Waikato Journal of Education

ISSN 2382-0373

Website: https://wje.org.nz

Wilf Malcolm Institute of Educational Research
Te Pūtahi Rangahau Mātauranga o Wilf Malcolm
THE UNIVERSITY OF WAIKATO

Volume 27, Issue 3, 2022

Exploring possibilities and challenges of Lesson Study: A case study in a small island developing state

Indra Wati and Hem Chand Dayal

Editor: Kerry Earl Rinehart

Cite this article: Wati, I., & Dayal, H.C. (2022). Exploring possibilities and challenges of Lesson Study: A case study in a small island developing state. *Waikato Journal of Education, 27*(3), 73–88. https://doi.org/10.15663/wje.v27i3.812

Link to this volume: https://doi.org/10.15663/wje.v27i3

Waikato Journal of Education
Te Hautaka Mātauranga o Waikato

Volume 27, Issue 3, 2022

Exploring possibilities and challenges of Lesson Study: A case study in a small island developing state

Indra Wati and Hem Chand Dayal
The University of the South Pacific
Fiji

Abstract

Lesson Study (LS) is a teaching improvement and knowledge-building process that has origins in Japanese elementary education. In Japanese LS, teachers work in small teams to plan, teach, observe, analyse and refine individual lessons called research lessons. This study examined a small sample of primary school teachers' perceptions of LS as a professional learning endeavour. The benefits and challenges teachers experienced when attempting to engage in LS was further explored. The study focused on the Fijian primary teaching context, specifically on Year 8 mathematics teachers. Data was collected using a series of class observations and semi-structured interviews in two case-study schools. Analysis of classroom observations and semi-structured interviews confirms that LS provided a useful mode for teachers to talk about their mathematics lessons and open them for scrutinisation by their teaching colleagues. The findings suggest that all the teachers in the two schools found that LS is a powerful learning platform to improve teachers' mathematical knowledge and pedagogical skills. These findings have important implications for the implementation of effective professional learning amongst practising primary school teachers.

Keywords

Lesson Study; *talanoa*; research team; research lessons

Introduction

Lesson Study (LS), a form of collaborative practice, is a school-based professional development (PD) initiative that aims to enhance teaching and learning through the methodology of professional sharing of practice (Burghes & Robinson, 2010). LS, called *jugyo kenkyu* in Japanese, involves a detailed analysis of teaching (Doig & Groves, 2011).

The primary focus of LS is not what students learn but rather how they learn from lessons, looking at student thinking and how they make sense of the material presented, the difficulties they have, how they answer questions and how their thinking changes during the lesson (Stepanek et al., 2006). LS involves groups of teachers meeting regularly over a period of time to work on the design, implementation, testing

Wilf Malcolm Institute of Educational Research, Te Kura Toi Tangata Division of Education, University of Waikato, Hamilton, New Zealand
ISSN: 2382-0373
Contact details: Hem Chand Dayal hem.dayal@usp.ac.fj
(pp. 73–88)

and improvement of "research lessons" (Stigler & Hiebert, 1999). Research lessons are actual classroom lessons, taught to one's own students. A group of teachers collaborate and share ideas, opinions, conclusions and perceptions, and their new-found knowledge of instructional practice is shared and discussed with peers (Stigler & Hiebert, 1999). Japan's teachers follow eight steps for collaborative LS (Stigler & Hiebert, 1999):

1. Defining and researching a problem
2. Planning the lesson
3. Teaching and observing the lesson
4. Evaluating the lesson and reflecting on its effect
5. Revising the lesson
6. Teaching and observing the revised lesson
7. Evaluating and reflecting a second time
8. Sharing the results

According to Lewis et al. (2005), LS has many benefits in terms of improving teachers' thinking and practices, which may come in the form of increased knowledge of subject matter, stronger motivation and sense of efficacy and better lesson plans (Lewis et al., 2005). These benefits align with key components of effective professional learning identified by prominent researchers such as Darling-Hammond et al. (2017) and Lipowsky and Rzejak (2015). According to Darling-Hammond et al. (2017), these key features include active collaboration between teachers and use of feedback and self-reflection.

However, implementing LS in classrooms also brings challenges. For example, teachers in many contexts, including Fiji, may see their classroom practice as a private activity. LS requires that teaching be seen as a public activity, with classroom performance open to collegial scrutiny and comment, similar to the Japanese classroom context (Lewis & Tsuchida, 1998). Providing constructive feedback to senior teachers may be problematic to some teachers (Rock & Wilson, 2005). In Australia, a major constraint to effective implementation of LS is the fact that most schools would need to employ casual teachers to cover teachers observing lessons in other classes or schools (Doig & Groves, 2011), while in Japan, this problem is avoided, as LS groups meet after school once a month and conduct research lessons open to all teachers within the school district, held on early release days when most students are dismissed early and research classes stay behind for an extra period (Lewis, 2013).

We sought to explore how the Japanese LS could be used in the Fijian primary education context, guided by the following research questions:

- To what extent do teachers see LS as a PD endeavour to enhance their knowledge and skills in teaching mathematics?
- What are the benefits teachers see in LS as a PD endeavour?
- What are the challenges that teachers experience when engaging in LS?

After introducing the readers to the context of the study, a literature review is presented. This is followed by a detailed description of our methodology. Later, the findings are presented, followed by discussion and a short conclusion.

Context of the study

In Fiji, mathematics has always been an area of concern, for government, educationists, teachers and students alike. Over the last two decades, the government launched a variety of attempts to improve mathematics education. Arguably, the most significant changes occurred during the introduction of Literacy and Numeracy Strategies and Assessments as diagnostic tools for gauging National Standards and School Standards at levels four and six and a review of mathematics textbooks. For example, in 1996, mathematics textbooks for year three, seven and eight were reviewed by the Basic Educational Management and Teacher Upgrading Project (Mohan et al., 2017). The mathematics curriculum was further reviewed with the inception of the National Curriculum Framework in the past decade by the

Curriculum Development Unit, which required massive work on in-service teacher PD. However, teachers are quite comfortable with the modes of lesson delivery existent in Fiji for decades and it can be argued that a lack of confidence or knowledge of teaching methods by Fijian teachers is part of the problem.

