural affordances for effective LS. This resulted in the science teachers taking ownership of LS and making it work in their context and in ways that would meet their individual and collective professional learning goals.

4.2.4 Case Summary and Distinguishing Features

Taken from the perspectives and reflections of the four teachers based at Treebank School, this case study shows how LS was introduced into a secondary science department in an ad hoc and largely unplanned manner. Although, the

Head of Science had attended a course on LS, three years previously, there was no evidence to suggest that the Head of Science was actively guiding and facilitating the LS process. Consequently, a relatively inexperienced group of science teachers constructed and participated in a model of LS that could be "shoehorned" into the teaching timetables of the teachers who had volunteered to participate. A distinguishing feature of this case in comparison to the two other case studies is that LS was being purposed to improve the science teachers professional learning conditions and working relationships. The teachers believed that LS could be used as a collaborative process to improve the quality of teaching materials, to open up classrooms, allowing them to observe their colleagues, teaching similar topics, in a non-judgemental manner. The LS model enacted by these science teachers lacked several of the elements of effective LS, notably *kyouzai kenkyuu* and the development of a research theme, or proposal, and enquiry questions. There was little planning time allocated at the start of each LS cycle, no contributions from *knowledgeable others* and no obvious intentions of sharing and disseminating the outcomes of LS. The key features of LS at Treebank were the shared planning and observations of individual lessons that were retaught in quick succession. The teachers reported some changes in their pedagogical knowledge (in the terms of using simulation in a biology lesson), but their reflections were of a technical nature in relation to the classroom management. There was also evidence to suggest that the teachers perpetuated a misconception of LS—that it is intended as a vehicle to design the *perfect lesson.* There was no clearly defined goal for student learning built into the process at any stage. However, as the teachers' initial engagement in LS was voluntary, teachers were well motivated to participate in LS. The school conditions did not afford regular or sustained peer collaboration; the teachers had strong desires to find ways to work with and learn from their peers, including observing each other's teaching on a more frequent basis. Teachers started to take ownership of the LS process and suggested ways that it could be adapted and improved in future. The science teachers started to jointly construct a model of LS and wanted to develop their LS skills and make it work in their setting.

4.3   Ashgate College

This case study demonstrates how LS was introduced, under the direction of the Head Teacher, as a whole school initiative over two years. Together with the support of senior leaders, the Head Teacher intended to use LS as a vehicle to raise student performance and to encourage teachers to carry out, engage with and use research. As LS was introduced, the Head Teacher's aspirations and expectations of LS were shared and promoted by senior colleagues. In the first year, teachers were provided with protected time on a weekly basis for their PD and given the option to take part in LS, working cross-curricular LS groups. In the second year of LS introduction, there was a requirement for every teacher to participate in a LS cycle and evidence their participation and contribution in their individual performance management reviews.

At the time of data collection, the science teachers interviewed had experienced a full LS cycle in the previous year and were positive about participating in LS for a second year. However, despite previous LS experiences, these teachers were somewhat uncertain and unclear as to what was involved or expected of them. Teachers had to find ways to adopt and adapt LS, as they worked in cross-curricular groups, and to connect LS with their wider professional learning activities and interests. Of particular interest, the case study shows that the school's close location and connection with a local University facilitated teachers' access and engagement with research and how teachers were supported through the formation of Teacher Learning Communities (TLCs) led by Advanced Skills Teachers (ASTs), teachers who have been recognised as outstanding classroom practitioners in England.

Ashgate College was established to offer 14 to 18-year olds a chance to gain technical qualifications in engineering and science subjects. It is an inner-city secondary school geographically located next to a University. The college ethos and principles are based on collaborative partnerships between teachers,

universities , employers and the students. The college had strong links with the engineering department in the adjacent University and with local employers and businesses that provide career guidance and work-based learning experiences for students. The school intentionally operated within standard business hours, with optional enrichment activities taking place late into the afternoon. Most students are boys (95%) and there was a wide range of student abilities and ethnicities, with 35% of the students having English as an additional language.

LS Model and History

After attending an external networking event, the Head Teacher commissioned an external provider and national charity for teacher PD and presented his vision for LS to the senior leadership team. All teachers and teaching assistants were invited to take part in a one-year pilot of LS, working in cross-curricular LS groups and to receive training in a LS process. LS was introduced to all teachers and students together during whole school assemblies. Students were made aware that other teachers would be coming into to observe lessons on a regular basis. Data collection took place, in the second year of LS introduction, when participation in a LS cycle had become mandatory for all teachers. LS was the main PD offer for teachers as part of the whole school improvement strategy to raise the progress and attainment of borderline (grade D to C) students in all GCSE subjects. This was also to encourage teacher engagement and the use of research to inform their teaching. Three schoolwide LS groups were established; each led by a member of the senior leadership team who had responsibility for leading teaching and learning across the school. Each schoolwide group was sub-divided into smaller cross-curricular subgroups described as Teacher Learning Communities (TLCs) led by Advanced Skills Teachers. Protected time was provided on Wednesday afternoons, when LS groups met and planned their research lessons. Each LS group was expected to present their LS findings at the end of the year at whole school event. At the time of the study, the science teachers were at the early planning stage of a LS cycle and were each interviewed once.

Teacher Biographies

Four science teachers volunteered to take part in this research. With an average experience of over five years, each teacher, apart from one NQT, were middle leaders who had school leadership lor science department responsibility. All teachers had experience of working in other schools and had taken part in LS in the previous school year. The science teachers were working in separate LS groups.

Table 4.3.1 Ashgate Teacher Biographies

Teacher Pseudonym	Subject specialism	Teaching Experience	Status and Responsibilities	Remarks
Frankie	Chemistry	4 years	Assistant Head Teacher and Head of Science	Co-LS Facilitator for the school, former Master's student
Mohammed	Biology	5 years	Head of Careers	Previously trained as a scientist
Lea	Chemistry	3 years	NQT	Master's student
Sonia	Chemistry	5 years	Subject leader for Chemistry	

During the data collection phase, the teachers were invited to share information and resources related to LS. The school had commissioned a national charity, the Teacher Development Trust (TDT), formerly known as the National Teacher Enquiry Network (NTEN) an external provider for teacher PD to introduce and train all teachers and teaching assistants in LS. TDT had already designed and produced a wide range of resources and materials to guide and scaffold teacher participation in LS. These were identified as secondary data and LS artefacts (Table 4.3.2). Each LS artefact was retained in its original form, photographed as images, catalogued and referenced in relation to this case study.

Table 4.3.2 Ashgate Lesson Study Artefacts

Catalogue Number	Artefacts	Description
ATF 1	NTEN Lesson Study Model	Graphic from outlining intended LS model
ATF 2	Guidance for Diagnostic Lesson	First stage in LS process—four questions to gain understanding of underlying learning issues
ATF 3	NTEN Diagnosis and Intervention Process	Graphic showing process of designing and intervention and measuring impact.
ATF 4	Enquiry project and pupil related question	Graphic providing examples of learning issues and pupil cohorts
ATF 5	Intervention/Refinement Lesson Planning Sheet	Template for planning intervention lessons

4.3.1 Teacher Perceptions and Understandings of Lesson Study

As mentioned previously, participation in LS at Ashgate College was voluntary in its first year of introduction and became mandatory in year two. Teachers were aware of the whole school goal for LS, targeted at accelerating the progress of borderline C/D GCSE students and, to encourage research informed teaching. Regardless of this top down approach, both the LS facilitator and LS participants expected that there would be some flexibility and autonomy in choosing the focus for a LS cycle or tailoring LS to meet their specific teaching and learning needs and preferred approaches:

> *We have an overall agenda, […] to raise attainment in boys, C/D borderline. That's from our school's professional development plan, but then within that, they could do whatever they want for their teaching and learning.*

(Frankie, INT 1)

> *I think with this [referring to LS for his PD] you have a lot more flexibility, where you yourself can actually influence the way in which the learning actually takes place, and how it takes place, rather than just following a formula[ic] method, which is just, again, I'll use the word "robotic". As a teacher, it's for me to understand what works and what doesn't work with students, because not only am I trying to make the students better learners, but it's for me to understand, what is a better learner?*

(Mohammed, INT 1)

Although Frankie said she was supportive of the Head Teacher's decision to link LS to performance management, she thought that this could constrain teachers from what she described as "taking risks" with their teaching and taking ownership of their professional learning:

> *Lesson Study is used to professionally develop someone themselves rather than driving agenda, and I think Lesson Study can't be linked to performance management. If it is, then it loses that impact, because then people don't feel like taking risks. I think part of that is you should feel comfortable and want to take risks, and if it doesn't work, it doesn't work.*

Noticeably, the three science teachers participating in LS were also apprehensive about the recent decision to link LS to their performance management review, questioning whether they were "doing LS right", and echoing Frankie's concerns that teachers may feel uncomfortable and unsure:

> *Sometimes you still get a bit iffy, because it's like, "Am I doing what I need to be doing? Have I met-?" Because it's also one of our performance targets as well, here, to be taking part in Lesson Study.*

(Lea, INT 1)

However, Frankie talked more about why she valued LS, explaining how LS could help teachers to use research to develop their practice. She felt strongly that teachers should have some autonomy in choosing the focus of their LS, but their choice of focus should be based around a teaching and learning need that had been clearly identified:

> *So, for instance, I had a colleague who picked praise, and I said, "Well, why have you picked praise?" "Oh, because it was easy to research". Not because that was something that they needed developing. I think that's the thing that a lot of teachers miss with LS.*

(Frankie, INT 1)

Frankie's strong belief the LS was a research process was made concrete in the ways that she endeavoured to promote the "diagnostic stage" in a LS—a distinctive aspect of the LS model introduced by TDT (ATF 1) by the external provider and as shown and their LS resources and materials (ATF 2 and 3).
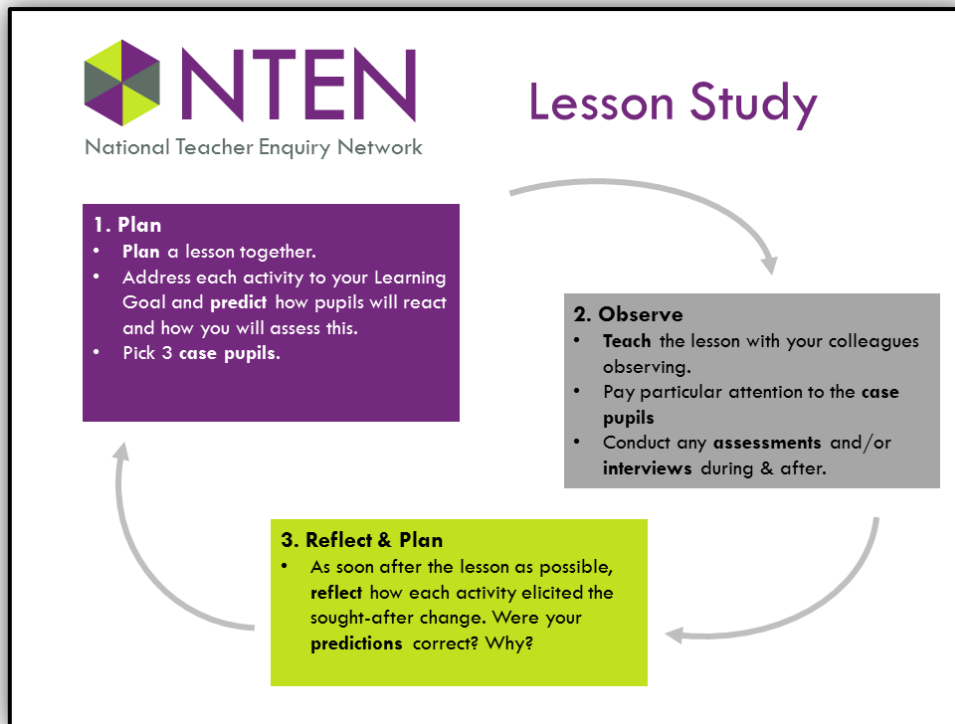
Figure 4.3.1 Ashgate The NTEN Lesson Study Model

(ATF 1)

In the first step this LS model—teachers are encouraged to carry out a "diagnostic lesson" observing student learning behaviours or interviewing three *case students* to try and explore any underlying teaching and learning issues by observing a as a representative group of students. To guide this stage, teachers are given a clear set of questions to frame their reflections and discussions. (ATF 2)

The Diagnostic Lesson

The diagnostic lesson is the first stage in the process. It helps the enquiry group answer four key questions.

- How are individual pupils learning and behaving in their lessons?
- How are they each experiencing the lesson in a different way?
- What obstacles or issues are standing in their way?
- How do teacher preconceptions of these issues compare to the reality for this group of pupils?

It is often tempting to want to jump straight in and try out a new approach or intervention. Evidence suggests that the greatest success comes if the group pauses and puts effort in to understand the underlying issues first.

Figure 4.3.2 Ashgate Guidance for Diagnostic Lesson

(ATF 2)

Frankie was convinced that this was an essential first step in the LS cycle, informed by her own understandings of LS and learning from the previous year. But she was conscious that this stage was often overlooked in the previous year *and* met with some resistance from colleagues:

> *So, basically, the diagnostic stage is something that I read around before. It's not very explicit when you're looking at the LS model…. that there is a diagnostic stage. Not many people will know, but there is. You can't assume that teachers know what's wrong and teachers are the people who will be really defensive about being challenged about their lessons.*

> Frankie, INT1)

Teachers indicated a lack of confidence in their knowledge and skills to carry out LS and the idea of the "diagnosis stage" was being interpreted and translated in different ways by the science teachers. Sonia thought it way of observing and understanding why these borderline students were "underperforming".

> *Okay. I've always been told it's to look at your classes, see if there's anything you notice about the underperforming students, and then suggest what could*

be causing them to underperform. Then see if you can try something to make them not underperform, or to get better results. That's my understanding of it. I'm so sorry if that's wrong

(Sonia, INT 1)

Whilst Lea saw this step as a way to find out more about her own teaching and sensitively involve students in LS.

I'm not sure if the other two have done the same thing I've done, but I basically tried to play it down a bit. So, I tried to say, "This is a questionnaire. Please fill it in. It will help my teaching". So, I didn't actually tell them I'm doing something really, really big; it was just calm and collected, like that.

