

A capabilities approach to examining mathematics and science teachers' reported experiences of lesson study professional development

Mzamo Wilson Jacobs, Thuthukile Jita, Loyiso Currell Jita, Thumah Mapulanga

Faculty of Education, University of the Free State, Bloemfontein, South Africa

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ABSTRACT

This study examined teachers' reported experiences of lesson study (LS) professional development (PD). A qualitative phenomenological design was employed, using face-to-face interviews conducted in 2018 with 15 mathematics and science teachers from several secondary schools in the Mangaung District, South Africa. Interviewees had participated in a university-facilitated LS program between 2012 and 2014. Data were analyzed using inductive and deductive thematic content analysis through the capabilities approach. The findings suggest that LS potentially expands teachers' capabilities for collaborative learning, reflective practice, and the development of pedagogical content knowledge, while also strengthening their professional agency, confidence, and engagement in practice. However, there were variations in the reported depth and nature of pedagogical change, ranging from procedural improvement to substantive shifts in teaching orientations. Furthermore, time limitations, heavy workloads, limited resources, and uneven participation shaped the realization of capabilities. LS is positioned as a PD model and a capability-enhancing practice that creates opportunities for teachers to exercise agency and engage in meaningful professional learning. Nonetheless, its effectiveness depends on conditions that support converting opportunities into sustained practical improvements. This study argues for a shift beyond access-based PD models. It recommends embedding LS within school structures that ensure its sustainability and impact.

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Corresponding Author:

Thumah Mapulanga

Faculty of Education, University of the Free State

Bloemfontein, South Africa

Email: mapulanga.t@ufs.ac.za

1. INTRODUCTION

Education is considered a vital capability because it can enhance other capabilities and well-being [1], [2]. Within this context, teacher professional development (PD) remains a central concern in education systems worldwide, particularly in relation to improving instructional quality and learner outcomes [3], [4]. Despite sustained investments in PD initiatives, concerns persist regarding the effectiveness of traditional models, which are often characterized by short-term workshops, limited follow-up, and weak connections to classroom practice [3], [5]. Such approaches have been criticized for their inability to bring about sustained changes in teachers' knowledge, beliefs, and pedagogical practices [6], [7]. In response to these challenges, there has been growing interest in school-based, collaborative, and practice-based PD.

Within many educational contexts, particularly those facing curriculum reform, learner underachievement, and resource constraints, there is a growing need for PD approaches that are contextually relevant, sustainable, and capable of fostering meaningful teacher learning [8], [9]. Understanding how teachers experience lesson study (LS) and how it influences their professional practice is, therefore, critical for informing policy and practice. There is a recognition that PD should not only focus on outcomes but also on expanding teachers' opportunities to act and make meaningful choices in their practices. The capabilities approach [10], [11] provides a useful lens for understanding PD in terms of what teachers are able to do and be. Applying this lens to LS offers new insights into how such initiatives enable or constrain teachers' professional growth.

Research on teacher PD highlights the importance of sustained, collaborative, and content-focused learning opportunities that are closely connected to classroom practice [3], [12]. Effective PD is characterized by active learning, coherence with curriculum goals, content focus, collective participation, extended opportunities for reflection and feedback [5]. Sims *et al.* [13] emphasize the importance of sustained engagement, feedback, and opportunities for reflection in effective PD. Despite this recognition, questions remain about whether current PD approaches are sufficiently effective in improving teaching practice. In many educational systems, including South Africa, these concerns are reflected in the continued reliance on traditional PD models that view teachers as passive knowledge recipients, limiting their impact on practice [14]. These limitations have prompted growing interest in alternative approaches that are more collaborative, sustained, and grounded in classroom practice.