In Fijian classes, teachers begin with examples of deriving solutions to problems shown on the blackboard, following textbooks. Students are then allowed to solve similar problems following the examples presented and complete repetitive textbook exercises. "Chalk and talk", a teacher-centred approach, was the most common instructional strategy employed by the teachers in the case-study schools. The class-teaching approach was dominant and teachers spent most of the time talking while children listened passively (Lingam, 2007). Fiji, like all Pacific-island nations, adheres to a centralised curriculum development approach, and national curriculum decision-making is located within this centralised system, driven by content and examinations (Koya, 2015).

This is not the case in Japan, where mathematics classes begin with investigative, collaborative and child-centred approaches. The problem-solving approach is an integral feature of Japanese classrooms and is utilised to derive solutions for problems individually, in pairs and in groups. LS is an integral part of teaching and learning practices in the Japanese education system.

Theoretical framework

There are many researchers who support transformational and reform-based models of teacher PD. Traditional methods include lectures and one-day-workshops situated outside school, as opposed to reform-based PD, which is more situated to the context, in this case the classroom. Researchers as well as practitioners must pursue greater rigour in the study of PD (Guskey & Yoon, 2009). LS revolves around a social–constructivist framework, particularly the three major themes of social interaction, the more knowledgeable other and the zone of proximal development (ZPD) (Vygotsky, 1978). The ZPD is the optimal condition where learners can solve problems with some guidance, a natural component of professional training that would lead to the transfer of workshop knowledge to classroom implementation (Vygotsky, 1978).

According to Carr and Kemmis (1986), teachers' knowledge provides a starting point for critical reflection. Pitman Brown & Brown (2015) suggest that "this critical reflection is concerned with the deconstruction of the participant's prior assumptions in a rational, thoughtful way" (p. 5). LS provides a dynamic platform for teachers to engage in critical reflection in the context of a classroom lesson, which is the most effective place to improve teaching. Teachers engage effectively when encouraged to take on the role of active change agents through practices such as action research, where they assume the role of theorists and researchers, gaining intellectual and moral control over their practice through a self-reflective process (Carr & Kemmis, 1986). And, as noted earlier, this process is one of self-transformation—not just changing sayings, doings and relatings as externalities, but as the things that compose one's own life and give it meaning, substance and value (Kemmis, 2007). Key to LS is its constructivist underpinnings (Wright, 2009).

In summary, the social constructivist principle of knowledge co-construction through social interaction (Vygotsky, 1978) supports LS and validates why each step of the process is important for bringing about increased professional knowledge and skills (Rock & Wilson, 2005). The professional collaboration that occurs as teachers of various levels of experience work together to implement LS (Rock & Wilson, 2005) allows teachers to become active, rather than passive, implementers of the curriculum.

Literature review

With regard to LS as a transformational, reform-based PD approach, Lewis' (2000) findings suggest that Japanese science teachers successfully shifted their approach from "teaching as telling" to "teaching for understanding" through intense studying and sharing during LS. The whole process "allows teachers to practice cognitive empathy and make student thinking visible" (Cerbin & Kopp, 2006, p. 251). Burghes and Robinson (2010) assert that LS contributes to the development of new ideas for teaching and learning, as teachers watch how children learn and see things that they did not see before: their thinking and reactions. LS outcomes are geared towards enhanced individual PD through collegial networking, increased subject matter knowledge, and a constant drive towards improving teaching and focus on student learning and outcomes as well as teachers being actively involved with a research stance (Stigler & Hiebert, 1999). According to Wright (2009) LS seeks to help broaden teacher mathematical content and pedagogical knowledge through collaboration.

The role of "critical friends" in LS is equally important. A critical friend is a trusted person who asks provocative questions, provides data to be examined through another lens and offers critiques of a person's work (Costa & Kallick, 1993). The critical friend plays a powerful role in LS as the process focuses on developing collegial relationships and encouraging reflective practice, altering the dynamics of leadership roles in the process. Helyer (2015) believes reflecting on learning achievements can empower learners to make intelligent decisions about how to move ahead with their learning needs. According to Mathew et al. (2017), reflective teaching is a process where teachers examine their practices, analyse how something was taught and how it might be improved for better learning outcomes.

In a study carried out by Rock and Wilson (2005), they proposed LS as a potential framework for an inquiry model of teacher PD to assist teachers to meet their professional growth needs. In this study, six out of seven teachers from an intermediate-level elementary school in North Carolina engaged in an LS process. Teachers worked in two groups—three fourth-grade teachers worked on math instruction using manipulatives while fifth and third-grade teachers worked on literacy—and brainstormed and planned a lesson which was then taught by a team member. Experts from a university faculty where the researcher was studying provided additional knowledge and strategies for the team to consider before they began planning the lesson. Lesson reflection and critique followed. At each phase participants recorded their feelings, understandings and experiences in a reflection log. Through multiple sources of data, findings suggested that participants believed focused and sustained work contributed to their professional growth. Furthermore, the researchers noted that participants developed professional confidence through LS and found peer collaboration valuable.

In another LS study carried out in a South African context with four science teachers, two grade-eleven teachers from a rural school acted as Pair A while two grade-ten teachers from city schools acted as Pair B. Data was collected through semi-structured interviews, observations, meetings, field notes, narrative accounts, lesson plans and reflective writing. Findings suggested that engaging in LS improved teachers' professional knowledge, attitudes and beliefs as well as collaborative planning. The major challenge was the need for subject experts to provide support to teachers where teachers' inadequate knowledge hindered meaningful cooperation. Other challenges included teacher workload, time constraints and lack of resources (Ogegbo & Gaigher, 2019).