(Lea, INT 1*)*

Teachers recognised that by taking part in LS, they would be carrying out some research and they welcomed being given some autonomy in LS despite lacking in confidence and being unsure of what they needed to do.

You're always thinking, "Am I doing what I need to be doing? Am I doing what that group is doing? Are we doing the same?" and that kind of stuff. But they're quite good; they're just like, "Well, as long as you're doing some sort of research-based intervention and looking at the impact, you're alright".

(Sonia, INT 1)

As teachers tried to make sense of LS in the early stages, they were strongly encouraged and supported so that they could access and use research to inform the choice of teaching and learning focus and approaches to include in their research lessons. For example, teachers were invited to read the work of educational academics, such as John Hattie, which had been made available in hard copy in the school library and to access research through a University library:

With our teaching and learning communities, the way we approach it, we've shared the log-in and we went through how to access it. So, that's one aspect

of the resources they've got, but the library is in, actually, the school's library. They've got books. So, the latest are, like, John Hattie, James Nottingham.

(Frankie, INT1).

There seemed to create a perception that the LS process was similar to higher academic study and for the science teacher already engaged in Master's study their participation in LS created a mutual benefit for their learning:

It helped me a lot because I am currently finishing off my Master's in Education. It's actually due in on Friday. So, it was quite nice seeing if what I was doing matched up to what they were expecting as a whole school and vice versa.

(Sonia, INT 1)

But there was also a sense that the teachers participation LS would produce longer term and direct benefits for students. Strikingly, there was also strong belief and commitment that for LS to work, students needed to be involved from the beginning and throughout the process and aware of what was taking place.

I hope that the students benefit from it. Not just this cohort, but the future cohorts to come. I don't really know how to put it into words. I think to become a better teacher is probably the best way to summarise it. I just want the students to do well, and I hope that lesson study will help me to help the students do well.

(Lea, INT 1)

These teachers wanted their students to understand what their teachers were trying to achieve. For example, as Mohammed said, "why there were two members of staff standing at the back and talking to three kids". Mohammed saw LS as way of enabling students to see their teachers as "learners" and see the whole school as a learning community:

I think it was important for the kids to understand I think we really believe that we're a learning school, not just for students, but for teachers as well. It is

important for them to understand that, actually, we're learning as well as they are, and this is part of our learning process.

(Mohammed, INT 1)

This student-centred perspective on LS was evidence at Ashgate in several ways, in the actions and decision of the senior leaders to introduce LS to students in school assemblies, and in the ways that the teachers were strongly encouraged to identify and diagnose student learning needs before any LS intervention could be used or tested in the classroom. Unlike, the other two cases studies, in this school, there was a stronger intention to use LS to strengthen collaboration between the teachers and their students rather than with other colleagues.

4.3.2 Teacher Enactments of Lesson Study

Frankie explained that the decision to commission an external PD provider to support the implementation of LS, was so that a consistent model of LS could be used across the whole school to meet the overall school agenda—improving the performance of borderline GCSE students. This commission also meant that teachers had access to other schools and teachers using LS and to LS experts. As a LS facilitator or as LS participants, the science teachers had access guidelines and detailed protocols to support each stage of the LS cycle and to a library of educational research and policy papers. In addition, there were opportunities for the science teachers to share and disseminate good practice and the outcomes of LS. The enactment of a consistent model for LS across the school was afforded through a devolved school leadership structure involving senior leaders and ASTs.

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                        ┌─────────────┐
                        │ Head Teacher│
                        └─────────────┘
       ┌───────────────────────┼───────────────────────┐
┌──────────────┐        ┌──────────────┐        ┌──────────────┐
│Assistant Head│        │Assistant Head│        │Assistant Head│
│   Teacher    │        │   Teacher    │        │   Teacher    │
│   Frankie    │        │              │        │              │
└──────────────┘        └──────────────┘        └──────────────┘
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Figure: boxes — LS group (Lea, Sonia,), LS group (Mohammed), LS group; LS group, LS group, LS group; LS group, LS group, LS group
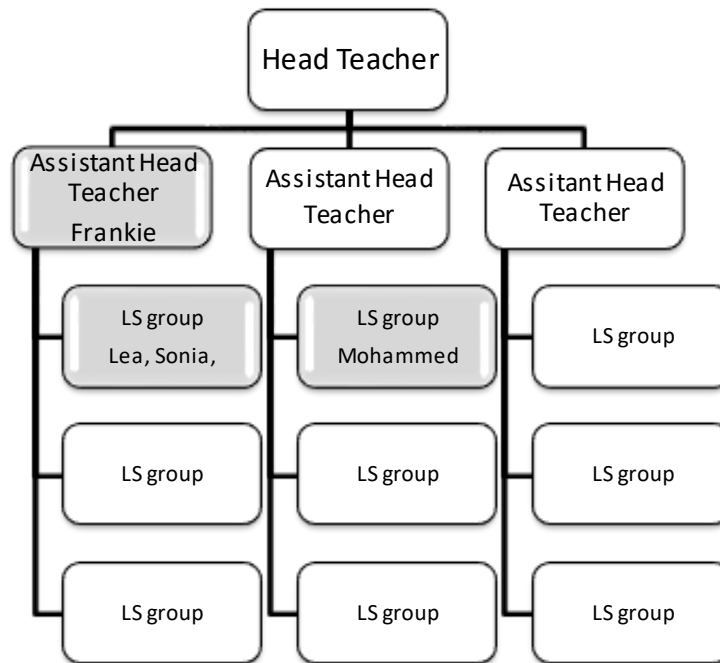
Figure 4.3.3 Ashgate Local Structure to support Lesson Study

Charged with the responsibility for leading and facilitating several LS groups (exact number unknown), Frankie was fully prepared to act on the directive of the Head Teacher to encourage teachers to take part in LS and work within the whole school agenda for LS.

Recognising that that there were gaps in her own skills and knowledge about LS, Frankie and other senior colleagues proactively engaged in external LS events, networks and workshops and sought advice from academics and experts in LS. Frankie engaged with a range of research and professional sources to develop a deeper understanding of LS and models available, stimulated by her own professional concerns and learning from the pilot in year 1:

> *So, in terms of what Lesson Study is, myself and Sarah [pseudonym] and the principal (Head Teacher) are quite enthusiastic about it. We've done a lot of research. What are the best models? What's out there? Who's doing it well? What's the Japanese model? How can we adapt it?*

> (Frankie, INT 1)

And as the science teachers started to recognise and accept that the diagnostic phase in LS was important, they developed their own ways of adapting this step within their cross-curricular LS groupings. Lea described how her group had developed a questionnaire as a tool, rather than sitting and observing "case students" to diagnose a learning issue:

> *It's more like a semi-structured observation. We're seeing how they're doing with each other, and at the same time, reading what they've written. Then I'll select a few and, "Right, what do you need to do, dah, dah? How was this better?" Kind of like that. It wasn't like a formal observation, me sitting there, watching the pupils; it was more of an interaction.*

> (Lea, INT 1)

Each member of her LS group used the same questionnaire with different classes and could then share the outcomes at their next LS meeting:

> *I've still yet to liaise with Richard [pseudonym) regarding results, but we've all used the same questionnaires, which I developed. So, everyone has got the same questionnaire, to try to get rid of any bias or anything like that.*

> (Lea, INT 1)

It was impressive to see the *rigour* that this LS group were trying to maintain at this early stage of the LS cycle. Consequently, the teachers felt that had carefully and consistently identified a common teaching and learning issue—the ways in which students responded to different forms of feedback:

> *Well, so far, pupils who read comments were more likely to understand what they need to do. They're more likely to focus on their weaknesses, and then do something about it. Whereas where they were just given a grade and had to look for their weaknesses themselves, their targets that they set, or the revision that they did was less specific.*

> (Sonia, INT 1)

To encourage teachers to use research, teachers were provided with access to a school library and local University library. In addition, each TLC/LS group leader spent time filtering and selecting academic papers, relevant to the interests of different LS groups. Frankie explained that was to not overburden teachers with too much information and support those who may be lacking in the confidence and skills in carrying out this part of the LS process:

> *Initially, what we did was we put loads of papers on our shared area on our VLE and we recommended the pages to the staff. We bought books in on recommendation that the staff could use as a starting point for those that were not very confident. Then we introduced the idea of them using the NTEN and the university e-copies and stuff.*

> (Frankie, INT 1)

The teachers also talked about sharing this research burden by sharing the workload and coming together to compare and make sense of the literature for their own contexts and develop the focus for their LS:

> *We all look for our own little bits of paper, so we do all our own individual research. Then we look for studies which were similar to ours. So, we were looking at comment-based feedback versus grade feedback. So, we're looking at literature surrounding that topic area, or looking at under-achievement for low performing boys.*

> (Sonia, INT 1)

It seems that the design and use of this questionnaire and the teachers' engagement with research were instrumental in enabling the teachers to develop a shared focus for the LS and to cross different subject boundaries and assessment practices:

> *It was quite different, because engineering don't do grades; they do B-Techs, and they do pass, merit and distinction. So, we met every week, we read a bit of literature, and then we divided back up again, and kind of did our own way, and then came back and did a meeting.*

The science teachers reported how they worked collaboratively to divide up tasks between members of the LS subgroups in weekly scheduled LS sessions, reporting back in meetings. In addition to carrying out a diagnostic lesson and researching teaching approaches, the teachers were expected to design an intervention, develop an enquiry question and measure the impact of their intervention (ATF 2 and 3).
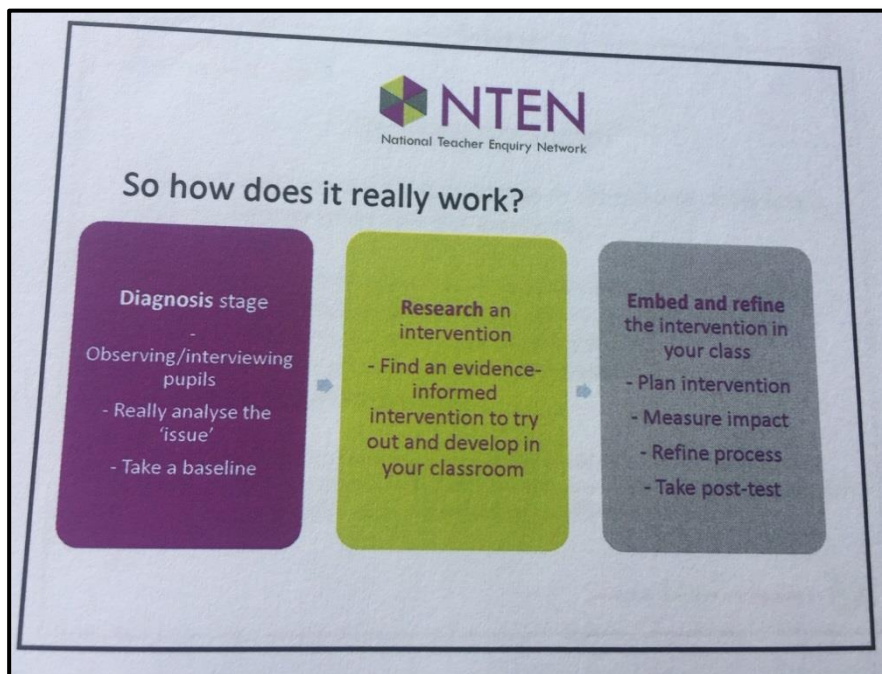
Figure 4.3.4 Ashgate NTEN Diagnosis and Intervention Process

(ATF 3)
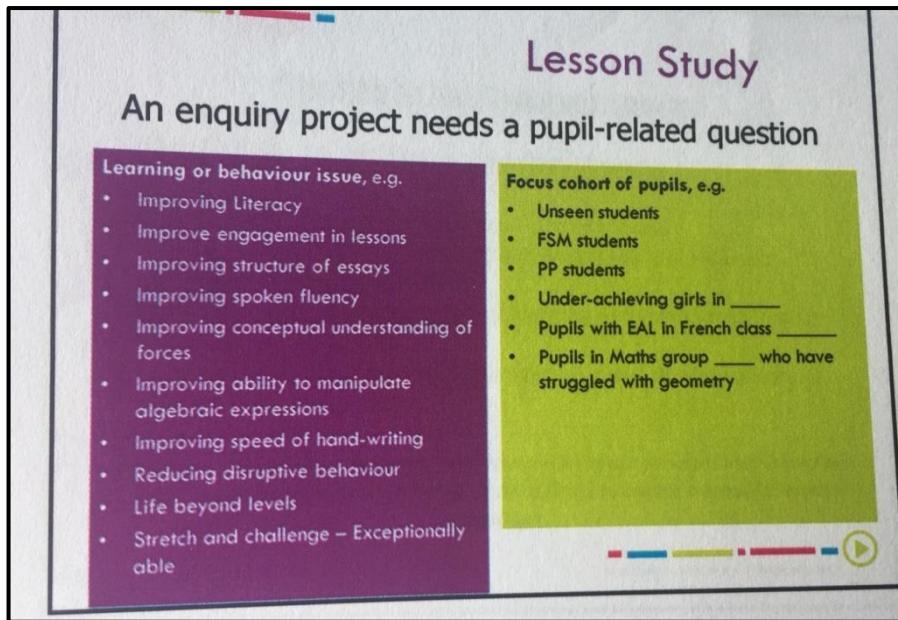
Figure 4.3.5 Ashgate Enquiry Questions

(ATF 4)

When asked about how their LS were progressing, Lea proudly shared their research question, enthusiastically describing how they had come up with this as a team:

> *I've brought it along with me. The exact title of our study is What Impact Does Process Orientated Feedback Have on the Progress of Fixed IQ Theorist Student[s]. We all worked together to come up with the actual title, but it was Richard's [pseudonym] idea to say, "Well, what about feedback? I wonder how it works on it". Then I think Richard or myself bounced off, "What can be said verbally can be a lot more important than what's written, sometimes".*

> (Lea, INT 1)

The closest we see to the LS groups involving a *knowledgeable other* is the role allocated to ASTs who were seen as knowledgeable in teaching and learning—irrelevant of subject specialisms:

We have three groups, each led by […] either an Advanced Skills Teacher (AST), or someone who's very, very good in terms of the teaching and learning aspect. So, someone who's continuously outstanding.