One such approach that has gained increasing attention is LS. LS originated in Japan as a collaborative, inquiry-based approach to PD that centers on the systematic study of teachers' classroom practice [15], [16]. In LS, a group of teachers plans a lesson, teaches it, and reflects on it, with an emphasis on students' learning [17]–[19]. Central to LS is the belief that teachers learn best through collective inquiry into their own classroom practice [6]. It has been recognized as an effective model for supporting teacher learning through collective inquiry, reflection, and experimentation [6], [19]–[21]. It aligns closely with the features of effective PD, particularly in its emphasis on collaboration, active participation, and ongoing cycles of learning [3]. Studies consistently show that LS supports teacher learning through collaborative lesson planning, classroom observation, and reflective dialogue focused on learner understanding and instructional improvement [15], [19], [22]. Through collaborative lesson planning and observation, teachers can examine instructional decisions in depth and learn from one another's expertise [4], [7], [23]. LS thus serves as a mechanism through which teachers transform their practice by engaging in collective inquiry and reflective dialogue [19], [24]. However, while LS has shown promise, its effectiveness is not uniform and appears to depend on the context in which it is implemented. This variability highlights the need to better understand how teachers experience LS in practice.

International research suggests that LS contributes to changes in teachers' beliefs, professional identities, and classroom practice [25], [26]. Still, the effectiveness of LS is influenced by contextual factors such as leadership support, school culture, and time [16], [26]. In many contexts, there remains limited empirical evidence on how teachers experience LS and how it functions as a sustained professional learning practice. This raises important questions about what LS offers and how teachers engage with and make sense of LS opportunities. To address these questions, a theoretical perspective is needed that moves beyond participation to consider teachers' ability to act on professional learning opportunities. The capabilities approach is one such perspective. The capabilities approach was proposed by Sen [10] and further elaborated by Nussbaum [11] to explain what individuals are effectively able to do and be. The central concepts in the capabilities approach—capabilities, functionings, freedom and agency, and reason to value—have been widely applied to examine issues of equity, agency, and human development [2], [27], [28]. Although it has also been applied in educational research [1], [27], [29], [30], little is known about its application in teacher PD research, especially in the African context [31]. Nevertheless, the capabilities approach may provide a useful lens for conceptualizing teacher PD as the expansion of what teachers are able to do and be as a result of exposure to and participation in PD.

The concepts relevant to this study (capabilities, agency, functionings, and conversion factors) have been operationalized as follows to ensure conceptual clarity and analytical depth [10], [11]: “capabilities” refer to the real opportunities available to teachers to engage in professional learning, such as collaboration, reflection, and experimentation within LS. “Agency” is understood as teachers' capacity/freedom to make purposeful pedagogical choices and to act on these opportunities in ways they value. “Functionings” refer to the realized outcomes of these processes, as evidenced by reported changes in instructional practices, professional interactions, and orientations towards teaching and learning. These processes are shaped by “conversion factors”, including the personal, social, and institutional conditions—such as time, workload, leadership, support, and school culture—that enable or constrain the translation of opportunities into practice. In this study, these constructs are used analytically to explain how and why professional learning occurs unevenly across contexts. LS is thus examined as a capability-generating structure whose effects depend on

how teachers exercise agency within specific contextual conditions, resulting in differentiated professional outcomes. Using the capabilities approach, this study examines how LS creates opportunities for professional learning and how contextual conditions shape teachers' ability to translate those opportunities into practice. In this way, LS is understood not simply as a PD activity, but as a socially situated process shaped by institutional and relational conditions [2], [32], [33].

Combining the LS and the capabilities approach provides a richer understanding of teacher PD. LS can be seen as a structure that expands teachers' capabilities by creating opportunities for collaboration, reflection, and knowledge development. At the same time, the capabilities approach provides a critical lens for interpreting PD as the acquisition of freedom rather than participation. From this perspective, LS structures do not guarantee meaningful professional learning unless teachers are genuinely able to exercise choice, voice, and agency within them. This framing challenges dominant assumptions in PD research that equate participation with impact. The capabilities approach highlights that opportunities in LS do not automatically lead to improved practice; they must be supported by enabling conditions. Research suggests that factors such as leadership support, school culture, and resource availability influence the success of PD activities [12], [14]. This shifts the focus from whether LS works to how and under what conditions it enables meaningful professional growth.

In the South African context, concerns about the limited impact of PD are reflected in persistent learner underperformance, particularly in mathematics and science, as highlighted in the recent international reports, such as the Trends in International Mathematics and Science Study (TIMSS) [34], [35], as well as in evidence that centrally driven workshop-based PD models often fail to translate into improved classroom practice. Reports have consistently highlighted a disconnect between PD provision and instructional change, with teachers frequently unable to integrate acquired knowledge into their teaching due to contextual constraints such as time pressure, resource limitations, and curriculum demands, thereby widening learning gaps [36]–[38]. Collectively, this suggests that the problem is not only access to PD, but the extent to which teachers can translate professional learning into meaningful and sustained classroom practice.