The research studies reviewed here inform us that LS, when well implemented, offers many benefits to teachers, such as improved confidence with a topic or developing positive beliefs and attitudes towards teaching which will likely impact on the overall quality of teaching, learning and student achievement. However, LS implementation can also be a challenge, and cultural contexts play an important part in its success. The current study situates LS in a small island nation of the South Pacific and aims to offer our understanding of how LS can be used in a different context.

Research methodology

The methodology adopted for this study was a qualitative one, allowing for deeper understanding of LS as a professional learning tool in a Fijian context. Since the study explored the effects of LS as an intervention within an interpretive paradigm, we wanted to get an in-depth understanding of participants' experiences.

> The interpretive paradigm is informed by a concern to understand the world as it is, to understand the fundamental nature of the social world at the level of subjective experience. It seeks explanation within the realm of individual consciousness and subjectivity, within the frame of reference of the participant as opposed to the observer of action. (Burrell & Morgan, 2019, p. 28)

As such, we selected two case-study schools: a large, urban, multi-stream school with 15 participants and a rural, single-stream school with four participants. Multi-stream classes exist in schools with large school rolls where same level students learn in different classrooms. Single stream classes exist in schools with smaller school rolls where there is only one class for each level. Our 19 participants were teaching at various levels from kindergarten through to Year 8. Our sample consisted of eight male and eleven female teachers, whose teaching experience ranged from one to thirty-two years. Upon receiving ethics approval from the university and the Ministry of Education, we approached the two school head teachers to get their consent. These first LS meetings with the school heads and their Year 8 teachers were useful since they allowed us to present our intentions and gave participants the opportunity to understand the research project and our methods. Both head teachers agreed to be part of the study.

The teachers were introduced to the LS model suggested by Stigler and Hiebert (1999) to familiarise them with the detailed processes involved to ease the implementation of LS. This model of LS has five key components:

1. Identifying the problem and goal setting
2. Planning a lesson
3. Implementing the (research) lesson and observing it
4. Evaluating the lesson post-presentation
5. Improving and re-teaching the lesson

A two-hour workshop on LS was conducted separately for both schools, after school hours. Four teachers from school A attended and eleven from school B. The detailed process of the LS model, including the key components of LS and the first author's brief, firsthand experience of LS in Japan was discussed during these workshops. The Lesson Study model by (Stigler & Hiebert, 1999) was adapted for the study (see Figure 1).

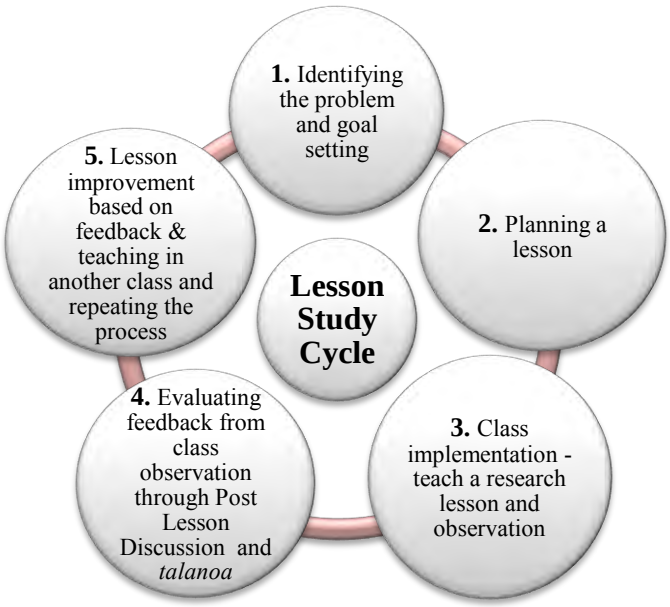


Figure 1. LS Model. Adapted version of Japanese Lesson Study model which was used to carry out the research in the Fijian context (Stigler & Hiebert, 1999)

Following the introduction to the process, the Year 8 teachers spent time identifying the problem and setting goals for lesson planning, and a date was set for lesson observation. The Research Team (RT) for school A consisted of three upper primary teachers and an early childhood teacher who participated in the two class observations. The RT for school B consisted of upper primary teachers and the head teacher of the school. Two lessons were observed in each school for Year 8. The lesson was planned and direct observation of lesson delivery took place using a checklist. To gauge the mean score of participants' responses, a five-point Likert scale (1 – Not at All, 2 – Poor, 3 – Satisfactory, 4 – Very Good, 5 – Excellent) was used. Likert Scales range from a group of categories—least to most—asking people to indicate how much they agree or disagree, approve or disapprove, or believe to be true or false (Allen & Seaman, 2007).

The checklist components were based on six criteria, as follows:

1. Teaching Material Analysis Power (teachers' knowledge of the unit, objectives and prior knowledge of the content).
2. Expertise of Mathematics (teachers' understanding of the position of the unit with regard to the whole unit, links within the contents and knowledge of various solving methods).
3. Power to Understand Learners (teachers' ability to understand learners).
4. Making Power of the Teaching Plan (planning the lesson with a focus on achieving the objectives of the lesson).
5. Teaching Skills (focused on teaching skills).
6. Sense of Mission for Teaching (teachers' in-depth teaching ability) (Source: Checklist used in LS training at Naruto University attended by first author.)

The lesson observation was followed by Post Lesson Discussion to analyse the strengths and areas requiring improvement in the lesson. While the researchers, school leaders and teachers began with informal *talanoa* by sharing some light moments, real work began when teachers took turns to critique the lesson by highlighting strengths and areas for improvement. *Talanoa* allowed teachers to relax, as it facilitated a safe environment to begin the serious work of lesson critique. *Talanoa*, a traditional form of dialogue in the Pacific culture, has been defined loosely as talking about something in particular. As a Pacific research methodology, *talanoa* can be described as a holistic and embodied amalgamation of the emotions, knowledge, interests and experiences shared between researcher and participants (Farrelly

& Nabobo-Baba, 2012). LS protocol was followed, facilitated by the researchers. The teacher who was presenting commenced with self-reflection on his/her lesson. Members of the RT took turns to comment, beginning on a positive note. Comments were directed to the lesson, not the teacher. Suggestions were noted by a record keeper appointed from within the RT, and considered for re-planning and incorporation in Lesson 2 (improved lesson), to be presented on a scheduled date. Since Fijian social and cultural settings value participation and collaboration, *talanoa* enables collective and self-reflection in Fijian settings and structures and can be used for communication, critical discussions, collecting information and social conversation (Vaioleti, 2006).

