

Empirical evidence of the impact of lesson study on: students' achievement, teachers' professional learning and on institutional and system evolution

Abstract

In this article we review the evidence of the impact of lesson study on student learning, teacher development, teaching materials, curriculum, professional learning and system enhancement. We argue for lesson study to be treated holistically as a vehicle for development and improvement at classroom, school and system levels rather than as a curricular or pedagogical intervention. We illustrate the need for this approach to evaluating lesson study through a complex case exemplar which used Research Lesson Study (a form of lesson study popular in the UK and Europe) to develop learning, teaching, curriculum and local improvement capacity across schools initially involved in a two-year mathematics curriculum development project that later evolved into three self-sustaining, voluntary lesson study school hubs in London. We discuss resulting changes in culture, practice, belief, expectation and student learning. We argue as a result for greater policy level understanding of this expanded conception of lesson study as a vehicle in classroom, school and system transformation.

Empirical evidence of the impact of lesson study on students' achievement, teachers' professional learning and on institutional and system evolution

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1 INTRODUCTION

Before we begin to discuss or evaluate the evidence of its impact either in the UK, Europe or globally, we need to first decide what we mean by lesson study – or at least how we will conceive of it for the purpose of this article. The nature of evaluative educational research has

changed in the last 20 years. Much focuses on the degree to which, whatever its focus, the evaluation impacts upon student outcomes. Additionally, as quality education research evidence increases, there has been a growth in evaluative meta-studies. Black and Wiliam (1998) helped to put UK educational systematic review centre stage with their influential ‘Back Box’ research. This helped to establish the Evidence Informed Policy and Practice Initiative (EPPI) Centre which commissions systematic reviews in education in the UK. The OECD has mirrored such developments internationally (Schleicher, 2018). The recent emergence of very large meta-studies such as those of Hattie (2009) has gripped the imagination of education policy makers alongside a growth in randomised control trials (RCT) in education which often feed them.

While it is right that educational evaluation should focus on student outcomes, the rise of RCTs creates a tendency to view educational processes that are the subject of these studies as ‘interventions’ or ‘treatments,’ defining outcomes for students in terms of test results. We argue here, however, that to view lesson study as a curricular or pedagogical ‘intervention’ is to miss the point in a way that creates partial and distorted understandings of its impacts. We argue instead for a more expansive view of lesson study as a complex process of student, teacher and organisational learning that has the potential to simultaneously support continuous educational innovation and improvement at classroom, school and whole-system levels (Dudley, 2018a). We argue that lesson study affects pupil learning by bringing about ‘meaning-oriented’ teacher learning (Vermunt, Vrikk, Warwick, & Mercer, 2017; Vermunt, Vrikk, Van Halem, & Mercer 2019). And we will illustrate one large-scale example in which LS-informed capabilities and cultures at each of these three levels have helped to build local capacity for sustainable educational improvement. At root, we take Takahashi and McDougal’s (2016) four-stage approach as a working archetypical model. They describe lesson study as collaborative classroom research in which a group of teachers seeking to

improve outcomes for students engage collectively in: (i) curriculum study (of learning progression leading up to and following the unit); (ii) agreeing critical features of a research lesson or unit that they jointly design, teach, observe and discursively analyse; (iii) analysis of progress students make in relation to the lesson study and school research theme, and (iv) identifying next steps for future teaching. Lesson studies are made public through open-house public teaching and published teacher reports. They are usually supported by internal or external experts and commentators in the curriculum area under scrutiny.

2 LITERATURE REVIEW

We view lesson study as a process associated with teacher learning and school and system knowledge-creation and change. We begin our review of the literature with reference to Lewis, Friedkin, Emerson, Henn, and Goldsmith's (2019) theoretical reappraisal of their large-scale randomised trial (Gersten, Taylor, Keys, Rolfhus, & Newman-Gonchar, 2014) examining teacher and student learning in lesson study¹. Developing Guskey (2000), they set out five areas for its impact, extending beyond student learning to those where its impact can be formative, generating conditions for further improvement at student, teacher, or school levels of:

- teachers' knowledge;
- teachers' beliefs;
- routines and norms of professional learning;
- student learning;
- instructional tools and routines

We initially use these areas of impact as our framework to shape this review of the literature, but we will later argue that lesson study requires a more reflexive, transformative framework

if its full effect is to be achieved. We also chose to focus on literature that has been influential in the UK and Europe and relates either to lesson study or to literature that provides evidence for any of the five aspects above that pertains strongly to forms of professional learning that impact on student learning and that can guide researchers, practitioners and policy makers towards gaining a better overall understanding of the affordances and limitations of lesson study. We will therefore briefly visit literature that has informed our own understanding and decisions under each of the above headings.

Teacher Knowledge and 2. Teachers Beliefs

Lewis (2016) lists the forms of knowledge that teachers gain at each stage of this cycle (Table 1).

Table 1. Forms of teacher learning occurring at each stage of the LS cycle.

Stage of Lesson Study	Forms of teacher learning that occur
Study	<ul style="list-style-type: none"> • Develop research theme connecting long term goals to daily teaching • Study other research or curriculum that develops knowledge • New insights into own curriculum and standards from joint study
Plan	<ul style="list-style-type: none"> • Learn subject knowledge as you solve task – consider colleagues and students’ ideas • Make tacit ideas explicit, confront different ideas, negotiate with colleagues

	<ul style="list-style-type: none"> • Take risks you would not take on your own
Teach	<ul style="list-style-type: none"> • See impact of class routines and lesson elements • Discover un-realised capacities of students • Experience the lesson from student viewpoint
Reflect	<ul style="list-style-type: none"> • Encounter new views from expert commentator and colleagues • Experience change in one's relationships with one's colleagues • Reflect on one's own practice and beliefs.