While a growing body of research has demonstrated the potential of LS as an effective PD approach [6], [19], [39], much of this work has focused primarily on outcomes such as improvements in pedagogical content knowledge or instructional practices. Although these findings are valuable, they often overlook the conditions under which such outcomes are produced. Limited attention has been given to how contextual constraints and enabling conditions shaped teachers' ability to translate PD opportunities into practice [8]. Meanwhile, challenges such as time constraints, heavy workloads, and limited institutional support can hinder its effectiveness [40], [41]. Addressing these limitations requires a more critical examination of LS that foregrounds context, agency, and the conditions of practice. Existing studies assume that participation in LS automatically produces professional growth, with limited attention to how teachers exercise agency within constraining institutional conditions. Consequently, less is known about how contextual realities shape teachers' ability to translate professional learning opportunities into sustained classroom practice. This study addresses this gap by examining participation in LS through the capabilities approach, which foregrounds not only what opportunities are available to teachers but also their ability to act on them. By focusing on the relationship between capabilities, agency, and contextual factors, the study provides a more nuanced account of how PD is experienced and enacted in practice. Therefore, the study is guided by the following research question: How do teachers experience and report how LS shapes their capabilities for professional learning, collaboration, and classroom practice?

This study makes theoretical, empirical, and practical contributions to the field of teacher PD. Theoretically, it advances the application of the capabilities approach in teacher PD by conceptualizing PD as the expansion of teachers' capabilities and agency rather than merely the acquisition of knowledge or skills. Empirically, it provides evidence from the South African context, demonstrating how LS is experienced and enacted under conditions of constraint. In practice, it offers a contextualized account of the factors that enable or limit the translation of professional learning into practice, thereby extending the existing understanding of how PD operates in resource-constrained environments.

These contributions are important in light of the persistent disconnect between the provision of PD and its impact on teaching and learning. While education systems continue to invest in PD initiatives, such efforts often fail to produce sustained improvements in instructional quality. By focusing on how teachers engage with and act on professional learning opportunities, this study highlights the importance of enabling conditions, such as collaboration and institutional support, in shaping PD effectiveness. In doing so, it offers practical insights for policymakers and school leaders seeking to design PD models that are more accessible, meaningful, and sustainable in resource-constrained contexts. Without paying attention to the conditions that enable teachers to act on what they learn, investments in PD are unlikely to yield meaningful improvements in teaching and learning. This study contributes novel insight by examining how institutional and contextual conditions shape teachers' ability to translate professional learning opportunities into enacted classroom

practice. It shifts the focus from participation in PD to the process through which such participation leads or fails to lead to sustained instructional change. Furthermore, the study contributes to theory by extending the capabilities approach to the analysis of teacher PD.

2. METHOD

2.1. Research design

This study adopted a phenomenological qualitative approach to explore secondary school mathematics and science teachers' experiences with LS as a PD practice [42]. Phenomenology was appropriate because the study sought to understand how teachers interpreted and experienced professional learning within their institutional contexts. The approach enabled an in-depth exploration of participants' perceptions, meanings, and experiences related to LS participation. Although the study was grounded in a phenomenological orientation, thematic analysis was used as the analytical procedure to identify patterns of meaning across participants' accounts. Meanwhile, phenomenology also informed the study's focus on teachers' lived experiences and subjective interpretations of LS participation. At the same time, thematic analysis provided a flexible and systematic approach for organizing, interpreting, and analyzing those experiences.

2.2. Context of the study

The study was conducted in the Mangaung District of South Africa. The South African education system is characterized by ongoing curriculum reforms, diverse learner needs, and persistent challenges related to teaching and learning outcomes, particularly in mathematics and science. South African teachers are required to engage in continuous PD, however, professional learning opportunities are often dominated by centrally organized workshops that are criticized for being disconnected from classroom realities [43], [44]. In response to these challenges, the University of the Free State partnered with the Free State Department of Education to offer an LS-PD intervention for mathematics and science teachers. The PD, offered between 2012 and 2014 at selected schools, aimed to improve teaching practice and learner outcomes through collaborative planning, practice-based inquiry, reflective practice, and shared inquiry. It was delivered over six months through six interactive, practice-oriented workshop days held every second month, during which teachers engaged in research, planning, presenting lessons, and reflecting on their lessons.