Post Lesson Discussions were video-recorded at both schools. To explore individual participants' perspectives on the benefits and challenges of LS, semi-structured interviews were conducted. These lasted for approximately 45 minutes, focusing on open-ended questions:

- Looking back on the study you were part of during these last few weeks, what are your views about LS?
- Did you see any benefits?
- If yes, what are the benefits of LS as a professional learning tool?
- What challenges did you experience while engaging in LS?

With permission from participants, *talanoa* with teachers were video recorded to maintain accuracy. The qualitative data gathered was recorded, transcribed, coded and analysed to identify patterns and trends, allowing categories to be derived from the actual data. Clustering under sub-headings and a systematic process of analysing textual data were utilised to segment interview transcripts, field notes, and written journal entries into coding categories that allowed for the emergence of themes.

Findings of the study

Below we describe our findings and the LS processes, including workshops, participation in lesson presentation and observation, post-lesson discussion, *talanoa* and semi-structured interviews. The findings are presented as two case studies.

Case study A

Once teachers agreed to participate in preparing and presenting lessons for class observation, the RT was ready with a lesson-observation checklist for use in both schools. All names in the case study are pseudonyms. Apau's lesson was observed in school A. Apau is a male with 17 years of teaching experience and a master's degree. He is also an assistant head teacher who trains teachers within the school and district. While the observation team (consisting of Apau, Ben, Chand and Disha) rated Apau's teaching highly using the checklist, in-depth knowledge was brought out through engaging teachers in Post Lesson Discussion and talanoa. Through critical analysis, the RT realised strengths and areas requiring improvement. This was a turning point for the teachers, including Apau, and enthusiasm for LS started to build.

Post Lesson Discussion was facilitated by the first researcher by setting a protocol. The lesson presenters were allowed to reflect on the lesson by highlighting what did and didn't work for them before other members commented on strengths and suggested improvements. The lesson summary for school A is shown below, followed by Apau's self-reflection, the RT's reflection and further lesson development and improvement.

Summary of Lesson 1 taught by Apau on the topic Algebra

Apau aimed for students to achieve the following outcomes: to be able to solve the unknown in algebraic equations using estimation, formal and flowchart methods. He introduced the lesson using the following equations on the blackboard as examples:

$w + 7 = 20$

$4p = 12$

$m/5 = 15$

Students were asked to read the equations as expressions and equations and use estimation to guess the values of *w*, *p* and *m*. Another example was provided, and students were allowed to proceed with the estimation and then solve the problem using both the formal and flowchart methods. Individual students were called on to solve the problem using the formal method and the rest of the students were asked to copy and try to grasp the concept. Students were taken through the equations using the flowchart method. They were given five more problems to solve using both methods:

$2b = 10$

$d - 5 = 14$

$m / 4 = 3$

$7n = 49$

$a / 2 = 5$

The teacher moved around, guiding students facing difficulties and assisting slow learners. The teacher then collected the exercise books for marking.

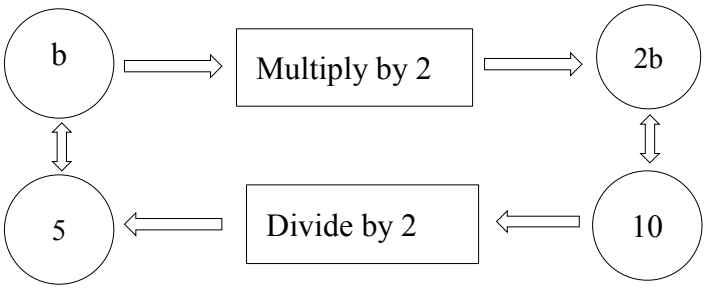
Example of solving the problem using formal method:

$b = 10$ (divide both sides by 2—opposite operations apply)

$b = 5$

To solve the same problem using a flowchart, students used graphical representations to show the process. Various shapes are used in a flowchart connected by arrows representing each step.

Various shapes are used in a flowchart connected by arrows representing each step.



Apau's self-reflection

Apau's reflection on his first lesson was that different students were confident with different methods, and he allowed them to use the method they were confident with: formal, flowchart or estimation. He observed that as students gained confidence, they were eager to solve more problems, and he noticed that even reserved children were actively involved. Apau affirmed, "Most of my *iTaukei* boys and girls

[the *iTaukei* students are indigenous students] are very reserved and today I was able to call them to the chalkboard to solve problems" (Apau's reflection: Post Lesson Discussion, Lesson 1, March, 2019). The challenge for Apau was that students lacked prior knowledge of the concepts being taught. In this case mastering the concepts on four operations: addition, subtraction, multiplication and division which was critical to progressing onto learning concepts on algebra.

Research team's reflection

The RT observed that the objectives of the lesson were explained well and students understood them. The teacher used mathematical language, for example, discussing "algebraic expressions" and "algebraic equations" thoroughly with students, as well as providing explanations in the three languages (English, *iTaukei* and Hindi). The RT felt that students were confident solving problems with at least one method: in this case they found the flow chart method was easier. The RT also noted that the lesson was student-centred, with group presentation and discussion allowing students to answer questions. The following changes were suggested for inclusion in Lesson 2.