Adapted from Lewis (Lewis, 2016)

2.1 Teacher knowledge and teachers' beliefs

Dudley (2013) reports how through lesson study teachers discover new pedagogical content knowledge, but also new information about their students as learners that dramatically improves their ability to match subsequent teaching to their needs. An analysis of lesson study group dialogues (Dudley, 2013; Vrikki, Warwick, Vermunt, Mercer, & Van Halem, 2017) reveals how teachers use 'exploratory talk' to create 'inter-mental zones' (Littleton & Mercer, 2013) to co-construct new knowledge about their pupils by discursively planning and analysing research lessons together, often spontaneously taking on the role of teachers, imagining, voicing and listening to tiny fragments of the taught or planned research lesson in order to feel how they might be heard by students. Through such processes, they elicit elusive, invisible, tacit pedagogical content knowledge from amongst members of the lesson study group. Dudley (2013) also identifies how deeply-rooted, long-held *beliefs* about

pedagogical practices are gradually transformed by changes in pupils' learning, revealed in response to methods trialled in research lessons.

2.2 Impact of lesson study on routines and norms of professional learning

The past 15 years have seen a sea-change in approaches to initial teacher education (ITE) and continuing professional development (CPD) in the UK (Dudley, 2011). Previously, CPD tended to take place away from the classroom (Opfer & Pedder 2010). The change resulted from growing evidence that the forms of professional learning that impact most on student learning take place over time (months not days), involving teachers experimenting together to improve student learning (Cordingley, Bell, Rundell, Evans, & Curtis, 2004). Lesson study has been judged to meet these criteria (Xu & Pedder 2015) and to go further, requiring that what has been discovered is reported to peers for use in their own professional learning and teaching. These findings were strengthened by the report by Cordingley, P., Higgins, S., Greany, T., Buckler, N., Coles-Jordan, D., Crisp, B., Saunders, L., Coe (2015) which, in addition to the above, stressed the importance of including expertise. Ball, Hoover-Thames and Phelps (2008) stressed that this expertise should not only be in subject knowledge, but also in pedagogical content knowledge in particular. Again, Lewis et al. (2019) argue that lesson study can meet these criteria.

This article supports the concept of lesson study as a form of teacher professional development that can bring about changes in teacher learning. However, while what is generally reported about teacher learning experienced during lesson study is overwhelmingly positive, the adoption of its processes as 'routines and norms' of school behaviour is more mixed (Dudley, Warwick, Mercer, Vrikki, Vermunt, van Halem, & Karlsen, 2019). For example, the introduction of Research Lesson Study into the England's National Strategies

in 2008-9 was viewed positively by the teachers involved (Hadfield, Jopling, & Emira, 2011) whose schools saw the increase in pupil attainment of non-lesson study supported schools double. However, most did not continue with lesson study following the intervention. Whilst use of lesson study in the UK, Europe and globally is rising steadily (countries represented in the World Association of Lesson Studies membership have grown from 10 in 2006 to over 70 in 2017,) perceptions of its high costs and organisational complexity persist (Dudley et al., 2019). We will therefore seek to demonstrate through our case-exemplar how an aligned, multi-level approach can help to overcome such obstacles and as a result we will argue that change designed at all three levels is necessary if lesson study is to be sustained and is to support self-improvement.

Sustainability has in some respects been less of an obstacle for lesson study in contexts of initial teacher education. Adoption in Europe of its features in ITE used in Japan (Chichibu, 2016) has proved more sustainable over time in some contexts than has been the case for lesson study in mainstream schooling described above. This seems to be mainly because structural changes that schools are obliged to make in order to synchronise school-based lesson study with the demands of accredited university courses tie its processes into the schools' procedures (Martin & Clerc-Georgy, 2015; Cajkler & Wood, 2015; Gómez, Núñez, & Caparros-Vida, 2016; Munthe, Bjuland, & Helgevold, 2016), forging productive partnerships. We will see through the case exemplar (below) how orchestrating school-based lesson study practices with the actions of other system partners helps to sustain lesson study across schools.

2.3 The impact of lesson study on instructional routines and tools

Abundant examples exist in the literature of lesson study developing, implementing and modifying instructional materials and pedagogical approaches. In Japan, prior to the Internet,

this literature of local lesson studies sold in local bookshops has existed for decades. Lewis (2002), for example, described encountering instructional approaches in use in Japanese schools that had originated in the US. In this case, lesson study had been used as a knowledge-transfer vehicle for capturing and later recreating in Japan the US pedagogical approaches and the philosophical understanding of their benefits. In their recent accounts of a mathematics RCT (Lewis and Perry 2017), Lewis et al (2019) demonstrate the changes that these lesson studies engendered in instruction and in materials in the treatment schools. Thinking beyond instructional routines to the curriculum itself, Kuno (2015) describes the role played by lesson studies across Japan in providing evidence that informs the five-year cycle of national curriculum review. This also involves multi-level partnerships between schools, local government prefectures and universities and was particularly influential in the decision to use lesson study as a vehicle for curriculum development in the case-exemplar below.