(Frankie, INT 1)

There was a sign that one member of one LS group was seen as more knowledgeable than others in relation to research—they included a teacher of psychology who was allowed to take more control:

I think that was the original plan, but due to Rob (pseudonym) being off, we've lost a bit of momentum. He was the person who was saying, "Let's really, really do this". He was saying, "This needs to be done. That needs to be done". Because I'm still quite new to it, but his background is in psychology, so he's used to doing this like this, he knew what needed to be done.

(Lea, INT 1)

In the second year of implementation, a local calendar structure was put in place to ensure that teachers used their protected teacher time for LS and kept on track:

We have an online appointment system, so it pinged up every there weeks. Whereas the first year it was quite a new thing. We were still developing it as a whole school. We did it and we did the summary, and we did the presentation and everything like that. It's just been a lot better—what's the word?—executed this year.

(Sonia, INT 1)

Teachers were being were given the space, time and guidance to carry out a research informed LS, to develop and tailor interventions in different subject areas and with student groups.

4.3.3 School Norms, Ethos and Workplace Conditions

Ashgate College prided itself as a specialised vocational learning community, operating in ways that would create authentic and collaborative workplace environment:

> *The way we operate, we have a teaching and learning leadership team, which is made up of myself, Lisa and three ASTs, and usually we work together. We implement things together*.

(Frankie, INT 1)

The overarching aim of the college was to prepare their students for the world of work. Discussions in interviews with science teachers, one of whom was a member of the senior leadership team, indicated that the culture and ethos of the school was forward thinking and outward facing. LS was being was introduced into a professional learning environment that was collegial and collaborative. Furthermore, students were valued as central to the school improvement process and learning as a community:

> *So, the students in Year 10 were introduced to it, and within the same week we were introduced to it as the fact that, "Look, this is something that could possibly help us, moving forward".*

(Mohammad, INT 1)

Being driven as a top-down PD initiative, participation in LS had moved from being a voluntary, pilot intervention to one that was mandatory to meet a whole school improvement agenda. However, the science teachers were used to this way of working, having been assigned to work in TLCs on an annual basis. The science teachers had an entitlement to PD and peer collaboration through regular protected time built into their weekly working patterns. To support and enhance the early stages of LS, every teacher was given direct access to academic research, reading materials on LS and on current trends in educational thinking:

Consequently, the local context in which teachers were working to enact LS offered significant structural and materials affordance. In its second year of implementation was seen to be gaining ground and status in the school community and *reification* as part of the schools professional learning culture:

> *Part of the academy culture is Lesson* Study*, so one of objectives is to do a Lesson study. It's the only way I really actually heard of it at first, having said that, it is actually quite useful to reflect back on your own practice and think what you want do for lesson study, if that makes sense.* (Lea, INT 1)

4.3.4 Case Summary and Distinguishing Features

There are three distinctive features of this case compared to the two other case studies. Firstly, that the Head Teacher and senior leadership team placed a lot of faith in LS and its potential to improve student outcomes. For this to happen, participation in LS required a schoolwide commitment, some Sub-system of accountability and delegation. In order to deeper embed LS within the whole school improvement strategy, the Head Teacher took the bold step of coupling teacher performance measures with their participation in LS and invested funds to develop teachers' understandings and skills, for carrying out LS in school, in order to introduce a consistent and rigorous model across the school.

Secondly, LS was being purposed to promote research informed teaching and although the science teachers represented here were lacking in confidence, they actively sought ways that research could be used inform their LS and teaching in targeted ways that would improve student outcomes. The emphasis and prioritisation of research informed teaching was further afforded enabled through the school's partnership with a local University and its outward facing nature also provided access to external experts and training providers (TDT). Thirdly, students learning outcomes were a central focus of LS from the start. Consequently, LS at Ashgate had many of the features of effective LS (Section 2.3). However, despite this highly structured support, access to expertise and training, the science teachers were challenged by LS. These teachers were preoccupied by "doing" LS right and meeting their performance targets.

Chapter 5 Findings—Cross Case Analysis

5.1 Introduction

In this chapter, the outcome of the cross-case analysis is divided into three sections to demonstrate the situated and contextualised nature of LS for teacher professional development (PD). Each section focuses on one research question (RQ), linked to one sub-system (Figure 2.3), to look across the cases in relation to the emerging themes and components identified in Tables 3.4, 3.5 and 3.7. The first section looks at the *teacher learning sub-system*, through the teacher's understandings and perceptions of LS (RQ1). The second section examines the *learning activity sub-system*, through the reported decisions and actions of the teachers during and forms of enactment represented in the artefacts (RQ2). The third section takes account of the *school learning sub-system* (RQ3), the local conditions that may have afforded or constrained LS enactment.

5.2 Teacher Understandings and Perceptions of Lesson Study

This section recognises the importance of teachers' beliefs, values and goals as being able to be developed dynamically through their PD practices and experiences, while also being critical to them. By examining the teachers' understandings and perceptions of LS for their PD, this study provides an indication of these science teachers' *professional learning orientations*, and ways this featured in LS enactment.

5.2.1 Professional Autonomy and Agency

For these teachers, participation in LS meant that they could have more autonomy and agency over their PD and, hence, their learning. Teachers were able to make both individual and collective decisions about what and how to learn and how LS was purposed. The teachers, in all three cases, believed that they would have more freedom to choose *how* to improve their teaching and *how* to understand more about their students' learning. The teachers talked repeatedly about the positive benefits of LS using phrases such as *"*it will help me to help

students learn*, "it's a lot more constructive that other PD*, "a nice way of doing things*. Moreover, the teachers explained how they could connect what they would be doing and learning in LS with their wider professional concerns and learning goals. At Overton, for one teacher, an individual learning goal was to "test" out teaching strategies that he thought were effective. Testing out these teaching strategies with other teachers, during LS, could provide evidence that the teaching strategies worked. At Treebank, for a Newly Qualified Teacher (NQT, openly unsure of his capabilities as a science teacher, an individual learning goal was to continue to develop his teaching in ways that he felt had been effective in his initial teacher training (ITT). He believed that having direct and constructive feedback from more experienced science teachers was the most effective way to learn how improve his teaching, at this early stage in his teaching career. The teachers at Ashgate talked about how they could direct and purpose their learning in LS and could take some ownership of the LS process, even when a research theme had already been decided. Taking ownership of LS, for these science teachers involved identifying both individual and collective goals for LS, such as agreeing on a common research focus that could work across their different subjects and in a cross-curricular LS group. The teachers in all three cases saw the LS process as flexible and malleable. Teachers could dovetail their LS planning and learning into their weekly patterns and commitments. As one teacher at Overton commented, it was PD that "could run in the background".

The teachers sought and gained more autonomy and agency in their learning during LS, regardless of teaching experience or whether participation was mandatory or voluntary. Furthermore, promoting teacher professional autonomy and agency was advocated and encouraged, by LS facilitators in all cases and by the senior managers at Ashgate; although, it was felt that there should also be some degree of accountability. This need for accountability in LS was acknowledged and accepted by LS participants, providing that the measured outcomes of LS were based around solutions to genuine classroom concerns that would benefit their students.

5.2.2 Collaboration, Collegiality and Trust

The science teachers were all seeking to solve genuine classroom concerns through LS. This was thought to be possible if teachers worked both individually and collectively. The teachers believed that they could purposely and constructively direct their own learning, whilst still being able to contribute to a professional learning community. At Overton and Ashgate, working in this way appeared to be the norm; at Treebank, however, this was an aspiration. Nevertheless, for the teachers in all cases, being or becoming part of a LS community, was felt to be one of the ways that the teachers would be able to create or sustain a more collegial, collaborative working environment. Their working environments could become more collegial *and* collaborative if the teachers' participation in LS was built on trust, shared contribution and shared accountability. Contribution and accountability could be shared in different ways. For example, at Treebank, the two teachers wanted to try out a technique to better manage student movement during a role play—this meant sharing the risk that the lesson may go wrong. At Overton, it was about being open about their teaching and sharing accountability for student underperformance in GCSE examinations. Working in this way was often cited by teachers to be the main rationale, and justification, for participating or opting to take part in LS. These teachers were willing to work together in a non-hierarchical manner in a LS group, regardless of experience, expertise or roles. The teachers sensed that their colleagues were dealing with similar teaching and learning challenges that could be solved more effectively by working more closely with each other.

Working more closely with each other, for the teachers at Overton and Ashgate, meant having more opportunities and time to talk about their teaching, to reflect on the learning needs of their students and to develop teaching solutions together. The teachers wanted to converse over sensitive and persistent teaching and learning issues, such as how to better teach difficult concepts or how to provide better feedback to their students. At Treebank, in comparison, the opportunity to participate in LS simply created an opportunity for these teachers to plan and observe lessons together. Despite the different school settings, as

the teachers started to participate in LS, they were prepared and positioned to open up and create space for more collaboration and having their individual and collective views valued; everyone would feel able and confident to contribute.

In all three cases, during their interviews, the teachers made positive comments about the lesson observation process in LS, without prompting. Discussions surfaced a common view that for lesson observations to be beneficial for both teachers and students, they should not involve any judgements of teaching or teachers. Judgements of teaching connected or framed by whole school targets or inspection measures were not perceived as helpful or effective. Moreover, some teachers were critical of their schools' lesson observation practices, seeing these as lacking in purpose and direction. This implied they found lesson observations to be unproductive. At Overton, one teacher explained that to be effective, lesson observations needed to be conducted in ways that would help *her* to understand *how* her students were learning. Taking this student-centred focus on lesson observations, an integral part of LS, was supported by the science teachers Ashgate. However, at Treebank, the teachers felt that to better understand how their students were learning, the insights of other, more experienced, teachers on their teaching were also required. Having the insights and feedback of other teachers, with *their* eyes on students, on their teaching could be most useful.

In all cases, there was a strong desire and intention to decouple LS from the usual norms and practices of lesson observation that were often linked to performance regimes. Even at Ashgate, where the completion of a LS cycle was linked to the teachers' performance management reviews, it was the completion of a LS cycle that was being monitored, not the performance of a teacher in a classroom. The lesson observation process in LS was seen as part of the collaborative and collegial process. It had to be built on trust in order to open up critical, reflective and professional dialogue between teachers, focused on the learning of their students in their classrooms. This approach was perceived to be more powerful, giving the science teachers more control whilst still being accountable for their own learning and that of their students.

5.2.3 Engagement, Confidence and Capability for Research

Open, critical, reflective and professional dialogue was encouraged and established, with the support of all the LS facilitators, in different ways. At Overton and Ashgate, teachers were strongly encouraged to take an enquiry stance during LS. For example, emphasis was placed on "diagnosing" students' learning needs as the first stage in the LS process and using the outcomes of this diagnosis as the starting point. Furthermore, teachers were encouraged to read academic papers and key texts to develop and localise a clear research purpose for LS. Having identified this purpose, teachers were supported and guided to identify and write enquiry questions. This proactive support and intentions for LS, directed from the LS facilitator, was less apparent at Treebank; although these teachers, as in the two other cases, did associate LS with research or higher academic study. These teachers did see LS as a research-based learning process; however, there was no evidence of any teacher engagement with research or processes of research at the time of study.

In all three cases, some of the teachers interpreted and translated LS as if it were a *scientific method* to systematically test teaching strategies and interventions. Teachers used phrases such as "being ethical", "gathering data" and using "control groups" when talking and describing the LS process. This view of LS, as a systematic and evidence informed way of testing out teaching, was believed to be beneficial both in the short and long terms. Teachers at Ashgate explained how longer-term benefits for teaching could be gained, because teachers would be able to transfer what they had learned through their research, during LS, to other teaching situations. At Overton, teachers saw this as way to ensure their teaching was evidence informed, while at Treebank LS, this was a way to compare the quality of teaching materials. It was noticed that, at Ashgate and Treebank, and perhaps to a lesser extent at Overton, the teachers were apprehensive about having to carry out and engage in research during LS. Teachers were concerned by several things: the logistics and the amount of time required to locate and read academic papers, whether they had the necessary sets of skills and knowledge to carry out research, what data to collect and how

to do so and how to use any data they gathered. At Overton, apart from one teacher who, incidentally, had a background in scientific research, the majority teachers across all cases were unsure of their capabilities and competence to carry out this research. At Treebank, the teachers were uncertain about how to compare and analyse data from different lessons in ways that would be meaningful and rigorous. At Ashgate, one of the teachers talked enthusiastically about a questionnaire that had been designed collaboratively to diagnose student learning but was still anxious about whether they were doing things "right".

Nevertheless, although there was this lack of confidence with research, the teachers were prepared to carry out research and engage with academic literature. This was noted, in particular, for those teachers who were engaged in or had recently completed higher academic study. These teachers were seeking ways they might be able to fulfil two professional learning goals at once—the individual goal of completing a Master's qualification and to successfully lead or take part in and a complete LS cycle.

In summary, as these science teachers participated in LS, their understandings, perceptions and expectations of LS were shaped by their beliefs, values and goals—their *professional learning orientations.* There was a shared expectation and ambition that by participating in LS, the teachers could take more control over both their individual and collective professional learning; the teachers could collaborate more and in ways that these teachers believed would be more effective. Noticeably, there was a common, strong desire to use LS to position and shift lesson observation practices outside of any internal and external performance contexts. There was also a common desire to avoid any judgemental practices, instead replacing this with forms of peer to peer support and validation of teaching by peers. This approach towards LS, in turn, it was thought would create better working conditions and improve their quality of teaching in ways that would benefit their students. However, many of the teachers anticipated that they would be challenged by aspects of this new learning process, in particular, how to prove evidence of the impacts of LS, along with the requirement to engage in, carry out and use research.

5.3 Teacher Enactments of Lesson Study

The section looks across the three cases to consider the teachers' decisions and actions, in the early stages of LS cycles, and the ways in which they experienced the process with regards to their professional learning. As a benchmark, these decisions and actions, as forms of enactment, are framed by the principles and practices of effective Japanese Lesson Study (JLS) (Section 2.3).

5.3.1 Evidence of Research

As discussed in Section 5.2, the science teachers' understandings, perceptions and expectations of LS were being shaped by their *professional learning orientations*—the science teachers' individual and collective beliefs, values and goals for their PD. These teachers were anticipating and seeking to gain more autonomy and agency over their learning; to create and work in a more collaborative, collegial and trusting environment and to be challenged to carry out and engage in research.