The RT suggested that the improved lesson must focus on prior knowledge, in this case the four operations—addition, subtraction, multiplication and division—were to be revisited before the next lesson. Secondly, the team suggested that the lesson was to be introduced with a game or a story in the form of word problems for better understanding of the concepts: deriving equations and solving equations. The third aspect that was agreed to be included in the next lesson was to make the class more interactive: thinking about the problem individually, pairing and whole class sharing. The fourth improvement point that was suggested and agreed upon was not giving too many problems to solve but focus on understanding by using fewer problems. Apau agreed: "Three-word problems should be enough" (Apau's reflection: Post Lesson Discussion, Lesson 1, March, 2019). Ben added, "That's what I have identified like what we did in the past, problem after problem, one whole page, never ending problems" (Ben's reflection: Post Lesson Discussion, Lesson 1, March, 2019). Chand said, "If in those days teachers taught us like this, giving us fewer problems to understand, we would have been better in mathematics" (Chand's reflection: Post Lesson Discussion, Lesson 1, March, 2019).

Apau's second lesson

Apau introduced his second lesson by writing three-word problems—mathematical problems expressed entirely in words.

1. Suka had $45 with him. His father gave him x dollars and now he has $75. Solve the equation by writing down the algebraic equation.
2. A customer pays $50 for a coffee maker after a discount of $20. What is the original price of the coffee maker?
3. When 9 is subtracted from a number (n) and then divided by 2, the answer you get is 4. What is the number?
4. The teacher explained the rules for solving word problems:
5. Name what you want to know (pronumerals).
6. Define everything in the problem in terms of variables to write the equation.
7. Start with what you know.
8. Solve the equation using either the flowchart or formal method.
9. Check your answer by substitution.

The students solved problems individually, checking their answers in pairs and then in groups led by group leaders. The solutions were presented by groups on the blackboard for whole-class discussion. Both methods were used to solve the problems, and estimation and substitution was used to validate the answers. The solutions were discussed by the teacher with the active participation of the whole class.

Further lesson development and improvement

Apau's self-reflection on Lesson 2 described how adopting new methods of teaching helped expand his teaching knowledge. For example, his student, Ratu, and his partner went about deriving equations from word problems, estimating the solution and then using the formal and flow chart methods to solve the equations, while other students used the formal or flowchart method to solve the equation first and then used estimation to verify and validate the solutions. Students were allowed to explore and were not required to rigidly follow textbook examples.

The RT agreed that the major strength of Apau's lesson was student-centred learning. Ben commented on the use of pairing and grouping while Chand, the class teacher, recollected the interaction between teacher and students, where students were able to input ideas during discussion and were engaged in solving the problem. According to the RT, an in-depth understanding of the concepts was evident, as many students could derive algebraic expressions and equations from the word problems and solve equations using both methods with ease. In summary, the RT felt that in-depth teaching was achieved and concepts were successfully grasped. The RT also felt that Apau focused quite well on students' prior knowledge during his second lesson.

Case Study B

In school B, Lesson 1 was presented by Fau, a male with 15 years' teaching experience and a certificate in teaching qualification. The lesson summary is shown below.

Summary of Fau's Lesson 1

Fau taught a 45-minute lesson on the topic of capacity to a Year 8 class in a multi-stream school. He aimed to achieve the following achievement indicators: to estimate, measure and compare capacities using standard units; and to express volume and capacity using appropriate units and language of comparison.

The teacher recapped students' prior knowledge of the units for measuring liquids and then explained the meaning of capacity. Plastic cola bottles of different volumes were given to each group and students were asked to estimate the volumes of the bottles. They were then given water and measuring cylinders to find exact volumes. Students wrote their results on the blackboard and discussion was initiated to note differences between actual measurements and estimated volume. Additional activities were given to students to solve. The teacher asked students what they had learnt and concluded the lesson.

Fau's self-reflection on the lesson was that students were engaged in the group activity and also used their prior knowledge to carry out the task. He felt the area that required improvement was ensuring that all students were engaged.

The RT, consisting of Fau, Ellan, Gita, Hina, Ira, John, Khem and Sylvia, felt one of the strengths of the lesson was that resources were prepared in advance. "You had the measuring cylinder, water and the bottles readily available for the students to use" (Ellan's reflection: Post Lesson Discussion, Lesson 1, March, 2019). Secondly, they commented that the lesson activity was practical and student centred. "Students were [more] engaged [than with the] traditional method' (John's reflection: Post Lesson Discussion, Lesson 1, March, 2019). However, the RT also mentioned that the activity needed to be aligned to the lesson objectives.

Lesson 2 was collaboratively planned and implemented by another team member, Gita). Gita volunteered to teach the improved lesson since the focus was on the lesson and not the teacher. She agreed to make the RT's recommended changes to the lesson, and these were included in the lesson plan. Gita taught the improved lesson on capacity to another class in the school.

Gita's improved lesson

The main changes for this lesson were that it was aligned to the lesson objectives. In addition, a motivational activity was included at the start of the lesson to capture students' attention. The activity was a quiz based on general knowledge, for example, name a piece of measuring equipment.

Furthermore, different–coloured water and different sizes and shapes of bottles were used for each group to generate enthusiasm for learning. Instead of writing the activity on the blackboard, worksheets were designed by the teacher for individual activity. Actual volumes were written by students in the worksheets as part of the activity. Finally, as noted by the RT, student-centred learning was encouraged (think, do, pair and share answers, group presentation and discussion on the chalkboard with the teacher).

In her reflections on the lesson, Gita said she found it very interesting as she learnt and incorporated many ideas from the Post Lesson Discussion and critique on the lesson presented by Fau; however, she also said she felt nervous "due to presence of the RT during the lesson delivery" (Post lesson discussion, Lesson 2, March, 2019). The RT agreed that the lesson presented by Gita reflected the many suggestions they put forward and was vastly improved. Ellan highlighted, "It was good to see that the [bottles] did not have the measurements on [them] so children, when they were estimating, they did not have a clue of [their] capacity" (Post Lesson Discussion, Lesson 2, March, 2019). The variety of different bottles allowed students to actually do the estimation compared to the previous lesson where cola bottles were used which are familiar to students and may have added bias to students' estimates.