2.4 The impact of lesson study on student learning

Capturing improvements in student attainment that can be solely attributed to use of lesson study has proved challenging. Researchers tend to measure its impact on student learning in the following ways:

- (i) administrating ‘pre’ and ‘post’ lesson study tests;
- (ii) gathering views of students and teachers about improvements; and in some cases (see below) tracking those changes over time;
- (iii) Or more recently, conducting large scale RCTs involving lesson study.

The problem with (i) is that, because we do not know what would have been the result of teaching the group *without* using the lesson study intervention, its impact is not captured.

Approaches (ii) that track back changes in observed student learning behaviours to teaching interventions in research lessons are likely to capture changes that can be attributed to lesson study – particularly if perceptions have been elicited from students and not from teachers alone. But it is difficult to extrapolate wider impacts from (often) individual changes. In her recent review of the impact of lesson study beyond Japan, Seleznyov (2019) found that only 18 of 56 selected studies reported impact on pupil learning or changes to teaching after the period of the lesson study.

Nevertheless, large studies have reported positive impacts of lesson study on the quality of learning of pupils with learning difficulties (Norwich & Ylonen, 2015) and on attainment of 11-year-old pupils in over 400 underperforming English schools (Hadfield et al., 2011). A randomised trial across 800 schools (Churches, 2016) compared curricular interventions that teachers claimed helped to ‘close gaps’ in learning for disadvantaged pupils (eligible for Pupil Premium payments in England²). Their list included Research Lesson Study as a ‘curricular’ intervention and while none demonstrated an effect size >0.1 , it was nevertheless recommended by the study as one of only two showing ‘promise’ for gap-closing on the basis of the results.

Two other large scale RCTs have reported in recent years. Lewis’s study (Gersten et al., 2014) discussed above measured differences in over 1000 pupils’ learning of fractions involving 231 teachers using identical materials. The control was tightly managed. The recorded effect size for pupil learning was 0.49. Measures addressing the broader headings above also recorded positive outcomes (Lewis et al., 2019). A second large-scale RCT (Murphy, Weinhardt, Wyness, & Rolfe, 2017) studied a composite intervention consisting of a talk-based mathematics pedagogy and a talk-based writing pedagogy with lesson study-based teacher development in 280 schools in England. Lesson studies were carried out every

term over two years. Results from national tests in English and mathematics taken either one or two years after the end of the intervention revealed no effect size despite a strong positive reaction from teachers and school leaders. No steps were taken either to evaluate the separate effects of the three interventions in use or to quality assure the control group (whose members were asked to refrain from using any element of the treatment for a two-year period, despite showing sufficient interest to register for the trial. A high number subsequently acknowledged using elements of the ‘treatment’).

2.5 What does this say about the evaluation of lesson study’s impact?

The growing literature often confuses lesson study (a teacher and school development tool) with curricular and pedagogical interventions and evaluates them as such. Methods with which to evaluate lesson study effectively are still being sought. Some illuminating hints in the literature reviewed here suggest instead a need to view it not only from the point of view of the individual lesson studies concerned or from perspectives of student or teacher learning alone, but also from broader institutional and system perspectives.

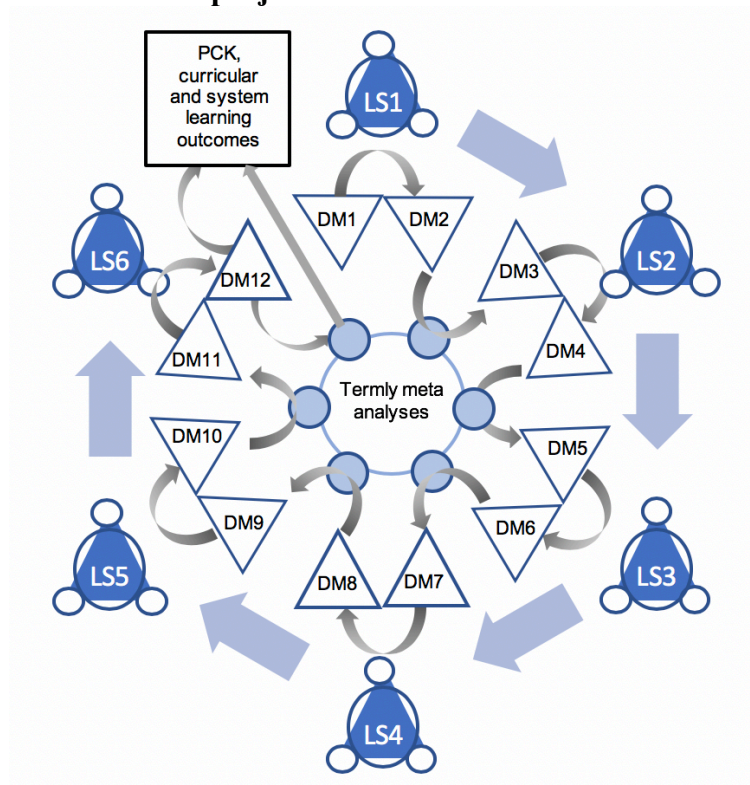
We are mindful of this and also of Robinson, Hohepa, & Lloyd’s (2009) meta-study’s main finding, that the most impactful action a school leader can take to improve student outcomes is to lead teacher enquiries in school into how to improve student learning (a 0.8 effect). We therefore describe a complex case-exemplar of the evolution of systems, procedures and cultures (as well as learning outcomes) over a four-year period in London: first, during a two year curriculum project; then, two years later, looking at what endured in three subsequent, voluntary lesson study hubs, at what faded and importantly what had developed in its place. Finally, we report the results of a different approach to capturing

lesson study effect from over 80 research lessons that were conducted by the voluntary lesson study ‘hubs’ described.