In all three cases, although the teachers were lacking in confidence to carry out and engage in research, they were not overwhelmed. Teachers began to navigate and purpose LS for research in a range of ways. At Overton, teachers working in science LS groups, under the guidance of the LS facilitator, interpreted LS as a form of "action research". The first action teachers needed to take was to collaboratively identify an "object of learning". To scaffold this action, the LS facilitator defined the object of learning as a "persistent pedagogical challenge" (Overton, Section 4.1.2). The intention was for the teachers to carry out an assessment of student learning needs to identify this challenge. However, they decided not to carry out this step. Instead, as experienced teachers, they decided to talk about teaching and the challenges that they each faced. At Ashgate, a similar approach was encouraged: however, the LS facilitator there was more determined, challenging those teachers who had chosen not to carry out this stage. In both schools, this stage of the LS cycle was initiated and guided by the LS facilitators. Teacher participation was sustained by providing and protecting

the time needed for teachers to engage in professional dialogue on the focus of LS and this was scaffolded through writing frames and planning templates (Overton, Section 4.1.2 and Ashgate Section 4.2.2). At Treebank, there was no expectation or guidance for carrying out a diagnosis of student learning needs or as a starting point for LS. Instead, the teachers' timetables, teaching groups and topics were used to determine the focus for LS. As such, we see start to see variations in LS enactment emerging from the outset.

At Overton, the teachers did not choose to assess student learning needs directly, rather they chose to draw together their individual understandings of student needs. These teachers chose to *unpack* a learning issue through extended peer to peer professional dialogue, soon reaching a consensus on a broad subject specific research theme—how to teach the mathematical concepts in science so more able students could perform better in GCSE examinations. At Ashgate, there was a whole school goal and research theme for LS that had been predetermined by senior leaders—how to address the underachievement of boys at the borderline in GCSE examinations. Teachers were encouraged to carry out a formal diagnosis of student learning as well as to read academic literature in relation to this research theme. These teachers were provided with step by step guidance in the form of planning templates, questions and prompts. They were also given access to a University library and academic readings that were filtered by senior colleagues, seemingly to make access to academic research more feasible and manageable. Teachers at Ashgate decided to share out this academic reading and started to take ownership by refining the whole school research theme for their individual and collective needs. It appeared that the teachers wanted to find a clear research purpose and theme that could be portable across their different subject groups. To then refine this research theme even further, the teachers decided to draw on the views of their students by asking their students to complete a questionnaire that the teachers had designed together. The teachers thought that if they used targeted, subject specific baseline data, this would enable them to contextualise LS within their different subject teaching domains. The teachers collectively decided to focus on how students working at borderline D–C grades responded to verbal and written

feedback, in their different subject areas. At Treebank, there was no evidence of a clear research purpose or theme for LS, although teachers were encouraged to ask questions of their practice by observing other lessons and trying to improve them. These science teachers interpretation of research was to simply collaborate in planning lessons they could each teach and observe.

Seen to emerge very early in LS were the different forms of enactment shaped by teachers' individual and collective beliefs, values and practices—such as the teachers' desires to take some ownership of their professional learning and their perceptions and understanding of LS as a research process within the affordance and constraints of their different school contexts. For teachers at Treebank, this seemed to be about making comprises and following a path of least resistance, given the lack of guidance and time. This is in contrast with the other two cases where the different forms of enactment appeared to be strongly influenced, initially by the school and the LS facilitators' support and guidance and the resources and expertise at hand. However, as the teachers started to take more control of LS, their own beliefs, skills, knowledge and professional learning goals became more evident. There were variations in the nature, forms and sources, of knowledge and evidence, that the teachers valued for giving insights into their teaching and student learning.

5.3.2 Evidence of Kyouzai Kenkyuu

Defined as the study or research of teaching materials, including national curriculum, examination questions and literature, *kyouzai kenkyuu* is an essential step in the LS process. The process of *kyouzai kenkyuu* appeared in two of the case schools in different forms. At Overton, when teachers were working in subject specific LS groups, they were asking questions about curriculum standards, student misconceptions, their students' prior knowledge and their learning progressions. In comparison, at Ashgate, where the teachers working in cross curricular LS groups, teacher discussions seemed to be equally in depth but had a pedagogical focus. It appeared that a pedagogical focus was required so that LS could be transferred to different subject areas and applied, whilst also addressing the whole school research theme. At Treebank, the extended process

of *kyouzai kenkyuu* was absent. Although the teachers did discuss some teaching materials for a role play simulation in biology as this was the lesson scheduled to take place during their LS cycle. These two teachers' conversations were about how to manage students' movements around the classroom, as opposed to engaging in any reading or reflection on what or how their students might be able to learn. Furthermore, these science teachers were only able to have short conversations, at break times and in between lessons, in which they could discuss and plan their LS.

Extended professional dialogue, and what looked like the process of *kyouzai kenkyuu*, was fuelled further in different ways at Overton and Ashgate. At Overton, having identified a subject specific research theme and been stimulated by changes in the science curriculum and student underperformance in examinations, teachers chose to study and compare science and mathematics curriculum specifications and examination questions. Without any evidence or emphasis on the reading of academic research or any intention to carry out a baseline assessment, student learning was discussed in terms of the learning trajectories of students at different grade Sub-systems and in different science topics. However, here was evidence of deep reflective talk about both subject and pedagogical matters.

At Ashgate, discussions were extended by engaging and sharing out academic reading, on teacher feedback. However, this seemed to quickly shift to a focus on teaching and learning logistics, such as members of the LS group noticing that they each used different assessment gradings in their subjects. This led to considering how they could develop their research theme into a worthwhile enquiry question that could be used across the LS group. These two early variations in *kyouzai kenkyuu* seemed to be influenced by several things: whether teachers were working in subject specific or cross curricular groups; the intended LS model; the guidance and resources provided by the school and, to a larger extent, the skills, knowledge and values of LS participants and facilitators.

At Ashgate, as discussed earlier, the LS facilitator reminded teachers that they needed to carry out a diagnosis of student learning needs—she was adamant

that this was an important starting point and she was willing to challenge her colleagues to do this, demonstrating how this could be done. Furthermore, these teachers had direct access and guidance for engaging with academic papers and key texts. At Overton, as the planning meetings progressed, the facilitator encouraged teachers to involve knowledgeable others. Teachers started to seek out a knowledgeable other (at one point trying to involve myself in that role, which I had to decline). In both these two cases, however, what looked like the Japanese process of *kyouzai kenkyuu* was well supported, resourced and scaffolded, through templates and writing frames, along with access to academic papers and experts, reflecting attempts to develop a consistent and systematic approach to this stage of the LS cycle.

5.3.3 Evidence of Knowledgeable Others

The role of a knowledgeable other or *koshi* is to provide extensive support to the LS group in planning a research lesson and in post-lesson discussion (Section 2.3). At Overton, the teachers were strongly encouraged to identify a knowledgeable other, the role of which was highlighted in the LS@Overton workbook and discussed with each LS group. The LS facilitator thought that this role was important, but it was up to teachers to identify this individual. As such, the science teachers at Overton choose to involve a mathematics teacher as their knowledgeable other, with a particular purpose in mind. For these teachers, the purpose of the knowledgeable other was for them to understand and experience how students were being taught mathematics in the school. The teachers reported that discussions with a mathematics teacher helped their LS planning and thinking significantly; the teachers were quickly able to drill down and discuss the mathematic tasks in science lessons that they could set for students and build into a research lesson.

At Ashgate, there was a tentative suggestion that that Advanced Skills Teachers (ASTs), teachers, recognised as outstanding (Section 4.3.3) would take on a different role in LS groups, although how these teachers were seen as being more knowledgeable or how they would be involved was unclear. But these ASTs were

charged with finding and providing academic reading that matched the interests and foci of the different LS groups.

Interestingly, at both Overton and Ashgate, the LS facilitators identified academic researchers as *their* knowledgeable others. Two academics, with research interests in LS, were perceived to be knowledgeable about the LS process, rather than having a deep subject or pedagogical understanding of the school curriculum or of student learning. At Treebank, there was no mention of knowledgeable others or any intention of including other colleagues in the LS process.

5.3.4 Evidence of Research Lessons and Post Lesson Discussions

As reported earlier, these science teachers had strong views on lesson observation practices. The lesson observation process in LS was desired to be a collaborative and collegial process built on trust. However, it is important to point out, that as I assembled the research timeline for this study (Figure 3.2), I anticipated that these teachers would all have reached or passed the lesson observation stage of a LS cycle. This was not the case at Ashgate and Overton; the teachers needed a longer time to plan their research lessons and they were unsure of what to observe or how the impact of the teaching interventions could be measured. Teachers were also unsure about how they could have to compare their findings from one lesson to another. For example, would there need to be "multiple testing" or "control of variables" to produce reliable results. At Treebank, the teacher who dropped out of the LS had questioned the feasibility of what teachers were being asked to do and what could be gained and measured. In all schools, there was a recognition that live lesson observations were a crucial part in LS, but teachers seemed to be more uncertain about how and when they would do this. However, at Treebank, the two science teachers, who stayed engaged in LS, prioritised the lesson observation stage; they wanted to have the chance to observe another teacher teaching the same lesson and there would have been no opportunities to do this otherwise.

5.3.5 Evidence of Sharing and Dissemination of Results

At Ashgate and Overton, there was an expectation that LS cycles would be carefully conducted over a full academic year (which I had not anticipated) and that teachers would share the outcomes of their LS with the whole school. With over 5 years history of LS, at Overton, there was evidence of teachers presenting posters of their LS and outcomes at external and internal networking events. Coupling LS with Master's accreditation also meant that those teachers had a clear endpoint to finish and write up their LS and the motivation to complete a full cycle. At Ashgate, presenting the outcomes of LS to the whole school was coupled with an individual performance management target, in its second year of operation, to sustain teacher engagement in the LS process. In both these two schools, the requirement to share and disseminate the findings of their LS strategies seemed to keep the LS process running. This was also evident in the school sub-system, in terms of shared beliefs and expectations that there needed to be some accountability for the school and teachers' personal investment and commitment to LS. However, what was less apparent, across all three schools at the time study, was how the outcomes of LS would be used to actually inform practice or meet school improvement targets.

As the LS cycles progressed in each school, some scepticism of the LS process, and what could realistically be achieved, started to emerge. At Overton, where the LS facilitator had questioned the merits of LS and what teachers could realistically do or achieve from the outset. This question formed the basis of her Master's dissertation. However, her professional learning beliefs and values were clearly centred around teacher autonomy, collaboration and collegiality. These seemed to be the drivers for learning more about LS, through experience, and demonstrating that LS had potential. Likewise, at Ashgate, the LS facilitator was carrying out her own reading and research about LS for her PD. It was clear from several follow up interviews, that many of these science teachers were becoming more confident and engaged in LS and had developed an increased awareness of what was required. However, these same teachers started to argue for LS itself

to have its own evidence base before it could be adopted more widely across their departments in their school and in the education system as a whole.

5.4   School Norms, Ethos and Workplace Conditions

This section takes account of the *school learning sub-system* system regarding the local conditions that may have afforded or constrained the teachers' participation and forms of LS enactment.

5.4.1   School Status, Leadership and Support

The schools involved in this study varied in terms of their status within the school system, hence varying in their pressures and expectations from a broader policy context: their degrees of external support, their accountabilities and, presumably, their league table positions. There were aspects of their local contexts that appeared to afford the effective implementation, leadership and coordination of LS. Firstly, two of the schools (Overton and Ashgate) took advantage of their partnerships with local Universities . The presence of fruitful and collaborative school–University partnerships enabled school leaders, LS facilitators, and LS participants to access research and academic expertise. Access to research and academic expertise enabled the LS facilitators to develop their knowledge on LS and to engage participating teachers in educational research. Furthermore, teacher engagement with research was extended by proactively encouraging teachers to take part in higher academic study. Taking part in such study meant that a teacher's efforts in LS could be rewarded through professional accreditation. The teachers would also be more equipped to complete LS, as intended, and other participants in LS would also have access to Universities libraries, research and expertise. Secondly, the school statuses of these two schools, suggested that they had more financial support and resources for teacher PD. Teachers could be given regular protected time throughout the academic year, to participate in LS and collaborate with their peers. At Ashgate, the Head Teacher, as the key school leader, took the decision to financially invest in teachers' PD through LS and to use LS as the key school improvement strategy to raise student performance. This Head Teacher's personal commitments and

strong belief in LS meant that he needed to persuade other senior leaders and middle leaders of this vision. To realise his vision for school improvement, funding was used to commission an external PD provider. This PD provider had a strong reputation in leading and quality assuring teacher PD. Quality assuring LS as a form of teacher PD and brokering teachers' introductions to LS through senior middle leaders and teacher (recognised as outstanding) were deliberate strategies at Ashgate. They were useful in embedding a consistent model and sharing good practice. Furthermore, the whole school community was involved in LS. Teachers talked about LS being part of the school's ethos and professional culture. Perceiving both teachers and students as lifelong learners was associated with being the school's culture. They were given the time and resources to learn, whilst still being accountable to school priorities and expectations. Sharing this accountability to school priorities meant that teachers had to spend time each week working in cross curricular LS groups. The monitoring of each teacher's participation was built into their performance review and teachers were expected to share their LS outcomes with the whole school.

At Overton, the school status created a different context. This school was recognised as outstanding and had a specific remit for leading and driving school improvement across over 20 schools based around the country. The imperative was to have evidence that LS could work so there was some *proof of concept* before further investment. Convincing school leaders of the merits LS and of the need to invest in this collaborative-research orientated form of teacher PD was not easy. In contrast to Ashgate, at Overton LS had not been introduced as a top down initiative; it had been brokered through the Head of Science who was a fervent LS enthusiast. Concrete evidence that LS could work could only be gained by teachers' participation in LS, which had to begin at a departmental level. As such, LS was initiated from the science department, and then introduced, as an optional pathway, to all teachers across the academy, but only once there was some evidence of its positive impact. Introduced to LS, almost by chance, at an event at a local University, the Head of Science chose to pilot LS as part of a Master's study. Overton developed their own LS model, principles and protocols that could be used in both subject specific and cross curricular teaching contexts.