The PD intervention was conducted in three stages. The first stage introduced teachers to the LS approach through literature, video case studies, and participation in a full LS cycle, with a focus on building collaborative and reflective practice. During the second stage, teachers engaged in hands-on activities and visual resources to enhance their pedagogical and conceptual understanding of mathematics and science concepts perceived to be difficult to teach and learn, learner misconceptions, and the effective strategies required to teach them. In the third stage, teachers formed research teams and implemented LS cycles in their schools. Each research team completed at least one LS cycle and documented their activities in a portfolio. To ensure continuity and accountability, the portfolios were confirmed by the head of departments or the school principal. Within this context, LS provided a structured opportunity for teachers to collaboratively plan, observe, and reflect on lessons, thereby creating room for professional learning grounded in classroom practice.

2.3. Sampling

Participants were selected using purposive sampling to identify participants who had participated in the LS intervention. This selection criterion ensured that they provided detailed reflections on their experiences. Therefore, 15 teachers participated in the study. This sample size was considered appropriate for phenomenological inquiry because it enabled in-depth exploration of participants' lived experiences rather than statistical generalizations. The sample included six females and nine males, with ages ranging from 25 to 60 years and varying years of teaching experience, spanning 6 to 30 years. In terms of subject specializations, six participants taught mathematics, four taught physical sciences, and five taught life sciences.

2.4. Data collection procedures

Data were collected through face-to-face semi-structured interviews with the 15 participants to ensure consistency across interviews, while allowing participants to elaborate on issues they considered important. An interview guide was used to explore teachers' understanding of LS, their experiences of collaboration, the perceived impact on content knowledge and classroom practice, and the challenges encountered during implementation. Each interview was conducted at the participants' schools at a place and time convenient to the teachers. Interviews lasted approximately 30–45 minutes. Interviewer bias was reduced by using a semi-structured interview guide with neutral prompts in Table 1, which allowed

participants to elaborate freely without leading responses. Reflective notes were also maintained to monitor potential bias and ensure consistency in data collection. To mitigate potential recall bias associated with the retrospective design, participants were encouraged to reflect on specific LS activities and concrete classroom experiences. Where possible, they were prompted to provide examples of lessons, interactions, or changes in practice to anchor their responses in actual events rather than general impressions. All participants agreed to audio-record the interviews, which were later transcribed verbatim to ensure data accuracy.

It is worth noting that the timing between intervention and data collection enabled exploration of teachers' perspectives on the sustained professional impact of LS, emphasizing its enduring values beyond immediate outcomes. While the retrospective design enabled insights into perceived long-term impact, it also introduces potential recall bias and post-hoc rationalization [45], [46]. Participants' accounts may reflect reconstructed narratives influenced by subsequent experiences rather than direct recollection of the intervention. Therefore, findings should be interpreted as insights into how teachers make sense of past PD exposure rather than as evidence of sustained impact. Although educational policies in South Africa have evolved over the period of the PD implementation and data collection, the core principles of LS remain stable. Thus, the dataset remains relevant for offering meaningful insights into the sustained professional significance of LS in school-based contexts. The study is positioned within current scholarship for contemporary support and a conceptual lens for interpreting the retrospective data.

2.5. Interview guide

The interview guide used in the study was developed by the first author after a review of relevant literature on LS and PD [3], [5], [6], [24]. Meanwhile, the guide was reviewed by the second and third authors, who checked the questions for clarity and relevance to the study's aim. Furthermore, an independent researcher experienced in PD research reviewed the questions for alignment with the main themes of LS and the aim of the present study. Consequently, the interview guide was refined based on comments from these researchers, and the leading questions used are shown in Table 1.