3. THE CAMDEN PROJECT AND THE LONDON LESSON STUDY HUBS

The two-year ‘Camden New Mathematics Curriculum Lesson Study Development and Research Project’ was funded by the Greater London Authority. Its principal aim was to use Research Lesson Study to help to develop a mathematics curriculum that was compliant with 2013 statutory requirements, but that also met the needs of London’s diverse population of 9 to 13 year-olds. A total of 96 London schools shared what they were finding out about students’ learning in what teachers identified as the hardest-to-teach and hardest-to-learn aspects of this new mathematics curriculum. Additionally, the Camden and Cambridge project team (which included expertise in mathematics teaching, lesson study, dialogic learning and teacher learning) meta-analysed their lesson studies each term to identify additional themes appearing across project schools (Dudley, 2018b).

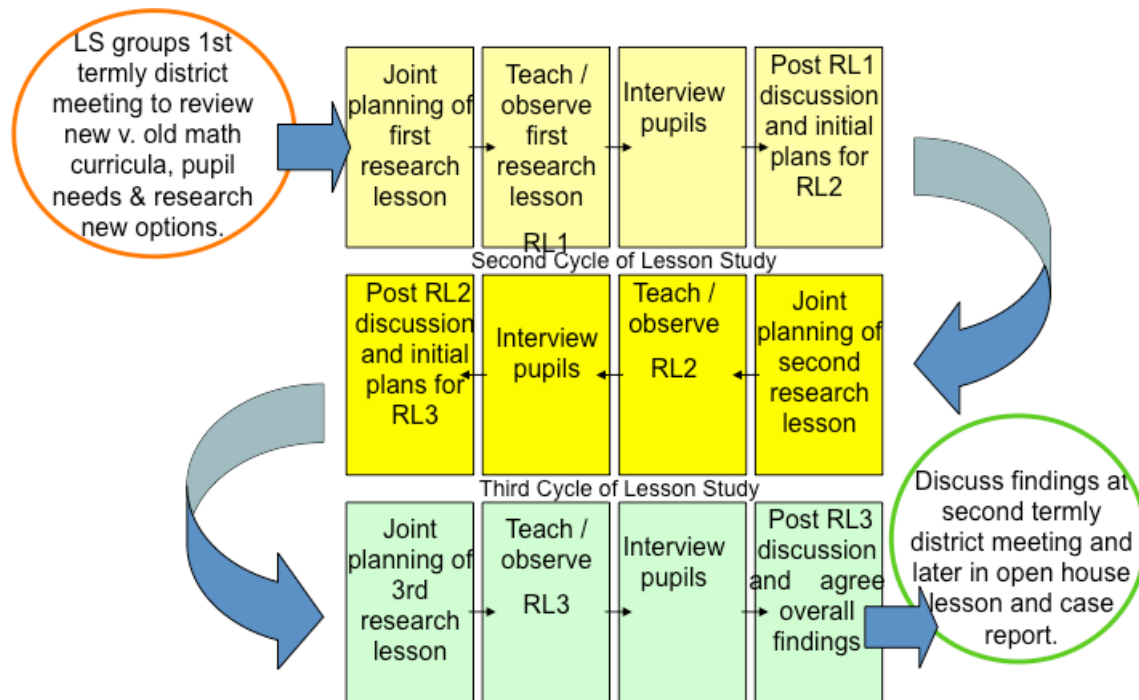
Figure 1. Classroom and district enquiry over six terms in the Camden Lesson Study New Curriculum Mathematics project.



Participating schools conducted a three-cycle Research Lesson Study each school term for a year in order to co-develop and share experiences of how children learned in trial versions of the new curriculum so as to create ‘schemes of learning’ in each school that were optimised to meet these children’s mathematics learning needs (Dudley et al., 2019). 22 of these schools in the London Borough of Camden participated for two years, conducting six lesson studies.

Research Lesson Study is an adaption of the Japanese model promoting cycles of research lessons in which lesson study teachers develop new approaches together predicting, observing and analysing ‘student learning in research lessons before going public. It uses protocols and ground rules for professional dialogue that promote the creation of new pedagogical content knowledge changing subsequent practice (Dudley, 2011; Dudley 2013), as well as tracking ‘case pupils’ and using pupil interviews (Figure 1).

Figure 2. Research Lesson Study Process.



Project reports (Ylonen, Dudley, & Lang, 2015; Dudley et al., 2019) demonstrate that it met Lewis’s evaluative tests (Table 2).