After extensive piloting, the Head of Science was given the trust and responsibility to introduce LS to the academy chain. This signalled a workplace environment that valued collaborative teacher PD and teacher innovation and agency as vehicles to improve both teacher and student learning.

Treebank is based in a rural location, a mainly white catchment area drawn from both affluent and deprived areas, but the school had no specific designation within the broader school led system at the time of study. There appeared to be little investment in teacher PD, hence little risk for LS, no accountability and no requirement to produce evidence that LS worked. Treebank was perhaps the school that appeared to be struggling most to meet external standards and attract teachers. Teachers talked of the high turnover of staff and teachers being often fast tracked into in leadership roles with little experience. Furthermore, the workplace conditions appeared to offer little to afford LS enactment—other than the enthusiasm of teachers to learn from other teachers, as there were few opportunities for science teachers to meet and share ideas. The only risk lay with the teachers in deciding how to use their own time. However, once LS started to interrupt the flow of learning for their students, the teachers started to question its purpose and feasibility. Treebank introduced a model of LS that could be regarded as ineffective and lacking many of the structures and practices that make LS identifiable. This underdeveloped representation of LS was handed down by a senior colleague who had received training in LS. However, this case provided a sharp backdrop against the other two cases when considering how the local school contexts could play a role in LS enactment and in the learning of teachers.

5.4.2 Social Structures and Resources

Each of the schools had allocated a science teacher as LS facilitator, who also had some middle leadership responsibility. These facilitators had different experiences of LS, ranging from 2 to 6 years, from no experience at all to the time of first implementation. As LS facilitators, they used a range of strategies to encourage teachers to participate in LS and senior leaders to support LS in their schools. One strategy involved identifying reflective teachers as early adopters

of LS and positioning these teachers in different LS groups. Teachers with some previous experience of LS, who one assumes had begun to see the benefits of LS and how it could work in practice, were carefully placed in groups to support discussions or act as ambassadors for LS.

Facilitators promoted teacher autonomy and agency in LS, encouraging the teachers to take ownership of the LS process. They lobbied senior managers to allocate time for teachers to meet and observe each other and they established ground rules and ways of working during LS. LS facilitators did this as they tried to develop their own expertise and understanding of effective LS. Facilitators had to balance their own learning and goals with those of the LS participants. Facilitators also had to respond to their colleague's questions and concerns, whilst trying to keep some control and direction of the process. Facilitators wanted to position LS outside of teacher performance and inspection regimes and encouraged the teachers to engage with research. At Treebank, although the facilitator was less involved in LS, she tried to monitor the LS cycle and align the teachers' timetables so that teachers could observe each other's lessons and find some way to collaborate. The teachers valued this encouragement and practical support which was instrumental in enabling them to meet and work together.

At Ashgate and Overton, the school contexts afforded teacher collaboration and engagement in research. These practices were already well supported and resourced, meaning that the LS facilitators could focus on shaping teacher discussions and actions and setting the tones for collegial and trusting working environments. Furthermore, both facilitators carried out "matchmaking" of teachers to different LS groups; creating other events for teachers to meet, talk and share ideas was the main strategy to gain buy in for LS.

Chapter 6 Discussion and Conclusion

6.1   Introduction

This section relates the findings in Chapter 5 to the existing literature to identify and elaborate on the distinctive contribution of the thesis. This chapter is written from the viewpoint of someone who is an experienced professional development (PD) leader, first and foremost; a Lesson Study (LS) facilitator and a former secondary science teacher. As such, there is an emphasis on "enactment" (Ball et al., 2012) and how LS is interpreted and translated in practice, through and by the socially situated interactions of science teachers seeking to do LS for their PD within their local school and workplace conditions. To this end, the discussion is not structured by each research question; it is framed by emergent questions and the implications of this study for LS and PD practice, PD policy, and future research.

6.2   Research Contribution

The aim of this study was to elaborate on and apply a complex conceptualisation of teacher learning (Opfer and Pedder, 2011), located within communities of practice theory (Wenger, 2000), to an empirical study. This broader starting point was taken to not only understand the ways in which teacher learning occurs through social interactions but how different contexts can also serve as a source for teacher learning (Koffeman and Snoek, 2019). In doing so, the study has identified a range of contextual factors that have featured in, and shaped science teachers' participation, engagement and enactments in LS.

There are two main contributions for this research. Firstly, the study serves to provide empirical evidence and build a stronger argument for PD researchers and practitioners to always consider the complexity and non-linear nature of teacher professional learning (Boylan et al., 2018b; Strom and Viesca, 2020). Through vivid, rich descriptions, the study has illuminated and can highlight the components and characteristics of three learning sub-systems of the wider teacher learning system in LS. Secondly, by taking this deeper, theoretical but

targeted perspective on teacher professional learning, within communities of practice theory and associated constructs, this study identifies a set of underlying mechanisms shown to feature in the ways the three learning sub-systems interact and are interrelated. These interactions and interrelationships shaped teachers' perceptions, understandings and participation and engagement in LS leading to variations in LS. These variations in LS enactment are reported as detailed, in depth individual case studies and a cross case analysis to reveal different patterns of teacher learning. This research provides a critical, contextual analysis of the socially situated nature of teacher learning during LS. This serves to show that is LS is variable, and versatile as a form of PD, that is highly sensitive to the contexts of its enactment.

This rich contextualisation of LS were enabled by making a clear distinction between PD, seen as an isolated event or activity, and teacher professional learning, seen as the process by which teachers enhance their knowledge, skills and practice to support high levels of student learning. In addition, the quality of LS enactments was tentatively benchmarked as a form of PD, using a set of principles and practices, in line with the literature. Existing studies are often set in ideal contexts to realise these principles and practices, often under the coordination and leadership of LS advocates. These advocates are often academics based in Universities who are seeking to make LS work. However this study was intended to extend and support these endeavours by considering the implementation of LS in more typical school contexts, that may not have this direct, sustained support and advocacy for LS. The next section discusses this contextualisation of LS, as a collaborative--research orientated form of PD, to show how LS may be shaped and reconfigured in different school contexts by a set of underlying causal mechanisms.

Taken and informed from the field of realist evaluation (Pawson and Tilley, 1997), in this study, mechanisms are considered as the hidden, contextual processes and underlying elements that featured in and led to variations in LS enactment. These variations in LS enactment, it is proposed, are shaped by three underlying mechanisms: i) the degrees of *alignment and dissonance* with individual and

collective teachers' and schools professional learning orientations; ii) the *reification* of individual and collective teachers' and schools professional learning orientations, in the form of artefacts and iii) the *brokering and boundary crossing* enacted by science teachers, to support and sustain LS within the affordances and constraints of their local school contexts. Bearing in mind that is not to suggest that these three mechanisms are mutually exclusive – taken and discussed, this helps to reveal how different patterns of teacher learning may appear through the variations in LS enactment, which in turn may subsequently give rise to further variations.

6.2.1 Mechanism 1: Degrees of Alignment and Dissonance

It is well known that teachers' beliefs have an influence on their practices, their professional identities (Wenger, 2000) and the decisions and actions they take in classrooms (Beijaard, 2019; Boylan, 2018b; Hsieh, 2015; Leander and Osborne, 2008; Noonan, 2019). Using communities of practices theory, these science teachers' identities were reconceptualised and fore fronted in this study as their professional learning orientations - as their values, beliefs, skills and knowledge in relation to LS as a form of PD (Section 2.5). Teachers' professional learning orientations were then explored through the teacher learning sub-system.

This important role of teachers' professional learning orientations, or goals, and the values that they place on current or new learning practices has been considered in other teacher PD studies and show to influence outcomes (Boylan et al., 2018a; Boylan et al., 2018b; Cajkler et al., 2015; Louws et al., 2017b; Yarema, 2010). However, for this discussion, I refer specifically to ways in which these science teachers' individual and collective professional learning orientations may have affected their perceptions, expectations and participation and engagement in LS, resulting in variations in LS enactment.

As LS was introduced to these teachers, they were presented with a distinctively collaborative-research orientated form of PD to which teachers responded in different ways. As described in Section 2, LS is a cyclic learning and teaching improvement and research process, where teachers are encouraged to work

together. The science teachers in this study, on the whole, all showed positive professional learning orientations to LS, whether as volunteers or mandatory participants. These science teachers believed that their participation in LS could be beneficial for their students, for them individually and, collectively for their schools or science departments. The individual case studies and findings (Section 4 and 5) showed that teachers often believed that LS was *aligned* to the learning practices and processes that they believed could would both help them to become better teachers and lead to improved student outcomes. These teachers had different understandings experiences, expertise and histories with LS and forms of PD, however the versatility and the range of learning activities offered through LS meant that teachers could align LS with their preferred learning practices and everyday ways of improving teaching.

For some teachers, for example at Overton, working collaboratively as a science department was the norm; these teachers were well prepared and accustomed to working together. Whilst at Treebank, working collaboratively, particularly through shared lesson observations, was more of an aspiration of the teachers involved, rather than an established practice in their school setting. The teachers at Treebank, therefore, believed that their participation in LS could play a part in creating more collaborative and collegial working conditions. For the two teachers participating in LS, the desire to work collaboratively and collegially affected their decisions to stay engaged in LS, despite the lack of alignment (or dissonance) afforded in their schools for them to meet, to talks, to plan and to observe lessons together. The lack of opportunities to observe other lessons meant that these two teachers, who incidentally were both recently qualified, prioritised lesson observation over lesson planning. In comparison, at Overton, the more experienced teachers prioritised reflective and critical professional dialogue over lesson or student observations. As such, the teachers in two different schools started to align themselves to different LS practices in different ways.

A common desire, however, for all the teachers was to be able to talk about the learning needs of individual and groups of students. In a recent study carried

out in a primary school in Norway, it was shown that sustaining opportunities for teachers to talk together about the needs and learning of their students created a greater collaborative learning potential (Aas, 2021). Furthermore, it has been shown that a key design feature of effective LS and other forms of collaborative PD, is having the involvement of facilitators who maintain this *alignment and focus* on student learning and thinking through professional dialogue (Akiba et al., 2019a). Conversely, studies have drawn attention to need to create some degree of cognitive conflict or *dissonance* during teacher PD programmes, in order to encourage teachers to reconsider their pre-existing beliefs about student learning, and to reconceptualise their teaching (Calleja and Formosa, 2020).

Similarly, for some teachers, engaging in research or using research to understand and inform their teaching, a central aspect LS, may create different degrees of alignment and dissonance with teachers pre-existing knowledge, skills beliefs and practices . For example, in these case studies and individual teacher accounts, we saw evidence of variations in alignment and familiarity with accessing and reading academic research and how this was valued. The less experiences teachers who had recently completed initial teacher training (Treebank and Ashgate) seemed more prepared and equipped for this task. For other teachers (Overton), research informed teaching was already rooted in and aligned with their epistemologies and the school norms—the ways these teachers believed teaching could be improved and understood. Thus, as LS was being offered to science teachers who had different backgrounds, experience, knowledge and skills, their individual and collective professional learning orientations, towards LS, were positioned in different ways from the start. Moreover, these science teachers were not passive recipients of LS, whether as LS participants or facilitators, these teachers started and were able to direct their learning individually and collectively. Teachers were active agents, seeking different ways to develop themselves professionally through LS and improve their teaching in ways that would benefit their students. Hence, the science teacher's past and current experiences, their values and beliefs, provided affordances to support the implementation of effective LS, as did their local school conditions,

resources and structures. Such positive professional learning orientations towards LS were found in another study which showed that teachers approached LS with enthusiasm and an open mind, but notably, this was only in the early stages of LS (Vermunt et al., 2019). Moreover, in a recent study carried out with teachers in Taiwan, it was claimed that teachers' participation in LS was affected by their attitudes towards LS, and towards their own self-development as well as the teachers' perceived competence that they would be able to do LS (Jhang, 2020). Together, these two studies and the findings here suggest that it is important in LS practice to consider the *status* and role of teachers' professional learning orientations and how this can be *aligned* to LS principles and practices. As argued in Section 2.3, for LS to be effective there are principles and practices of Japanese Lesson Study (JLS) that need to be adopted and prioritised to have a positive impact outside of Japan (Takahashi and McDougal, 2016). However, the prioritisation of these principles and practices, may only be maintained and sustained,   if we take account of the professional identities, beliefs, values and practices of those involved or seeking to take part

What follows now, to add to this complexity, is a discussion of the school learning orientations, explored through school learning sub-system in relation to LS, regarded here as the local affordances and constraints for effective LS. Takahashi and McDougal (2016), claim that for LS to be effective, there needs to a clear research purpose and process that enables teachers to be able to learn something new and to develop their teaching expertise At Overton and Ashgate, teachers were given the time and space to be able to engage in deep reflective talk about their teaching, to take joint risks (Dudley, 2010) and learn through evidence informed collaborative enquiry (Yuk, 2012). This type of school *structural* affordance appeared to promote and deepen teacher participation and engagement in LS while sustaining a professional learning community, as observed in other studies (Groves et al., 2016).These conditions were present to a greater extent at Overton and Ashgate, perhaps due to the schools' past histories and experiences with LS, but predominantly due to their privileged status within the English school system: Overton as a leader of a Multi Academy Trust and Ashgate as a University Technical College. Furthermore, these schools'

internal priorities and external influences meant that supportive and well-resourced environments were created for teachers to work collegially, enquiring into their teaching practices without the pressure of being judged. These practices were well established, supported and resourced. In these two schools, there was an investment in, and cultures of, teacher collaboration, professional enquiry and research orientated practice.

Schipper et al., (2020a) have argued that not only can LS thrive in such professional cultures, but can help to create this a collaborative and research orientated professional cultures. A professional culture in which teachers can feel confident to engage in inquiry and exchanging knowledge through collaboration. Furthermore, in support of these claims, in a recently reported longitudinal study to consider the long term impact of LS , it was shown that in the absence of other professional development intervention, teacher professional learning communities have been sustained through LS (Lewanowski-Breen et al., 2021)

At Treebank, however, it was the practical alignment of the two teachers' timetables that appeared to be the only affordance that helped to sustain their participation and engagement in LS and collaboration. This echoes the findings of Boylan et al., (2018a) that have shown that there are significant structural and material affordances such as the status of a school in the current self-improving system, that can indeed influence and sustained teacher participation and engagement in collaborative educational innovations.