Following the conclusion of the LS cycle in school B, the school head and teachers decided that another cycle of LS should be conducted for Year 6, which would allow the remaining teachers to participate.

Benefits of LS

All 19 participants were interviewed following the completion of the LS cycles in both schools and the responses are presented next. The responses to open-ended questions pertaining to the LS Model were videotaped and transcribed in search of patterns and trends; simultaneously, teachers were engaged in *talanoa* sessions. Participants stated that they experienced several benefits from LS, including enhanced knowledge of mathematical content as well as pedagogical knowledge; learning through self-reflection and collaboration in a real context; and affective benefits such as enhanced self-image.

Enhanced content knowledge (CK) and pedagogical knowledge (PK)

All teachers reported that LS had improved their CK and PK. With respect to CK, Chand reported improved confidence in solving algebraic problems: "Algebra is one of the toughest areas for me personally, but after going through LS, I have managed to grasp the basic concepts …" (Post Lesson Discussion and *talanoa,* 6 March, 2019). Gita affirmed that LS presented an opportunity for her to observe other teachers and present lessons for others to critique: "We have lots of ideas to teach a concept and this helped me greatly to build my knowledge on how to deliver lessons properly, probably in the way that would make children learn better (Group interview, 20 March, 2019). Along with interview data, there were numerous instances from lesson observations that support these claims. For example, Ellan mentioned that LS provided teachers a platform to discuss and exchange ideas and open up areas they lacked confidence in (Group interview, 20 March, 2019).

Additionally, teachers mentioned that their understanding of teaching methodology improved. Lina shared that through LS

> we are able to [understand] various methods that teachers shared … and then implement [them] in our classrooms … we have children with different learning capabilities … so

> we have to come up with different methods of teaching that can suit different levels, so … we can ensure that students understand the concepts. (Group Interview, 20 March, 2019)

The teachers who presented lessons said they got a chance to improve lesson planning and delivery. All the teachers agreed that engaging in LS helped them prepare better lessons. The LS Post Lesson Discussion and critique and *talanoa* ensured that lessons captured the key components of a good lesson plan. John emphasised, "After going through the LS process, I was able to do a lot of things like lesson plans, lesson notes, teaching materials, blackboard preparation, my preparation physically [and] how ready and prepared I am to present to my class' (Post Lesson Discussion, Lesson 2, 20 March 2019).

Self-reflection and collaborative learning in real context

According to some participants, the Post Lesson Discussion and whole group *talanoa* provided the avenue for reflection on strengths and areas for improvement. Another point that participants mentioned, especially those part of the RT, was the focus on teaching and learning rather than individuals. In other words, participants realised that LS was based on collaboration rather than competition. Chand said, "LS is like a reflection for teachers, Post Lesson Discussions when we got to see our lessons from other teachers' perspectives and from there we could think back and say ok, this is what we could have done better' (Interview, 17th May, 2019). Apau explicitly stated, "What I like about LS is that it is the most effective PD avenue because the situation is real life, the situation is contextual … to do it in your room and be critically analysed in your room" (Interview, 17th May, 2019). Hina added, "It provides [an] ongoing cycle of lesson observation, lesson dissection and ways to improve teaching and learning of mathematics so it is a continuous process, it's a cycle" (Interview, 15th May, 2019).

Apart from learning, LS provided participants an opportunity to collaborate and network amongst themselves. From Apau's point of view, LS "facilitates networking. We need to network with [a] professional community of learners from within the school and as well as between schools" (Interview, 17th May, 2019). Nelly added, "We can do a lot of PDs among colleagues in schools and we can have clusters like nearby schools and we can share this knowledge because we know our children don't do quite well in this subject in our country" (Interview, 13th May, 2019). Ellan summarises: "LS, they see as a personal development for themselves, they are able to develop more collegial relationship with other teachers" (Interview, 20th May, 2019).

Participants also stated that LS leads to a paradigm shift in the sense that teachers take a research stance, critically looking at teaching and learning in collaboration with knowledgeable others in their classroom context. Apau said, "LS is seen to be a very powerful tool because it provides the platform for teachers as a group to come together, observe and dissect the lesson" (Interview, 17th May, 2019). Sylvia asserted, "It creates a platform for exchange of ideas" (Interview, 13th May, 2019). Colleagues are seen as critical friends, as confirmed by Nelly: "We went through the lesson, what happened in the lesson, and my colleagues came up with my strengths and areas [for] improvement that I need to work on to make math a better lesson" (Interview, 13th May, 2019).

Enhanced self-image

Additionally, the LS experience impacted participants' self-efficacy. Teachers reported having more productive beliefs about themselves and an enhanced understanding of their own ability as a result of the social and observational nature of LS. Lina commented, "Teachers' self-confidence and enthusiasm [were] increased as a result of engaging in LS" (Interview, 14th May, 2019).

Ellan added that

> LS enables them in a way to discover their potential as a teacher, like one example is John … he did not like to teach fractions, but he took it as a challenge to prepare the lesson and he did a very good teaching or delivery of that lesson. (Interview, 20th May, 2019)

John said,

> … and I was also able to learn a lot of things when the lesson concluded and we had the Post lesson discussions where the teachers had their inputs … it has really boosted my passion for teaching which I had lost. (Interview, 14th May, 2019).