Table 2. How the Camden project met Lewis et al.’s evaluative tests for Lesson Study impact: data from 132 lesson studies conducted by 22 primary and secondary schools

Area of impact	Evidence from the Camden project
Teacher knowledge	<ul style="list-style-type: none"> t-tests on pre and post intervention surveys revealed primary and secondary teachers were significantly more confident in the areas of new curriculum mathematics they identified as the hardest to teach and hardest for pupils to learn.
Teacher beliefs	<ul style="list-style-type: none"> RLS workbooks and video data of research lesson planning and analysis meetings revealed that observations of case students’ actual learning compared with predictions, and also what pupils revealed in post research lesson interviews, helped teachers to confront and accept aspects of pupils’ learning in mathematics that they had not previously noticed or imagined. This led to changes in what they believed students could achieve given the right support in learning.
Instructional routines and tools	<ul style="list-style-type: none"> Key changes reported at project level were (i) the ‘slowing down’ of learning in order to ensure key concepts were grounded before moving on; (ii) greater use of manipulatives, models and images by all students (not only the youngest and lower attaining); (iii) greater engineering of group talk and problem solving in order that children could articulate mathematical concepts in safe spaces and engage in exploratory talk in order to help concepts form and become grounded.

Routines and norms of professional learning	<ul style="list-style-type: none"> Teachers and subject leaders were overwhelmingly positive about the opportunities to work together in each other's classrooms through the deliberate processes of RLS which helped them form close-knit learning communities.
Student Learning	<ul style="list-style-type: none"> Workbooks and video recordings of LS groups' planning and post research lesson discussions revealed multiple examples of transformed student learning (supported by one-year on follow up interviews discussed below). A year after the intervention the 11 year olds who had been involved in the project took the first new curriculum national tests. A four-percentage point gain was opened up as non-LS Camden schools fell against the national average by 2 ppts while LS project schools rose against it by 2 ppts.

(Adapted from Lewis et al. 2019)

The increases in attainment in 2016 test scores suggested that the effects of the lesson studies and the curriculum constructed from them were still being felt in primary schools up to two years after the end of the intervention. However, as secondary students were not externally tested in the 11–14 curriculum, a more diagnostic approach was taken to understand what groups of subject leaders and teachers in three secondary schools identified as the changes that conducting Research Lesson Study departmentally and sharing findings with other Camden schools had made to the learning, teaching and leadership of the new curriculum mathematics in their schools. A brief summary follows of what these interviews revealed:

(i) Teacher knowledge

Children are making much more progress than they used to do – even the lower ability children... because we are thinking differently about how we teach topics, how we deploy people in the classroom and what sort of things we are doing. [Teachers] are willing to take a risk and try things they would not have done before.

All three respondent groups stated that gaining insights into how the lesson studies revealed to them that time and specific opportunities needed to be designed into teaching to enable teachers more fully to understand *how* children conceived and thought about mathematics.

All respondents spoke of the breadth and deeper insights lesson study gave them into mathematical pedagogical content knowledge – particularly regarding conceptual aspects.

(ii) Teacher beliefs - aspirations and expectations were raised:

The teacher had thought she [a student] wasn't taking it in whereas actually, when she was asked to explain it in a different way and write about it, we realised that she was listening and paying attention, and she did understand it. Her barrier was using the numbers and the arithmetic side of it: she was scared to do maths that involved arithmetic in her book because she was scared of getting it wrong... It was quite eye opening, and interesting!

All respondents retained (two years later) vivid, detailed memories of how observing and discussing the learning of numerous case teachers in research lessons who had changed their understanding of those pupils and sometimes transformed their beliefs in what they (and other similar pupils) might really be capable of learning.

Respondents in all schools also spoke of developing an understanding of how, for some students, fear of mathematics was an affective barrier to learning and how developing conditions of discursive learning that invited them to engage in 'interthinking' (Littleton & Mercer, 2013) was just as important in enabling student participation and progress as it was in revealing the nature of students' conceptions to teachers (who could then immediately adjust subsequent teaching to better match their needs).

(iii) Instructional tools/routines

‘...having that opportunity to interview the students and reflect on the planning of the lessons, meant that we could really start to analyse a bit deeper what it is that the students understand and don’t understand, and not be frightened to take another [research] lesson, and explore things again - to get that *depth* into the planning; a lot of which has survived. We have now heavily integrated all that into our Scheme for Learning’

All respondents described how their newly-discovered pedagogical content knowledge was built into their schools’ mathematics ‘Schemes of Learning’ (long, medium and short-term curriculum teaching plans) and processes of assessment. A year or more on, they still continued to echo a whole project finding by stating that they taught much more slowly and carefully than before:

I have changed the way I teach [mathematical] subjects and the areas that we have focussed on as part of lesson study so that it has a greater impact. I start a new topic in a completely different way than if I had not been part of the lesson study.... Before I would just look at the scheme of work and think about what would have to be covered. But now we have slowed down and we think about the concepts. And we make sure the students understand the subject really well before moving on.

(iv) Routines/norms of professional learning

All respondents spoke of the aspects of Research Lesson Study they were building into their professional practice and learning routines. This included: always discussing particular students’ learning at weekly departmental meetings; focusing on different students each week

as ‘case pupils’ in order to ensure that all were observed in-depth each half term. Two spoke of ways in which they were creating space for departmental Research Lesson Study to continue. One described how lesson study was being used as a means of inducting new teachers into the departments’ practices and creating a systematic departmental focus on problematic curriculum areas or students. Respondents retrospectively attributed regular sharing of lesson studies during the project at district level to having raised their game. It motivated them to challenge themselves to explore new pedagogical approaches in order to discover pedagogical content knowledge that other teachers would find interesting and useful.