When LS was presented to these teachers as a form of collaborative-research orientated PD, there was also some scope for different teacher interpretations and orientations whether as LS participants or facilitators. For example, some teachers associated LS with higher academic study, as a scientific process or as an approach that could show that a teaching strategy did or did not work. These teachers were given and were able to exercise some autonomy and agency to make some sense of LS for their own learning and for the benefits of their students. At both Ashgate and Overton, we see the science teachers, both as LS participants or facilitators trying to grasp LS as a research process but in different

ways: through the filtering of academic literature, access to University libraries, the diagnosis of student needs and, collecting student and classroom data. A distinctive structural affordance for research was observed at Ashgate; LS was located within a school-wide improvement agenda and research theme: improving the attainment of borderline students at GCSE. At Overton, open, collaborative, and critical professional dialogue and enquiry were carefully guided and sustained using scaffolds, discussion protocols and ground rules. This provision of scaffolds, as a form of reification, was more explicit at Ashgate. They took the form of writing frames and formulae for teachers to develop robust and feasible enquiry questions and research methods. These scaffolds were well received by teachers to support their participation and engagement in LS at both schools. Thus, at Overton and Ashgate, the local school contexts afforded a stronger structural and *cultural* alignment with teachers' perceived high values of certain learning practices such as collaboration, collegiality, extended professional dialogue and open classroom cultures. This strong alignment to collaborative-research orientated professional learning is a widely accepted feature of effective PD, also reified in the Standard for Teacher PD, at the macro level of the English school led system (Hadfield, 2018).

Nevertheless, although there was evidence in the teacher learning sub-system and school learning sub-system of positive affordances towards LS as a research process, teachers lacked the confidence and skills in how to engage with and do research during LS. Furthermore, all of the science teachers interviewed, showed concern as to how carry out and use research, for example, when deciding which types of data to collect during a research lesson or, how and when to use control groups to show the impact of an intervention. Such teacher cognitive and emotional barriers to using, carrying out and engaging with research have been reported recently in a large scale study in England (Coldwell et al., 2017). This report provided an assessment of how schools and teachers used evidence to improve their teaching, stating that teachers do not feel confident to engage with research directly or able to judge its quality. The report recommends that this issue can be addressed by senior school leaders acting as intermediaries and facilitators of access to research evidence. This was the approach being taken at

Ashgate through the access to, and filtering of, academic literature and to key educational thinkers such as John Hattie. In addition, at Ashgate, there was a strong alignment with research use and engagement across the whole, with research informed teaching being prioritised and built into the school improvement plan.

At Overton, we see this alignment with research being afforded in a different ways—through the collaboration with an academic recognised for expertise in LS (identified by teachers as one of their knowledgeable others) and by a funded entitlement for the science teachers to engage in higher academic study. Involving an academic and providing teachers with an entitlement to higher academic study helped to develop LS practice and expertise in the school, raising the status of LS in the academy chain and providing a structured process for disseminating research findings and LS outcomes. In contrast, at Treebank, there was an acceptance and understanding that LS was a form of research, but this was solely based on teachers' recent experiences of academic study during their initial teacher training. For these teachers, there was no structural support, nor place for research, and no clear recognition of the value of research informed teaching.

As elaborated in Section 2.3, it is reported that in Japan, teachers spend a significant amount of time on the process of *kyouzai kenkyuu, supported* by knowledgeable others or *koshis*. This study showed a definite lack of awareness or recognition among teachers and schools of the purpose, role and value of knowledgeable others in LS. Granted, at Overton and Ashgate, the science teachers did talk about the benefits of involving individuals outside their LS groups, for guidance on subject specialist matters and for guidance on the LS process and some teachers explained how they had sought and identified knowledgeable others. At Ashgate, there was also a tentative suggestion, that teachers, identified as outstanding, could support LS groups in some way. However, the teachers' and school visions of knowledgeable others, and the set of skills and knowledge they represented, seemed far from the expectations of JLS (Table 2.1)

This study did not extend through to fully explore all stages of LS cycles, but from the stages of LS that were observed and reported, there was a stronger degree of *alignment*, between the teachers' and school professional learning orientations towards LS than a *dissonance* or lack of alignment. Dissonance is understood here as the disconnect or lack of harmony between the principles and structures of LS, and the teachers' or the school professional learning orientations to LS. However, when the teachers talked about the lesson observation process in LS, we saw an alignment, between the teachers' professional learning orientations and LS, but a strong dissonance and lack of harmony with school lesson observation practices. The teachers, in all three cases, wanted to take part in lesson observations that were enacted in a trustful and non-judgemental manner. These teachers believed that their peers were facing similar classroom challenges, which they were each struggling to resolve in isolation. The teachers felt their local school contexts and the wider performativity culture, created through inspection regimes, did not afford these desired conditions for their individual and collective professional learning. Surprisingly, this value–practice dissonance or *gap* appeared to promote rather than hinder teacher participation and sustained engagement in LS, thus warranting further study.

This section has provided and discussed some important observations that deepen our understanding of the ways in which teachers' and school professional learning orientations may have different influences and effects. These different effects and influences featured in the ways in which teachers responded to, participated in and, stay engaged with LS. And, as one might expect, in schools that have invested in LS, this appeared to afford a greater degree of alignment than dissonance, which may have created some common and predictable patterns of teacher learning. However, as LS is contextualised and enacted in different school contexts, in different classrooms and in different subjects perhaps, recognition is growing of how LS enactment is shaped and impacted within and across different sub-systems of a highly complex and non-linear professional learning system.

6.2.2 Mechanism 2: Participation and Reification

The concept of practice in this study is defined as the things that teachers do—how they use their knowledge and skills, their repertoire of resources and experiences, in short, the practices and the ways in which teachers participate and engage in their professional learning and in communities (Wenger, 2000). In this section, I discuss ways in which the reification of these individual and collective teachers' and school professional learning orientations (their identities, beliefs, knowledge and practices) featured in, and shaped LS enactments.

These science teachers were being encouraged to introduce LS as a collaborative-research orientated form of PD into their practice. Teachers were invited to work with other teachers in small subject and cross-curricular groups, to plan and observe research lessons and to take part in critical and reflective professional dialogue about the teaching and learning issues facing their students. The teachers were becoming members of new and different communities of practice. Overall, these teachers' perceptions, understandings and expectations of LS were strongly aligned with the features of effective LS reported in the literature (Akiba et al., 2019a; Akiba et al., 2019b; Cajkler et al., 2014; Cheng, 2019; Coenders and Verhoef, 2019; Godfrey et al., 2019; J. M. Lewis, 2016; Schipper et al., 2020a; Willems and Van den Bossche, 2019). Furthermore, in two of the schools studied, Overton and Ashgate, there was a strong alignment with school learning sub-system to create structural affordances and workplace conditions to support for LS enactment.

To further theorise the socially situated nature of LS enactment and context, the teachers' learning environments can be considered as being shaped by what is reified – what is *noticed*, *prioritised* and *valued* by the teachers as LS participants and facilitators. This socially situated nature of LS enactment was brought out in each school case study and can be observed as the variety and breadth of the teachers individual and collective practices and experiences, in relation to the teaching and learning issues that the teachers and school LS communities chose to address. From a communities of practice perspective,

reification is viewed here as a way of making something real or concrete that emerges through these individual and collective teachers' participation in LS and what they were being asked or encouraged to. Examples of these forms of reification included finding ways that teachers could collaborate in LS across different subject disciplines, noticing certain topics as the focus to deepen their understandings of teaching or finding ways that teachers could enquire into together.

At Ashgate, where teachers were working in cross-curricular LS groups, it was a challenge to identify, agree and refine a clear research purpose for the LS. Noticing that there was variety in the practices and concerns across different disciplines, reification took the form a collective decision of a LS group to focus on how to improve teacher feedback in their different subject disciplines. This collective decision to have a shared *portable* goal meant that teachers could cross into each other's classroom settings and find ways to participate in LS both individually and collectively. The teachers working in different subject areas could collaborate with each other and talk about both their individual feedback practices, the specific learning needs of their own students as well as their collective concerns. Additionally, this form of reification meant that the teachers could carry out some research, which appeared to increase both their capacity and capability to ask questions focused on student learning and their teaching in different classroom contexts. Hence, forms of reification may promote teacher participation in collaborative enquiry, which then becomes more central and aligned to the teachers' beliefs, skills and knowledge and everyday practices.

To further elaborate on the ways in which reification featured in the case studies, I use the example of Overton, where a group of science teachers were also seeking to agree on a shared research goal for their LS. Here, the LS facilitator encouraged teachers to collaboratively in order to identify a persistent teaching and learning issues. Reification took the form of a common concern and problem for many teachers—improving student performance in examinations. These science teachers started to notice and reflect on the ways they used mathematics

language in science lessons. They became more aware that their practices were inconsistent and confusing for their students. Reification then took the form of a longer term collaborative endeavour, producing a model for teaching mathematics in science to all students across all examination groups.

Vermunt (2019) suggests that teachers who have high perceived values of LS, in the early stages of a cycle, are more likely to engage in *meaning* orientated and *application* orientated learning as opposed to less problematic learning. Meaning and applicated learning involves teachers being an able to *regulate* their own and collective learning and apply their learning in authentic teaching situations as was outlined in the example above. These science teachers chose to look for *why* certain practices may or may not work and *how* to apply their individual and collective learning in their individual classrooms. In accordance with these findings, Schipper et al (2020b) have shown that through participation LS, teachers can become more adaptive – they learn how to better respond to the strengths and need of all their students and know when and how to use different teaching and learning approaches.

In contrast, the two teachers at Treebank were trying to solve a less complex issue—how to manage student movement around the classroom.

As Wenger (2000) states, meaning is created through participation and active involvement in some practice—the practice, in this case, being a science teacher taking part in LS. At Treebank, the science teachers had few opportunities to participate in LS practices that involved extended professional dialogue or collaborative enquiry. In contrast, at Overton, the teachers desired and showed an increased awareness of the need for a consistent model for teaching mathematics in science, through sustained professional dialogue. Teacher professional dialogue and enquiry were further sustained through the involvement of a mathematics teacher that appeared to challenge these science teachers' beliefs.

These examples are intended to show ways in which certain principles and structures of LS may create different forms of reification *and* participation and

engagements in LS. There must be some reciprocal, fluid relationship between how teachers participate and engage in LS and what is reified. By using communities of practice theory, teacher learning can be understood here as the process of increasing science teachers' participation in LS and becoming more knowledgeable about teaching *and* about LS. As such, we can see ways in which teachers' participation and engagements in LS are shaped within a community of practice and, in turn, how the community of practice is shaped by teachers' participation and engagement in LS. It is essential, therefore, that teachers have positive early experiences of LS and attention is given as to how to sustain their participation and deepen their engagement throughout a full LS cycle, at the very least.

6.2.3 Mechanism 3: Brokering and Boundary Crossing

These science teachers were members of multiple communities of practice, the science department being the most predominant. In England, as many countries, science teachers may be members of a science subject association, a leadership team or other grouping, or professional network. These multiple, communities of practice offer different sites for teachers' learning and are bordered both physically and virtually, but also in terms of the activities that may gone and forms of engagement.   By encouraging teachers to take part in LS, we are asking teachers to become a members of other communities of practice for example as a member of a LS group or of an external LS network. Becoming a member of multiple communities of practice creates multiple *boundaries.* According to Lave and Wenger (1991), boundaries are related to what counts as expertise within a community and what distinguishes one community of practice from another. Furthermore in sociocultural terms, boundaries are thought to create learning potential (Akkerman and Bakker, 2011). As these teachers started to participate in LS, there were faced with multiple and different boundaries that offered different sites and potential for their professional learning.   This potential for professional learning at a boundary, however, had to be sustained and mediated through social interactions and actions.

A boundary can be seen as a sociocultural difference leading to discontinuity in action or interaction. Boundaries simultaneously suggest a sameness and continuity in the sense that within discontinuity two or more sites are relevant to one another in a particular way.

Akkerman and Bakker, 2011, p. 133

One example of how social interactions and actions were mediated and sustained at a boundary was observed when teachers were asked to work in cross-curricular LS groups. Multiple boundaries were inevitably created due to these teachers' different, subject specialisms, classroom settings, assessment protocols and so forth. However, learning potential and continuity in action, was mediated and sustained through their collective decision to focus on teacher feedback. This pedagogical goal for their LS was then operationalised through the design of a LS artefact which took the form of a student questionnaire. This questionnaire was used as a diagnostic tool to gather students' views on the value of teacher feedback before designing a research lesson. As a diagnostic tool, this acted as a *boundary object* that could be used in different classrooms *and* serve to foster teachers' discussions during LS and to develop their understandings of how to improve teacher feedback. As a boundary object, the diagnostic tool became relevant in different classroom sites and in LS discussions, in different ways.

The science teachers in this LS group, and in other groups across these three cases, had started to become active in multiple communities in different ways. The teachers became active within each other's classrooms - as they chose and enacted a shared focus for LS, within the academic community - as they started to engage with academic reading and, for some within internal and external networks -as they disseminated the outcomes of their LS. In doing so, these teachers became *boundary crossers*. As boundary crossers this afforded and stimulated reflections on their teaching and questioning of their skills and knowledge, beliefs and values.

In each of the case studies, there were then multiple ways in which this boundary crossing was facilitated and promoted. As teachers negotiated a shared goal for LS or found ways to observe each other's lessons, boundary crossing and professional learning in different communities and contexts, not only involved the use of *boundary objects* but the involvement of *brokers*. For example, the prospect of being required to engage in academic reading during LS created boundaries and barriers - often by the practical and logistical challenge of accessing academic literature. In order to minimise this discontinuity in action or interaction, teachers were given direct access to relevant academic reading, that was sourced, filtered or *brokered* by senior leaders and external experts.

By acting in this way, facilitators, senior leaders, experts can act as brokers to connect across other boundaries and introduce practices into different communities of practices during LS (Lave and Wenger, 1998). Brokering was most obvious through the introduction of LS protocols and ground rules, through senior leaders and LS facilitators who brokered access to academic researchers in Universities, to external experts in LS and to colleagues with likeminded interests and expectations. As such these teachers and senior leaders as active brokers in multiple communities were becoming essential for LS. Brokering and boundary crossing was enacted in form of several LS artefacts acting as boundary objects which became instrumental, in the same way that Wake and Seleznyov (2019) refer to LS research lesson as being instrumental in both a LS group and in a teacher's classroom.