Challenges of LS

Apart from the above benefits, our participants also discussed challenges they encountered. Five out of nineteen teachers (particularly lesson presenters) mentioned that teachers' willingness to participate was a challenge. A school leader commented that as a school head, he had a difficult time convincing teachers about LS initially; however, more teachers showed an interest after experiencing the benefits firsthand:

> … once the teachers had observed a lesson and once they had attended a Post lesson discussion, identified the benefits of it and how this mechanism works, then it made sense to them, they were excited about it, they wanted to try it out so that's why we had gone for lesson study for year six.' (Ellan's interview, 20th May, 2019)

Eight out of nineteen teachers, particularly lower primary teachers, mentioned class supervision as another challenge due to teachers' engagement in lesson observations and Post lesson discussion; however, all of them suggested potential solutions, such as prior planning. Nervousness and fear constituted another challenge, specifically for teachers presenting lessons for observation. All five participants who presented felt that fear of failure was one factor that made teachers nervous. Eleven out of nineteen participants identified time constraint as a challenge while observing other classes but felt in the long run it was beneficial for students. Pre-planning could help to meet this challenge.

Discussion

The study explored teachers' perceptions of LS to determine the benefits and challenges of its implementation. Our findings suggest that when given support, Fijian primary school teachers respond to LS very well. This was evident in the Post Lesson Discussions, *talanoa* and final group *talanoa.* Regarding the question of teachers' engagement in LS as a PD model and benefits, the findings suggest that all the teachers were able to participate actively in the LS process, which was new to them, deriving several benefits which were classed in two broad categories: cognitive benefits, such as CK and PK, and affective benefits, such as collaboration and networking amongst colleagues.

The first represented increased knowledge of content and other specifics of teaching that we loosely classify as PK. These include improving teaching and learning plans and executing these appropriately in the classroom. This is demonstrated by evidence from both case studies where teachers made noticeable improvements from the first lesson to the second. This is consistent with Lewis et al. (2005), who suggested that LS creates multiple pathways for learning that lead to instructional improvement. According to their model, teachers' thinking and practice may improve in multiple ways as a result of: increased knowledge of subject matter, increased knowledge of instruction and improved quality of available lesson plans. Burghes and Robinson (2010) echo this view, stating that LS contributes to the development of new ideas, as teachers watch how children are learning and see things they didn't see

before: their thinking and their reactions. Social constructivist principles of knowledge construction through social interaction and a shared experience rather than an individual one (Vygotsky, 1978) support LS and validate why each step of the process is important for bringing about increased professional knowledge and skills (Rock & Wilson, 2005).

The second major findings suggest that teachers experienced affective benefits from LS, such as opportunities to collaborate and network amongst themselves where colleagues are seen as critical friends and increased confidence and enthusiasm for teaching as a result of engaging in LS. Not only did teachers believe more in their own ability, but their beliefs about others also changed in a positive way, which is consistent with what Lewis et al. (2005) assert in terms of increased ability to observe students; stronger collegial networks; stronger connection of daily practice to long-term goals; and stronger motivation and sense of efficacy. During LS, professional collaboration occurs as teachers of various levels of experience work in groups to study their practice through the implementation of a research lesson (Rock & Wilson, 2005). These are also consistent with what Stigler and Hiebert (1999) found, that LS outcomes are driven towards enhanced individual PD through collegial networking, increased knowledge of subject matter, constant drive towards improving teaching, focus on students' learning and outcomes, and teachers being actively involved with a research stance. The findings are also supported by Helyer (2015), who believes reflecting on learning achievements can empower the learner to make intelligent decisions about how to move ahead with their learning needs, and by Mathew et al. (2017), who state that reflective teaching is a process where teachers think over their teaching practices, and analyse how something was taught and how the practice might be improved for better learning outcomes. The findings also revealed how teachers' self-efficacy was positively impacted. Accordingly, psychologist Albert Bandura's self-efficacy theory (1977), which describes our belief in our ability to succeed in certain situations, was evident. In this study participants found that LS contributed to enhanced self-image by altering teachers' beliefs about themselves and others.

The findings also revealed challenges faced by teachers at several stages of the LS cycle. Willingness to participate in LS was a major challenge for teachers who presented lessons for class observations. And the fact that outsiders, other teachers, experts and novices were observing the lesson contributed to teachers' reluctance to engage. This may be because Fijian classroom contexts are similar to Australia, where teaching is seen as a private activity while in Japan it is seen as a public activity with classroom performances open to collegial scrutiny and comment (Lewis & Tsuchida, 1998). Supervision of classes while teachers observed lessons elsewhere also posed a problem, leading to time constraints covering their own classes. Similar challenges, including teacher workload and lack of resources, were identified in a study conducted in an African classroom context (Ogegbo & Gaigher, 2019). Most schools would need to employ casual teachers to take the place of teachers observing lessons in other classes or schools in an Australian classroom context (Doig & Groves, 2011) or mitigate the issue by organising LS on early release days as it is done in Japan (Lewis, 2013).

Conclusion

Effective professional development is paramount in ensuring that curriculum implementers are equipped to support diverse learning needs in schools, classrooms and communities. This paper has examined a transformational PD model, Lesson Study. Hence, policymakers could adopt, adapt and adjust LS to support teachers and provide increased opportunities for professional and personal development. Teachers, schools, districts and nations could organise LS regularly and use and share useful data, resulting in building powerful learning communities and organisations. Identifying, supporting and engaging mentors and coaches from within the entire professional continuum of the learning organisation, including head teachers, experienced teachers and ministry officials, can be instrumental in leading LS in schools, districts and nations as a whole, and the data gathered can be used to inform policy. The sustainability of this new approach to PD will depend on support and commitment from all

stakeholders, including researchers, school leaders, teachers and policy makers. This study, albeit with limitations of a small sample size, has provided glimpses of the effectiveness of LS as a PD model with much potential and relevance to the Pacific context. Professional learning endeavours such as LS can prove critical to the success of mathematics teaching and learning as the quality of teachers directly impacts learner outcomes. Previous studies in teacher professional learning in mathematics in the Pacific have noted the need for more sustained professional learning opportunities for mathematics teachers (Dayal, 2019; Dayal & Cowie, 2019). Keeping this in mind, we intend to take LS to a greater number of schools and teachers in future iterations of this study. We hope that the findings of this study will be beneficial to teachers as well as researchers.

References

Allen, I. E., & Seaman, C. A. (2007). Likert scales and data analyses. *Quality Progress, 40*(7), 64–65.