I think that [dialogic teaching for understanding] might have come from us [the RLS group]³ implicitly, from all of us sharing the idea that [this is what] good teaching looks like. Anyway, so when asked to plan lessons which were to be presented to other Camden schools [in termly district meetings] and make them good, we instinctively went for that approach.

(v) Student learning

All respondents described significant improvements in student learning and progress and in students’ abilities to engage in mathematics with increasing confidence and independence – both collaboratively and individually. They cited examples where these improvements had subsequently been sustained by specific students, as described for the Research Lesson Study case student below:

His methods were usually right but quite often his answers would be incorrect. So we made him slow down and write everything down. He objected a lot but we made sure he wrote full answers. And once he had been doing that for a while he found it much easier to start explaining his thinking - because he had slowed himself down a bit. And he is still doing really well [eighteen months later].

One school described regular, sustained dialogic teaching sessions where all students participated. Two schools described the marked difference that Research Lesson Study enabled them to make to the learning of previously low-attaining students or students with learning difficulties as a result of better teacher understanding of the barriers to their learning and how these could be overcome.

3.1 Summary

There is a common thread in all these accounts linking the value of learning from collaborative, classroom enquiry; incorporating resulting pedagogical content knowledge into school systems and making the resultant knowledge and processes public at district sharing events. As a result:

- (a) Research Lesson Study groups jointly reflected on the new curriculum's demands; jointly planned routes through the hard-to-teach-and-learn elements, trialled them in research lessons and jointly learned from predicting, observing and discussing the behaviours of case pupils: repeating this processes three times each Research Lesson Study.
- (b) This led them to both: capture curricular knowledge and pedagogical content knowledge and to build these into documentation and guidelines for staff and also to incorporate elements of Research Lesson Study such as case-pupil observation and

regular discussion of specific pupils' learning into regular meetings. They also presented findings to other local teachers.

- (c) They built these approaches into routines and norms of professional learning, staff induction, curriculum and even performance management.

3.2 Voluntary district level Research Lesson Study hubs

While continued post-project enthusiasm for mathematics Research Lesson Study remained palpable in these three schools, for two of them it was nevertheless apparent that without the termly, district-level meetings to share and gain ideas from others and to identify emerging themes, momentum was slowing.

However, enthusiastic demand from many of the 96 project schools to continue termly meetings and lesson studies led to the creation of three voluntary, post-project London Lesson Study hub groups of up to 15 schools each located in London's North (Camden), East (Redbridge) and South (Croydon). Their shared 'meta' focus was on exploring new approaches to: (i) capturing the impact of lesson study and (ii) creating sustainability of this practice. It was co-ordinated by members of the original project team in Camden. Schools volunteered as venues for the hub meetings, led by mathematics specialist teachers from local schools. The same termly project processes were otherwise maintained. From 2015 to 2017 over 25 schools participated in the Redbridge and Croydon hubs, conducting over 84 mathematics lesson studies and ultimately extending their focus to include literacy.

3.3 A new approach to capturing lesson study effect on learning in these hubs

As a step in developing an approach to isolating the lesson study effect, the Research Lesson Study model was adapted to include a pre- Research Lesson Study mathematics teacher assessment of pupils in the class as well as a prediction of what each pupil would most likely attain by the end of the unit *if the school were to teach the curriculum as usual - with no Research Lesson Study*. These assessments were submitted prior to starting the Research Lesson Study. This process captured the thoughts of these teachers about their pupils' probable learning, prior to planning and teaching a sequence of lessons in a curriculum unit. This is precisely the nature of the knowledge that most teachers utilise in planning and teaching such units in normal practice. It therefore has both construct validity (Messick, 1989) and ecological validity (William, 1996) for use as a measure of predicted attainment.

A second pupil level assessment was carried out at the end of each Research Lesson Study. Pre- Research Lesson Study predictions and the post Research Lesson Study outcome assessments were compared in order to identify differences between 'teach-as-usual' predictions and post Research Lesson Study assessments. Results from 29 lesson studies conducted between 2015 and 2017 in the two hubs are reported for the first time in Table 3.

Table 3. Differences between predicted teaching-as-usual attainment and actual post-Lesson Study assessments in London Lesson Study Hubs 2015-17

	Below expectations		Meeting expectations		Exceeding	
	Predicted	Actual	Predicted	Actual	Predicted	Actual
Total	237.5	110.5	365.0	444.0	144.0	186.5
Ave. per class	8.5	3.9	13	15.9	5.1	6.7
Difference (whole nos.)		-5		3		2
Percentage		-18%		11%		7%
747 total students						
28 classes						
Class ave. 27 stdts.						
84 lesson studies (252 Research Lessons)						

On average, 5 fewer pupils per-class failed to attain expected learning than was predicted if they had been taught as usual. Three more attained better expectations than predicted with teach-as-usual and two more exceeded them. The percentage attaining (and exceeding) post Research Lesson Study assessments was 18% above that predicted for teach-as-usual attainment.

There is not room here to speculate on whether the fact that these areas of mathematics had been prioritised for improvement depressed the ‘teach-as-usual’ predictions. It is well-known also that teacher assessments favour girls over boys compared with tests. However, despite this, if we accept these predictions as genuinely held professional reflections of expectation, the salient point here is that, in 84 lesson studies, almost a fifth more students succeeded following one lesson study than their teachers believed would have done if taught as usual. Furthermore, the interviews reported above suggest that many children whose learning is improved in this way through Research Lesson Study sustain the gain for at least two years and perhaps permanently.