Boundary objects, whether concrete or abstract, have different implications in different social worlds; however, it is important that these objects or LS artefacts retain a common identity across the boundaries of these worlds. As such the job of brokering and the use of boundary objects is complex:

> *It involves processes of translation, coordination and alignment between perspectives. It requires enough legitimacy to influence the development of a practice ... it also requires the ability to link practices by facilitating*

transactions between them and to cause learning by introducing into a practice, elements of another.

(Wenger, 1999 p 109)

We see evidence of this at Overton when the balancing of an equation in has a common identity in both a mathematics and a science classroom – effectively facilitating cross-curricular communication and professional learning and the achievement of a longer term educational goal.

LS artefacts, such as writing templates designed by the LS facilitators at Overton, and at Ashgate by externally PD provider, acted as boundary objects, enabled these science teachers to connect, talk and mobilise themselves in different individual and collective ways in different communities. A set of ground rules for LS at Overton, was used to aid teachers in transitioning from teacher performance led practices to being part of practices where teachers could feel more confident to take risks and to talk freely. Providing these conditions for teachers to collaborate and talk freely in different ways re-examined here through both brokering and boundary crossing is claimed to be a key motivating factor for sustained collaboration and participation in LS (Lewis et al., 2006). Furthermore, teacher participation in collaborative talk is claimed to promote joint risk-taking and access to tacit knowledge, such as how to solve specific and complex teaching and learning issues (Dudley, 2010; Fernandez and Yoshida, 2004; C. C. Lewis et al., 2009) and how to become more aware of student learning as ground LS in authentic teaching situations (Suh and Fulginiti, 2012).

This careful management and support for teacher participation and engagement in LS through collegiality, collaborative talk and professional dialogue draws attention to the important role of teachers as boundary crossers and LS facilitators as brokers in the implementation of LS. As seen at Overton and Ashgate, but to a much lesser extent at Treebank, the LS facilitators were instrumental in creating collaborative and well-resourced working conditions for LS. As brokers, LS facilitators had to support these science teachers to

negotiate and address their individual and collective interests and concerns. This was often enacted by matchmaking teachers to other teachers with shared subject specialisms, interests and experiences – and professional learning orientations. LS facilitators also engaged academics from Universities, they lobbied for senior leadership support and identified teachers experienced in LS as ambassadors to gain buy-in from other teachers. LS facilitators encouraged teachers to identify a shared focus for LS which meant that teachers were able to *virtually* cross over into each other's different classrooms, teaching groups and their different teaching and assessment routines. Markedly, the most significant professional learning boundary for teachers' in LS was created through the requirement to engage in, carry out or use research. This was being at the whole school level at Ashgate, through brokering access for teachers to experts from other Universities and via national LS networks, for example. At Overton, this was through access to higher academic study and to LS research communities and research resources. The next step for research would be to add to the limited knowledge base on the leadership of teacher PD (Perry and Boylan, 2018; Hallinger and Kulophas, 2020) to consider this important role of facilitators in LS and PD leaders more generally over a longer period of time and in different contexts (Hadar and Brody (2020)

6.3   Implications for Professional Practice, Policy, and Research

In this section, I consider the implications of the study for my own professional practice, for other organisers and leaders of PD and for further research. This includes a discussion located in the broader landscape of PD leadership and, specifically in LS leadership and implementation, alongside a consideration of the research implications and broader national policy of teacher PD.

6.3.1 Leadership of Teacher Professional Development

By engaging with theoretical models of PD and wider theories of social learning, this study has highlighted the socially situated, complex and non-linear nature of teacher learning. The study has revealed that teachers' participation and engagement in PD, in this case LS, can be afforded or constrained by the

contexts of its enactment, creating variations and different patterns of teacher learning. The analysis in this thesis leads to recommendations for how PD and school leaders can support the enactment of effective PD in local settings.

Since the emergence of the self-improving system in England (Section 1.2), the importance of teachers and school leaders, often described as PD leaders or "system leaders", in the development of the teaching workforce has been acknowledged (E. Perry and Boylan, 2018). Teacher and school leaders are becoming more involved and responsible for organising, coordinating and evaluating teacher PD activities and have a pivotal role (Boylan, 2013). Therefore, given the current fragmented and unpredictable landscape and variety of contexts for teacher PD, we need to support and develop the skills, knowledge, capacities and capabilities of teachers as PD and system leaders.

> *Alignment requires specific forms of participation and reification to support the required co-ordination … With insufficient participation, our relations to broader enterprises tend to remain literal and procedural: our co-ordination tends to be based on compliance rather than participation in meaning … With insufficient reification, co-ordination across time and space may depend too much on the partiality of specific participants, or it may simply be too vague, illusory or contentious to create alignment."*

Wenger, 1998, p. 187

As an experienced PD leader myself, a notable feature of this field of research is the potential for using theoretical models to understand and explore teacher PD. This has been exemplified in this thesis and so can lead to recommendations. For example, the quality, relevance and suitability of PD programmes and their effectiveness may be assured by considering how and why teachers may choose to participate in different form of PDs, at different times and for different purposes and at different times in their careers. To achieve the "right contextual fit" (Braun et al., 2011), consideration, therefore, needs to be given to how PD leaders and system leaders can engage with this and other contextualised studies and, pay attention to the complexity of the

professional learning system—the teachers, the schools, the PD programme itself and the broader PD landscape. This could be achieved through the provision of quality assured and accredited PD programme for PD leaders, system leaders and teacher educators that offers learning opportunities to use a range of evidence and research to identify, select and critique PD models and practices, to select models of PD that help to identify the nature of professional learning and pathways and to consider how teacher engagement and participation in PD may be contextualised.

A specific, practical action would be to raise awareness of the likelihood that variations in professional learning orientations that may exist in any one department, school or groups of schools, at any one time. This variation in professional learning orientations can be considered as a potential teacher learning or motivational gaps. For example, a gap may exist between teachers' values, their everyday practices and school cultures. In the case of LS, as an example, recognising such gaps suggests that teachers and schools may be in different states of *LS readiness for research* and therefore LS can be reconfigured and redesigned appropriately.

Furthermore, when selecting and introducing different forms of PD, school leaders must not underestimate the important role that some teachers have in promoting and sustaining teacher participation and engagement in PD. These teachers need to be supported, enabled to act as ambassadors for the individual and collective groups of teachers that they are working with—recognising how gaps might be addressed or where there may be a need for further support, structure and resources to promote and sustain teacher engagement. This is, of course, not an insignificant challenge. To ask teachers to pay full attention to individual and collective teacher professional learning orientations, in the design and leadership of a PD programme, is unrealistic. This would require PD leaders and system leaders to consider each teachers' past experiences, their attitudes, their existing knowledge and skills, their willingness to participate and engage in different forms of PD and how they see themselves as both teachers and as professional learners (Beijaard, 2019).

However, PD leaders can promote autonomy and agency in teachers' professional learning—as with school students' learning—PD leaders can guide, scaffold, and facilitate teacher learning, gradually passing over responsibility. PD leaders can encourage individual and groups of teachers, whom they are working with, to reflect on their own professional learning orientations and the forms of PD offered to them. Teachers may then be able to take more ownership of their learning, take more risks, find creative and realistic ways to improve their teaching and improve student outcomes both individually and collectively.

Such quality assured and accredited programmes of PD for PD leaders need to be developed in partnership with Teaching Schools[6], Mult-Academy Trusts, Universities, and other key stakeholders in education. This would give school leaders and teachers the confidence to initiate and strengthen school–university partnerships and promote a smoother progression from Initial Teacher Training routes. All of which may help to promote and sustain a collaborative, research informed teaching profession.

6.3.2 Leadership of Lesson Study

The study has highlighted some of the dilemmas and tensions, specifically in the design and leadership of LS. Within my own professional practice, I have experienced tension and professional conflict when asked to lead and facilitate LS while also observing, critiquing and giving advice on a research lesson. As described in Section 2.3, in Japan there is an established community of knowledgeable others or *koshis* positioned strategically, outside of LS groups, to offer expert challenge and to commentate on research lessons (Watanabe, 2002). In these case studies, this role of a knowledgeable other was not formalised, nor have I seen this role established systematically in LS practice in England. What is clearer now from this study, is that teachers saw the benefits of involving external experts in their LS and were seeking ways to identify and involve knowledgeable others. Therefore, for LS to be effective in England, the

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[6] These are outstanding schools which have been nationally recognised for their capacity to support and help other schools to improve outcomes.

role of a knowledgeable other, or external expert in LS, demands to be clearly identified and resourced, within the context of the English self-improving system. However, I also argue that the role of knowledgeable others needs to be "delineated" from the role of LS facilitators.

To justify this delineation of roles of knowledgeable others and facilitators, we can draw from the evidence from this and other studies on research and collaborative PD. For example, studies have shown that access to, engagement with and use of research is problematic for teachers in all schools in England (Maxwell, Bronwen & Greany, Toby. (2017)., 2017). And, even, as in one of these case studies (Ashgate), when improving the use of research was built into the whole school improvement plan and prioritised by senior leadership, teachers lacked confidence in how they could use research to solve practical teaching problems. As such, there is an opportunity, and indeed an imperative, for schools to strengthen their links with Universities and vice versa; this should be seen as a collaboration of experts in different fields, with different skills and knowledge. School and PD leaders and teachers would then be able to identify academics who can act as knowledgeable others. In turn, academics may find mutual benefits and opportunities to embed their research into practice. As knowledgeable others or *knowledge brokers*, University academics are better placed to identify, source and assure research findings, advise on suitable school based research methods that are appropriate to LS and are correspondingly realistic for teachers, their students and their schools.

Together with the recent establishment of a Research Schools Network [7]in England, there are longstanding opportunities for teachers to participate in educational research, in higher academic study and enjoy strengthened University partnerships. These would teachers to better use evidence to inform their teaching and learning and to approach LS as *teacher researchers*. What is more, there are other ways that research and evidence is becoming more

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[7] The Research Schools Network is a collaboration to create a network of schools that support the use of evidence to improve teaching practice

accessible to teachers through publications such as the Chartered College Impact Journal[8], and organisations like the Sutton Trust and the Education Endowment Foundation. The work of these organisations has an explicit remit to connect research findings to classroom practice and to offer affordances at a higher system Sub-system for LS as a collaborative-research orientated forms of PD

In contrast to role of a knowledgeable other, I see the role of the LS facilitator as someone who can broker teacher participation and engagement in the structures and practices of effective LS. As LS facilitators, ideally teachers and school leaders, these colleagues would be based in schools, making these individuals better placed than academics: to work individually and collectively across different communities, to build trust and collegiality, to mobilise school leadership and draw attention to LS. Besides, in each of these case studies, we see evidence of successful implementation of LS, afforded by the allocation of *middle leaders* as LS facilitators and the assignment of these roles as a form of reification. As middle leaders, with both teaching and school or subject leadership responsibilities, these teachers were perceived as being able to work across different boundaries and LS communities. These teachers were both accepted as members of school leadership teams and as facilitators and contributors to LS. By straddling different communities, middle leaders can broker relationships and resources, with the ability to action things that may be required to align LS with wider school priorities and expectations. In my view, for external PD leaders or system leaders such as myself, working outside of schools, before we decide to take on a LS facilitator role, we need to consider how and if we can attune ourselves with schools' professional learning cultures and ethos. This is something that I will personally reflect on in the future. For LS, PD leaders need be aware of schools' orientations towards collaboration, classroom research, lesson observation, professional enquiry and evidence informed teaching. Without this awareness, LS facilitators cannot fully consider how to align LS with teacher and school goals, values and beliefs and with

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[8] Impact is the termly journal of the Chartered College of Teaching. It connects research findings to classroom practice, with a focus on the interests and voices of teachers and educators

accountability measures. Nor will they be able to identify the barriers that individual and collective groups of teachers are likely to face during LS.

6.3.3 Implications for Policy

England has seen the recent introduction of the Standard for Teachers' PD, set out to provide a clear description of what makes effective PD. The 5 key headlines state that PD should be led and designed to improve and evaluate pupil outcomes, be underpinned by robust evidence and expertise, should include collaboration and expert challenge and should be sustained over time. All of these must be prioritised by school leadership. The first striking omission in the Standard for Teachers' PD, that this study has revealed, is the lack of focus and attention to individual and collective teacher professional learning outcomes. This empirical study has shown that teacher PD is influenced by many contextual factors. Of note are the roles, skills and knowledge, values and beliefs of the teachers involved—their individual and collective professional learning orientations. Although the Standard does draw attention to the modes of teacher learning, there is no clear emphasis or consideration given to the starting points of teachers' learning or teachers desired learning outcomes. A professional learning outcome of highly effective PD, for example, could be the formation of highly engaged professional learners that can:

> *sustain high Sub-systems of classroom based, collaborative-research and external orientations, thus possess a very flexible and broad repertoire of professional learning practice in line with their values*

> (Pedder and Opfer, 2012 p. 555)

This formation of a community of highly engaged professional learners is just one illustration of a teacher professional learning outcome. There, will of course, be others. Thus, a recommendation for PD policy, is for the Standard for Teachers' PD to include an explicit and direct reference to learning outcomes of teachers — not just students. This addition to the Standard may encourage school leaders, teachers and PD leaders to seriously take account of individual and collective teachers' professional learning orientations, their starting points,

motivations, aspirations and contexts. Moreover, for newly qualified teachers in England, the Standard, alongside the recent introduction of the Early Career Framework[9], may provide a structure for school leaders and teacher educators to take account of teacher outcomes and to develop coherent professional learning pathways and progression. However, for more experienced teachers, we will need to find additional ways for them to increase the amount of influence they have over their professional learning and for creating PD opportunities that motivate teachers as well as students to perform. Secondly, it is essential to consider the nature and location of *expert* challenge, in collaborative-research orientated forms of PD, and who is best placed to provide this challenge. The query this raises in relation to LS, for example, what is the role of subject specific knowledge in LS, how this can be accessed, developed and reified in LS.