Table 1. Leading questions in the interview guide

No.	Examples of leading questions
1.	Reflecting on your career as a teacher, how is LS different from your past experiences with PD opportunities offered at the district or provincial level?
2.	To what extent did your teaching improve through participation in LS? Elaborate.
3.	What would you consider as challenges or constraints to the implementation of LS in your school?
4.	Would you say LS contributed to improving your content knowledge and classroom practice? Elaborate.
5.	Describe how you and your colleagues collaborate following your participation in LS (e.g., in planning to teach, discussing a taught lesson, or discussing a unit yet to be taught).
6.	How have you experienced planning in a group following your participation in LS?
7.	To what extent can participation in LS create a community of practice or a professional learning community?

2.6. Data analysis

The interview recordings were first transcribed verbatim and analyzed thematically following Braun and Clarke's approach [47], [48]. The fourth author and an independent researcher conducted data analysis collaboratively to enhance consistency and reduce individual bias. The process involved repeated reading of transcripts, independent initial coding, comparing and refining codes, identifying patterns, and developing themes. Both inductive and deductive approaches were used: open coding initially generated descriptive codes grounded in the participants' accounts, which were subsequently refined and interpreted through the lens of the capabilities approach. The capabilities approach informed the analysis of how LS created opportunities for professional learning, how teachers exercised agency in responding to these opportunities, and how contextual conditions enabled or constrained the translation of teacher learning into practice. Themes were continuously refined through constant comparison and researcher discussions to strengthen analytic rigor. Verbatim quotations were included to illustrate themes and preserve participants' voices. Table 2 provides a summary of themes, codes, and illustrative excerpts to demonstrate alignment between the data and the analytic framework.

Beyond categorizing data, the analysis focused on identifying the relationships between the capabilities approach constructs by tracing how LS created opportunities for professional learning, how teachers engaged with and acted on these opportunities, and how contextual conditions shaped whether these opportunities were realized in practice. This involved examining causal pathways within the data, specifically how particular features of LS (e.g., collaborative planning, observation, and feedback) enabled or constrained teachers' ability to translate learning into practice. This approach allowed the study to move beyond description to provide a more explanatory account of variation in teacher experiences and outcomes.

Table 2. Summary of themes, codes, and illustrative excerpts

Theme	Analytical category	Codes	Illustrative excerpt
Reconfiguring professional practice: from individualism to interdependence	Capabilities (collaborative opportunities); relational conversion factors	Collaboration; shared planning; peer support; reduced isolation	<i>"Lesson study instilled confidence and self-esteem as an approach that we as teachers need one another. If I am not able to present a certain concept, I will call my colleague to present the same concept while I am listening and observing."</i> (Teacher 3)
Teacher learning as layered development	Capabilities; functionings	Reflective practice; feedback; pedagogical shifts; focus on learner understanding	<i>"Previously, I only focused on teaching... [now] whether the learners have learned something."</i> (Teacher 6)
Developing epistemic capability beyond content knowledge	Functionings (realized outcomes/practice); Epistemic capability (interpreted)	Improved content knowledge; Instructional strategies; learning from peers	<i>"I experienced a significant improvement in content knowledge. My way of thinking and how to teach changed. It [lesson study] has made the approach to mathematics very interesting as one was exposed to various approaches to teaching mathematics."</i> (Teacher 3)
Strengthening agency, identity, and reflective professionalism	Agency	Confidence; willingness to experiment; openness; Professional dialogue	<i>"It [lesson study] has made me learn about many teaching approaches from other teachers. It has empowered me regarding teaching approaches."</i> (Teacher 8)
Collaboration as a relational capability enabling condition	Functionings: capabilities	Trust; mutual accountability; time constraints; uneven participation	<i>"If I am not able to present a certain concept, I will call my colleague to present the same concept while I am listening and observing."</i> (Teacher 14)
Anticipatory capability and the intensification of practice	Relational capabilities	Intentional planning; alignment with objectives; use of resources; learner-centered planning	<i>"We tend to forget to infuse resources into teaching and learning. In lesson study, we learned about teaching in the context of using resources in lessons."</i> (Teacher 2) <i>"When I teach, I used to forget the lesson objectives [goals]. Lesson study taught me that the lesson plan needs to show some coordination with the lesson objectives."</i> (Teacher 13)
Situating communities of practice as relational learning	Relational capabilities	Shared learning; mutual engagement; collective problem-solving	<i>"Lesson study improved my teaching a lot. Now I am not scared to ask if I don't understand as I prepare for my lessons. If I am having a problem with my lesson, I will be able to share it with my colleagues."</i> (Teacher 9)
Conversion factors limiting capability realization	Conversion factors	Workload; time pressure; resource constraints; non-participation	<i>"We are too committed. There is a lot of paperwork, and we don't focus much on lesson study practice. Overcrowding in classrooms and a shortage of learning materials and textbooks are also factors that make lesson study implementation difficult."</i> (Teacher 5)