3.4 Further evolution of the Camden hubs

The Camden mathematics hub evolved very differently from the other two. During the initial project, Camden’s 60 state schools had formed Camden’s ‘Schools-Led Partnership’ (CSLP) (Dudley, 2016) for school-led support and improvement (Hargreaves, 2012). Between 2015 and 2017 it commissioned groups of schools to form ‘learning hubs’ that led improvement locally in mathematics, literacy and assessment by developing and mobilising knowledge and practices in these areas through cross-school classroom enquiries (such as ‘Connecting classrooms mathematics’, ‘Shanghai mathematics’ and Research Lesson Study), as well as

through coaching by Specialist Leaders⁴, and local practice-sharing innovation and development activities.

In the discussion that follows we will describe this process in terms of the extent to which it has extended, sustained and to some extent cemented the impact of lesson study-based practices for the future across this partnership of schools.

4 DISCUSSION

Before we describe the genesis of the Camden Learning Hubs, it is necessary to reflect on the forms of teacher learning generated in contexts of Research Lesson Study that were observed in the project and which have recently been reported (Vermunt et al, 2017; Vrikki et al, 2017. Vermunt et al. 2019). We suggest that meaning-oriented forms of teacher learning enhanced the effect that district level meetings had on the impact of the outcomes of that learning for both subsequent teaching and pupil achievement, as well as for long term sustainability and development of lesson study processes by schools. Finally, we contend that the embedding of aligned school and district-level enquiry in the work of ‘learning school hubs’, which have not only endured but also proliferated, has played a key role in bringing about a transformation in local improvement through cultural and systemic changes that are potentially replicable elsewhere.

4.1 Meaning-oriented teacher learning in Research Lesson Study

A recent longitudinal study by the Cambridge research team revealed that meaning-oriented teacher learning increased during the year that the teachers worked with Research Lesson

Study (Vermunt et al., 2017; Vermunt et al., 2019). In ‘meaning-oriented’ teacher learning, teachers’ focus is not only on learning about ‘what works’, but also on ‘why and how things work’. Teachers adopting this way of learning compare different students’ work, think about how different lessons relate to each other, monitor pupils’ progress, experiment with new ways of teaching, try to understand how students learn and reflect on their own teaching practices. It is a high-quality, deep mode of teacher learning. Features of Research Lesson Study that may explain its impact on this form of teacher learning may include: Research Lesson Study’s strong focus on understanding case pupils’ learning; searching-out explanations for pupils’ misunderstandings; the high degree of ownership that teachers feel they have over their own learning; and a simultaneous focus on subject knowledge, teaching, and pupils’ learning.

It was clear that through the processes of jointly unpicking and understanding how individual pupils navigated curricular pathways and pedagogies in mathematics, lesson study groups socialised this knowledge, made it explicate and recorded it. As such, it becomes something to which teachers and the school must be accountable and as a result it cannot be collectively ‘forgotten’ as easily as can the semi-conscious reflections of lone teachers.

What was also clear was the fact that, by bringing together the pioneer discoverers of these small acts of learning at district level, their discoveries were brought to the attention of a wider local audience. A three-tier learning community was thus created at classroom, school and district levels. It was fuelled by the discoveries in pedagogical content knowledge and understanding of pupils as mathematics learners that were made in the lesson studies and it was driven by the deliberate process and regular rhythm of district-level discussions. Here, local experts and peers from other schools were on-hand to help to discuss subject knowledge and to interpret student misconceptions or behaviour. These created relationships between teachers interested in mathematics, a forum and a process for discussion and community-

building that ultimately became local habits and routines (Spillane & Diamond, 2007) for improvement.

The role of the district and university teams was also key at these meetings. They conducted termly meta-analyses of the lesson studies that identified emerging, cross-school themes which were ‘fed-forward’ to inform the new term’s lesson studies. These teams thus became valued co-creators of aspects of the new curriculum (Dudley, 2018b).

Classroom lesson study-informed enquiry practices made public, thus played an important role in creating a local system where such inherently self-improving activity was not a novelty, nor indeed a habit or a routine. Over four years, it has become something the schools’ partnership believes in, expects and indeed funds. Figure 3 illustrates three phases of this evolution: (i) creation of the culture, foundational routines and system-leadership knowledge required to transform the system; (ii) application of that knowledge and development of integral processes; and (iii) systemisation of these processes into ongoing expectation through new structures and roles.

Figure 3. Three-year evolution of a LS class-room inquiry informed local schools-led improvement system.