6.3.4 Further Research

The beneficial effects of LS on teacher and student learning are becoming more widely accepted and well documented globally (Xu and Pedder, 2015). However, the literature searches for this thesis have identified only 10 empirical studies in science education reported in English speaking journals. There is, therefore, a need for an increase in studies on LS enactment in the context of science teaching, as we are seeing in mathematics teaching and, to consider suitable science subject and pedagogical contexts for LS.

In addition, given the clear importance of context in LS, further research could examine the ways in which the teacher learning Sub-system, learning activity Sub-system and school Sub-system sub-systems interact and interrelate through the different stages of a LS cycle. It would be recommended that this research to further focus on how to take contextual features into account in order, to sustain LS and to promote effective LS practices. This research would not only apply to

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[9] The **Early Career Framework** provides a two-year package for Newly Qualified Teachers and their mentors. It is supported and fully funded by the Department for Education.

LS, but to other forms of collaborative-research orientated PD, which are clearly influenced by the local contexts and the wider environment.

This study has recognised two important roles in LS implementation; the central role of LS facilitators in promoting and sustaining teacher participation and engagement in LS and, the role of a knowledgeable—which is less clear. It is important, to find how the role of knowledgeable other can be fulfilled in, whether this role should be delineated as external to LS process, and how to identify and develop the knowledge and skills to be a knowledgeable other. Moreover, by delineating the roles of LS facilitator and knowledgeable others in future research studies, this will not only focus on how to successfully implement LS but be worthwhile for gaining an understanding of how LS can be embedded within the broader landscape repertoire of PD in the English self-improving system. It is also relevant to find out how teachers' and school professional learning orientations feature in other forms of PD. Looking at how we can help teachers, PD and school leaders to better identify and modify the patterns of alignment and dissonance between individual and collective professional learning orientations, school affordances and constraints and, how to encourage teachers to take more control of their professional learning.

6.4   Limitations of Research Study

This section considers the limitations of this small scale qualitative study, acknowledging the importance of both the research and participants' roles, the practical applications of findings to school based professional development programmes and the need to study other aspects of the LS process.

6.4.1 Researcher and Participant Roles

The decision to adopt a naturalistic inquiry methodology with myself as a researcher, describing and interpreting the experiences and actions of science teachers, means that the findings lack some *generalisability.* These findings cannot be extended to the population of science teachers as a whole for several

reasons. Firstly, the science teachers may have seen me as an *expert*—knowing that I was an academic as well as a researcher. Participants may have held back information about their understandings, decisions and actions for fear of being judged or seeming inexperienced. Secondly, teachers may have seen me as having a vested interest in LS, in leading science teacher PD and therefore having an impact on power relations during data collection. This potentially may have led to teachers accepting LS as a solution and effective model for their PD. Thirdly, my presence and involvement was perceived by some teachers as an opportunity to improve their knowledge and capabilities in LS. I was asked on several occasions whether I thought the science teachers were, in their words, "doing LS right". Together, my professional role and presence as the researcher meant that teachers may have conformed in some way during interviews— providing answers that they thought I may have wanted to hear. This may have acted as a barrier to finding out the research participants' authentic views, experiences and attitudes to LS. Moreover, although understanding the social world of science teachers may have had advantages and added credibility to the research methodology and design and to the findings, this also meant that assumptions were made which may limit the reliability of this research.

6.4.2. Practical Applications in Practice

This study was concerned with understanding the ways in which the contexts of a PD programme may feature in its enactment and in teachers learning by theorising teachers' perceptions, understandings, participation and engagement in LS, based on the reflections of science teachers involved. The research did not involve observations of practice or impacts on student outcomes. As such, findings can only present an approximation of what teachers have done or planned to do with LS. A greater number of interviews conducted more frequently over a longer period, plus direct observations of planning meetings, research lessons and post lesson discussions would have provided richer data, greater confirmability and more detailed representations of LS enactment. If we are to consider the applications of these findings in practice, it is important to recognise

that this study is only a 'snapshot' of LS enactment at one time, in one country and from a particular perspective.

6.4.3 Representation of the LS Process

Observations of all aspects of the LS process were not feasible given the time and resources available to me as a part-time doctoral student. In addition, as a researcher, determined to stand back, I could not predict nor control the pace and timings of the LS process. Schools and teachers were at different stages, with different LS histories. Some LS cycles had begun and been completed while others were still in the very early stages of planning, and there were unforeseen pressures due to workload and teacher absences. Therefore, given that the teachers were only in the early stages of LS, the extent to which any benefits and outcomes of LS could be determined was severely restricted. Moreover, interviews were used as the key research method, so it is important to acknowledge that interviews will only portray part of the story, they are only one participant's reflections on LS at one given point in time. Science teachers' perspectives on LS would only be more accurate if they were the persons telling the story. What has been reported here is predominantly the researcher's version of these science teachers' stories, filtered and constructed via a range of research perspectives and positions.

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Appendix A1: Email Invitation to Participate in Research

Research Study: The Enactment of Japanese Lesson Study in Science in English Schools

I would like to invite you to participate in a doctoral research study on Lesson Study. The aim of the study is developing a deeper understanding of how Lesson Study is used in science teaching and as a school-led model of teacher professional development. If you would like to part, please read this attached information Sheet that will provide more details of what will happen and what is required of all participants. If you have any questions or require further information on the study, please do not hesitate to contact me.

Best wishes and thank you in advance for your time and attention. I hope that you will the study of interest and look forward to meeting you.

Julie Jordan (edjaj@leeds.ac.uk)

EdD Student, School of Education, University of Leeds

Principal Lecturer in Science Education, Sheffield Hallam University

Appendix A2: Information Sheet

Research Study: The Enactment of Japanese Lesson Study in Science in English Schools

The research will be undertaken as a part of part-time Doctorate of Education in the School of Education at the University of Leeds, under the supervision of Professor Jim Ryder and Dr Michael Inglis. The research began formally in May 2015 and I will submit my thesis in 2017/8. I will be collecting school data from October 2015 until April 2016. The main ethical issues have been addressed and my study has been approved by the University Ethics Committee.

PARTICIPANTS

The participants considered for this research must be teachers from secondary schools that meet the following criteria for the study.

There is

- a group of 3 to 4 teachers (including science teachers) who are willing to participate in Lesson Study in the next 6 months
- some previous experience or familiarity with LS within the school or organisation (e.g. a TSA)
- senior management support for teachers to participate in a doctoral study

All participants will be invited by e-mail to participate and provided with more detailed information about timescales and data collection.

TIMESCALES

The research will be conducted over two phases.

*Phase 1 (October to December 2015) * and will involve up to four secondary school LS groups.*

LS facilitators and participants will be invited to:

- participate in an individual interview with the researcher
- offer any documentation that may be useful for the study e.g. lesson plans, observation schedules, evidence of outcomes on student learning

*Phase 2 (January to April 2016) * will involve the schools who are continuing with the Lesson Study in the Spring Term.*

LS facilitators and participants will be invited to:

- participate in an individual interview with the researcher
- offer any documentation that may be useful for the study e.g. lesson plans, observation schedules, evidence of outcomes on student learning

During Phase 2, senior leaders will also be invited to participate in individual interviews

*The researcher will endeavour to fit around school arrangements during these to minimise any disruptions.

Participation is voluntary and therefore it is up to each participant to decide whether they want to take part in this study. If you do decide to participate all participants will be asked to sign a consent form. If you decide not to participate there will be no consequence and your decision will be confidential. Additionally, you can withdraw from the study at any time without giving any reason.

BENEFITS AND RISKS

There are no anticipated risks in participating in this research. The possible benefits are that you are helping the development of knowledge and practice about teacher professional development in science—how Lesson Study in Science can be implemented and used effectively. The research may also benefit your own professional practice and provide opportunities for you to collaborate with other teachers, science education researchers and professional development leaders.

DATA SECURITY

All interviews and observations will be recorded to facilitate the process of data analysis. They will be transcribed and used for illustrating purposes in my thesis document, published papers and conferences. All data will be anonymised prior to their use. All your personal data will be digitised and kept in the secure University server. The only people that will have access to your data will be the researcher, the supervisors and any colleagues that will help to validate the data analysis.

If you need to know more about the study before deciding to participate please contact do not hesitate to contact me on edjaj@leeds.ac.uk

Appendix A3: Consent Form

Research Study: The Enactment of Japanese Lesson Study in Science in English Schools

Please tick box if you agree with the statement

1.   I confirm that I have read and understand the information sheet dated October 2015 that explains the research project and I have had the opportunity to ask questions about the project.

2.   I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. Should I not wish to answer any question or questions, I am free to decline. I understand that if I withdraw, I can decide whether or not the data collected from me up to that point can be used in the study or destroyed immediately.

3.   I understand that interviews and planning and review meetings may be visually and audio recorded, and my responses will be kept strictly confidential. I give permission for members of the EdD supervisor and research team to have access to my anonymised responses. I understand that my name will not be linked with the research, and I will not be identified or identifiable in the reports that result from the research.

4.   I agree for the data collected from me to be used in future research.

I agree to take part in the above research project and will inform the Julie Jordan (Lead researcher) should my contact details change.

_____ _____ _____

Name of participant Date   Signature

_____ _____ _____

Lead researcher   Date   Signature

To be signed and dated in presence of the participant

Appendix A4: Ethical Approval from Leeds University

Performance, Governance and Operations

Research and Innovation Service

Charles Thackary Building

101 Clarendon Road

Leeds LS2 9LJ Tel: 0113 343 4873

Email:

University of Leeds

22 July 2019

Dear Julie

Title of study: Lesson Study: The Role of Knowledgeable Other

I am pleased to inform you that the above application for light touch ethical review has been reviewed by a School Ethics Representative of the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee. I can confirm a favourable ethical opinion on the basis of the application form and your response as of the date of this letter. The following documentation was considered:

Document	Version	Date
LTEDUC-064	Ethical approval JJ.docx	03/03/15

Please notify the committee if you intend to make any amendments to the original research as submitted at date of this approval, including changes to recruitment methodology. All changes must receive ethical approval prior to

implementation. The amendment form is available at
http://ris.leeds.ac.uk/EthicsAmendment.

Please note: You are expected to keep a record of all your approved
documentation, as well as documents such as sample consent forms, and other
documents relating to the study. This should be kept in your study file, which
should be readily available for audit purposes. You will be given a two-week
notice period if your project is to be audited. There is a checklist listing
examples of documents to be kept which is available at
http://ris.leeds.ac.uk/EthicsAudits.

We welcome feedback on your experience of the ethical review process and
suggestions for improvement. Please email any comments to
ResearchEthics@leeds.ac.uk.

Yours sincerely

Jennifer Blaikie

Senior Research Ethics Administrator, Research and Innovation Service

On behalf of Dr Andrew Evans, Chair, AREA Faculty Research Ethics
Committee

CC: Student's supervisor(s)

Appendix B1: Early Interview Schedule

1. Could you tell me about your background as a teacher?
Prompts: route into teaching, experience, teacher training route, subject specialism, career stage

2. Could you tell me about your school and working environment?

Prompts: teacher context, catchment area, students taught, priorities, working environment and culture, things you enjoy

3. Are there any school /departmental priorities?
Prompts: aims, challenges, opportunities

SUPPLEMENTRY QUESTION FOR FACILITATORS
- *how/does LS meet any of these?*

4. How did you hear/get involved in Lesson Study?
Prompts: other teachers, senior colleagues, other schools/contacts

5. What are your thoughts or understandings about Lesson Study?
Prompts: what it is/what is going to happen/what you need to do/key features/elements

6. What's happening with your Lesson Study at the moment?
Prompts: stage in cycle, what you are doing now, how things are progressing

7. Who is involved in Lesson Study -- why and how?
Prompts: teachers, subject areas, internal/external colleagues
SUPP.LEMENTRY QUESTION FOR FACILITATORS
- *what is your role in LS?*

8. How is the Lesson Study set up and structured?

Prompts - model, stages, cycles, guidance, resources, reference points

9. Is there anything about LS that stands out for you, compared to anything else?

Prompts: in terms of your practice, PD, teaching etc.

10. What are your expectations of participating in LS?

Prompts: opportunities, benefits, outcomes

11. Is there anything that you feel is particularly challenging about Lesson Study or easy?

Prompts: time, resources, ways of working

12. What are the next steps in your Lesson Study? What do you plan to do?

Prompts: next week, next term

13. Is there anything that you think you have gained so far from Lesson Study?

Prompts: next week, next term

14. Is there anything else you would like to share at this point?

Prompts: Thoughts/reflection on LS

Thank you for your time.

Appendix B2: Late Interview Schedule

1. Would you mind telling me again about your Lesson Study project?
Prompts: How are things going? What is happening now?

SUPPLAMENTRY QUESTION FOR FACILITATORS
- *have things gone as expected?*

2. Is there a focus/topic/ for the LS?
Prompts: school focus, personal, subject focussed, pedagogical

3a. If you have not chosen a focus - can you briefly describe what you hope to achieve?
Prompts: aims, plans, outcomes in mind

3b. Where did this come from, how did you develop a focus?
Prompts: top down, bottom up, individual, collective

4. Who is involved in the LS?
Prompts: other teachers, school leaders, managers, external colleagues, students

5. How did you select the lesson/student groups/teaching topics?
Prompts: discussions, personal interests, school data
SUPPLEMENTRY QUESTION FOR FACILITATORS
- *how have you been involved?*

6. What was the purpose of LS for you?
Prompts: personal, professional development, other

7. Where would you say you are in the LS cycle now?

Prompts: goal setting, planning, investigation, lesson observations, discussing/sharing results

8. Are there any particular/different roles, jobs, activities in your LS?

9. Is there anything that you feel is going well/not so well? What do you feel has gone well?

Prompt: Any ideas why/why not?

10. Is there anything that you think is important about doing LS?

Prompts: things that stand out/feel different

SUPPLEMENTRY QUESTION FOR FACILITATORS

- *what is your view now – has anything changed?*

11. How does LS will fit with other things?

Prompts: day to day/other plans

12. Do you think anything has changed as a consequence of LS?

13. Is there anything that you have personally gained from LS?

14. Is there anything that you think you students have gained from LS?

15. If you were to do LS again, what would you do, could anything be improved?

16. Is there anything else you would like to share at this point?

Many thanks for your time