Bandura, A. (1977). *Social learning theory*. General Learning Press.

Burghes, D., & Robinson, D. (2010). *Lesson study: Enhancing mathematics teaching and learning. Report for Centre for British Teachers Education Trust* (CfBT Education Trust).

Burrell, G., & Morgan, G. (2019). *Sociological paradigms and organisational analysis: Elements of the sociology of corporate life* (2nd ed). Routledge. https://doi.org/10.4324/9781315609751

Carr, W., & Kemmis, S. (1986). *Becoming critical: Education, knowledge and action research*. Falmer Press.

Cerbin, W., & Kopp, B. (2006). Lesson study as a model for building pedagogical knowledge and improving teaching. *International Journal of Teaching and Learning in Higher Education, 18*(3), 250-257. https://files.eric.ed.gov/fulltext/EJ1068058.pdf

Costa, A., & Kallick, B. (1993). Through the lens of a critical friend. *Educational Leadership, 51*(2), 49–51).

Darling-Hammond, L., Hyler, M. E., Gardner, M., & Espinoz, D. (2017). *Effective teacher professional development.* Learning Policy Institute. https://learningpolicyinstitute.org/sites/default/files/product-files/Effective_Teacher_Professional_Development_REPORT.pdf

Dayal, H. C. (2019) Teacher professional learning in formative assessments in mathematics. In M. Peters (Ed.), *Encyclopaedia of teacher education.* Springer. https://doi.org/10.1007/978-981-13-1179-6_353-1

Dayal, H. C., & Cowie, B. (2019) Professional learning intervention in mathematics: A case of developing portfolio assessment. *Australian Journal of Teacher Education, 44* (2), 99–118. https://doi.org/10.14221/ajte.2018v44n2.7

Doig, B., & Groves, S. (2011). Japanese lesson study: Teacher professional development through communities of inquiry. *Mathematics Teacher Education and Development, 13*, 77–93.

Farrelly, T., & Nabobo-Baba, U. (2012, December 3–5). *Talanoa as empathic research* [Paper presentation]. 2012 International Development Conference, Auckland, New Zealand.

Guskey, T. R., & Yoon, K. S. (2009). What works in professional development? *Phi Delta Kappan, 90*(7), 495–500. https://doi.org/10.1177/003172170909000709.

Helyer, R. (2015). Learning through reflection: The critical role of reflection in work-based learning (WBL). *Journal of Applied Management, 7*(1), 15–27. https://doi.org/10.1108/JWAM-10-2015-003

Kemmis, S. (2007, October 18–20). Action research as a practice-changing practice [Opening Address]. The Spanish Collaborative Action Research Network (CARN) Conference (pp. 18-20). University of Valladolid, Spain.

Koya, C. F. (2015) Pedagogical practices in Fiji schools. In E. Hau-Fai Law & U. Miura (Eds.) *Transforming teaching and learning in Asia and the Pacific: Case studies from seven countries* (pp. 22–43). UNESCO.

Lewis, C. (2000, April) *Lesson study: The core of Japanese professional development* [Invited address to the Special Interest Group on Research in Mathematics Education]. American Educational Research Association Meetings, New Orleans, United States.

Lewis, C. (2013) How do Japanese teachers improve their instruction? Synergies of Lesson Study at the school, district and national levels. Paper commissioned by the National Research Council's (now the National Academies of Sciences, Engineering and Medicine) Board on Science Education.

Lewis, C., Perry, R. & Hurd, J. (2005) How do teachers learn during lesson study? In P. Wang-Iverson & M. Yoshida (Eds.), *Building our understanding of lesson study* (pp. 77–84). Research for Better Schools.

Lewis, C.C., & Tsuchida, I. (1998). A lesson is like a swiftly flowing river: Research lessons and the improvement of Japanese education. *American Educator, 22*(4), 12–17, 50–52.

Lingam, G. (2007) Pedagogical practices: The case of multi-class teaching in Fiji primary school. *Educational Research and Review, 2*(7), 186–192.

Mathew, P., Mathew, P., & Peechattu, J. (2017). Reflective practices: A means to teacher development. *Asia Pacific Journal of Contemporary Education and Communication Technology, 3*(1), 126–131.

Mohan, P. P., Lingam, G. I., & Chand, D. D. (2017). Teachers' perceptions of the impact of professional development on learning and teaching in a developing nation. *Australian Journal of Teacher Education 42* (11), 18–33. https://doi.org/10.14221/ajte.2017v42n11.2

Ogegbo, A. A., & Gaigher, E. (2019). Benefits and challenges of lesson study: A case of teaching physical sciences in South Africa. *South African Journal of Education, 39*(1), 1–9. https://doi.org/10.15700/saje.v39n1a1680

Pitman Brown, P., & Brown, C. S. (2014) Transformative learning theory in gerontology: Non-traditional students. *Educational Gerontology, 41*(2), 136–148. http://doi.org/10.1080/03601277.2014.950492

Rock, T. C., & Wilson, C. (2005). Improving teaching through lesson study. *Teacher Education Quarterly*, (*Winter*), 77–92. https://files.eric.ed.gov/fulltext/EJ795305.pdf

Stepanek, J., Appel, G., Leong, M., Mangan, M. T., & Mitchell, M. (2006) *Leading lesson study: A practical guide for teachers and facilitators.* Northwest Educational Regional Laboratory.

Stigler, J. and Hiebert, J. (1999) *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. Free Press.

Vaioleti, T. M. (2006) Talanoa research methodology: A developing position on Pacific research. *Waikato Journal of Education, 12*, 21–34. https://doi.org/10.15663/wje.v12i1.296

Wright, T. D. Jr. (2009) *Investigating teachers' perspectives on the impact of the lesson study process on their mathematical content knowledge, pedagogical knowledge, and the potential for student achievement* [Doctoral thesis, University of New Orleans]. https://scholarworks.uno.edu/td/906