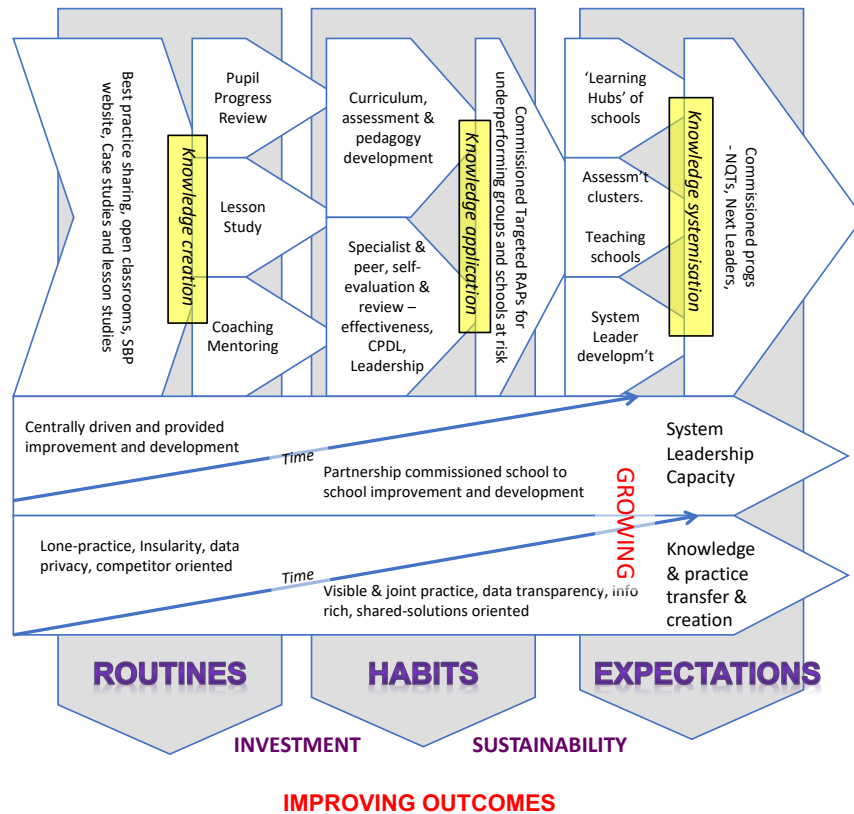


Figure 3 also highlights the formative, complementary and reflexive roles that both lesson study-informed and lesson study-like enquiries played, alongside orchestrated district-level development in setting the scene and creating the ‘know-how’ and conditions for the evolution of a new way of organising ‘school-led’ improvement locally in England.

In 2016, CSLP incorporated into a not-for-profit schools company called Camden Learning, whose members include every state school in Camden and the Council itself.

Schools in Camden have re-engineered their professional development and improvement systems individually and collectively in order to bring about a new, inter-dependent, incorporated way of working where every school is, to some extent, responsible for the successes of students and for high-quality learning in all the schools. Well over half of

Camden's schools participated in the original lesson study project. One headteacher describes below how the experience of sustained Research Lesson Study development in mathematics led her to realise an underlying need to address not only her children's mathematics, but more fundamentally their underlying ability to use talk and language effectively to think and learn. She has, with three other schools in Camden, created and led a schools Learning Hub focused on 'Oracy:' the development of effective spoken language in learning, to which almost half of Camden's 60 schools belong.

'I thought the answer to improving our pupils' learning of fractions in the mathematics project was going to be concerned with understanding fractions. It wasn't. 'The answer' was Oracy. Their lack of ability to talk about mathematics was as a result of a lack of the language needed to think as they learn - and this wasn't confined to thinking about and learning in mathematics.' (Bannon, 2018).

5 CONCLUSION

In this article, we have illustrated the impact of lesson study was being felt in England and elsewhere in the world beyond its country of origin, Japan. We have used Lewis's evaluative framework to present this, noting that much evaluative literature, in our view, wrongly treats lesson study as a curricular or pedagogical 'intervention' (as one might treat mathematics or history teaching materials, text books or resources). We argue instead that lesson study is a process for optimising innovation, development and implementation of effective classroom learning. We used our studies of Research Lesson Study in mathematics in a local school system to demonstrate how a focus on student learning and recursive cycles of lesson study could develop the curriculum and raise standards, whilst simultaneously supporting the creation of the necessary conditions for organisational and system learning and culture

change. These resemble Clarke and Hollingsworth's growth networks and change sequences (2002) that can contribute to cycles of development at system level. We have illustrated this in relation to a complex and advanced case in London, which demonstrates potential gains from aligning and orchestrating classroom, school and system learning and development.

We would therefore propose that, in addition to the indicators of impact used in this article, we should add one further impact indicator in relation to lesson study, which is: 'Changes in the experience of classroom-enquiry informed professional learning at both school and local system levels'.

More broadly, however, we believe that policy makers in England should look beyond the results of blunt-instrument RCTs and consider the broader evidence for the cultural changes that lesson study can support in creating an improvement-active, teaching force and a new knowledge-base of classroom and school generated practice knowledge to inform national curriculum and teacher development policy. We note with some optimism recommendation 6 the Royal Society's recent report (Royal Society, p.58) to support the use of research to inform teaching, using 'Close to practice' (CtP) research methods of which we believe Research Lesson Study to be a salient example (Dudley, 2018b). Furthermore, the Royal Society report calls for more partnership in joint evidence gathering and synthesis between a research-incentivised school system and researchers as we have described occurring in Japan.

Perhaps we are calling for less policy reliance on evidence-informed practice alone and for more enquiry-based-practice informed policy which, with enabling eco-systemic conditions, could lead to sustained impact of lesson study in education systems at classroom, school and system level in Europe and globally.

NOTES

¹ This was one of only two studies to show impact on student attainment (from only five of a total of over 643 submitted studies submitted to the US Research Clearing House in 2016 to be approved for publication).

² English state schools receive an additional payment of around £1,000 for each pupil on roll who, in the past six years, has been eligible for free school meals or who has ever been taken into local Council care.

³ Parentheses added for clarity.

⁴ ¹ Specialist Leaders in Education are local expert teachers recognised for their ability to work across schools to coach and support improvement in their area of specialism.

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