2.7. Trustworthiness

The trustworthiness of the study was ensured through strategies aligned with credibility, dependability, confirmability, and transferability [42], [48], [49]. Researchers enhanced credibility by engaging with the data for an extended period, during which the transcripts were read several times and verbatim quotations were used. Credibility was further enhanced through member checking and peer debriefing among the research team. Meanwhile, transferability was supported by giving a thick description of the study's context, enabling readers to determine whether and how the findings may be applied to similar contexts [42]. Dependability was supported by keeping a clear audit trail of decisions made during data collection and analysis [50]. Meanwhile, confirmability was addressed through reflexivity, detailed documentation, and grounding interpretations in participants' accounts rather than the researchers' assumptions [50]. Researchers' interpretation biases stemming from their positionality as teacher PD scholars were minimized through reflexive discussions that critically interrogated emerging themes and considered alternative explanations [51].

2.8. Ethical considerations

The study was cleared by the Ethics Committee of the University of the Free State. Furthermore, permits to conduct the study were secured from the Free State Department of Education and the school principals of the participating schools. The aim of the study was described to all the participants, including voluntary participation and their right to withdraw from the study without any consequences. Furthermore, participants were informed of the measures taken to protect their identities, such as the use of pseudonyms and the secure storage of data.

3. RESULTS

This study explored teachers' experiences of LS through the capabilities approach, foregrounding the relationship between capabilities (real opportunities), agency (freedom to act), and functionings (realized outcomes/practice) [10], [11]. The findings suggest that LS supported professional learning through collaboration, reflection, and shared pedagogical inquiry. However, participants' experiences varied depending on contextual factors, including workload, time, institutional support, and participation patterns. The findings are organized into eight themes that reflect different dimensions of capability development. Each theme presents empirical evidence from participants' accounts of their experiences of LS participation.

3.1. Reconfiguring professional practice: From individualism to interdependence

Teachers consistently described LS as enabling collaboration and shared professional engagement. As Teacher 1 explained, *"Lesson study brings the educators together.... We share information to plan together....and become more confident."* Meanwhile, Teacher 4 emphasized its role in promoting collective work and shared pedagogical approaches, *"Lesson study encourages teachers to work together and share best practices in teaching mathematics. We sit together as a group of teachers teaching mathematics, and we share how we are going to present our lesson plan."* Furthermore, Teacher 3 stated, *"If I am not able to present a certain concept, I will call my colleague to present while I am listening and observing."*

3.2. Teacher learning as layered capability development

Teachers reported that LS facilitated meaningful professional learning through reflection, feedback, and dialogue. For example, Teacher 1 noted, *"We focus on strengths and provision of constructive criticism. In this way we learn from one another,"* while Teacher 6 highlighted how post-lesson discussions enable teachers to *"advise one another and see one's shortcomings."* Teachers also highlighted shifts in pedagogical thinking, as can be seen from Teacher 9, *"When I give lesson objectives, it is not for me, it is for the children."* For some teachers, learning involves procedural improvements, e.g., planning and resources, while for others it entailed deeper epistemic shifts, such as reorienting teaching towards learner thinking. Teacher 6 stated that, *"Previously, I only focused on teaching, but now, I focus on whether the learners have learned something."*

3.3. Developing epistemic capabilities beyond content knowledge

Teachers reported significant improvements in content knowledge and pedagogical approaches. For instance, Teacher 3 stated, *"I experienced a significant improvement in content knowledge. My way of thinking and how to teach changed. It [lesson study] has made the approach to mathematics very interesting as one was exposed to various approaches to teaching mathematics,"* while Teacher 13 noted learning through peer interaction and observation, *"It opened my eyes that there are colleagues who know better and can present the content better than me."*

3.4. Strengthening agency, identity, and reflective professionalism

Participation in LS was associated with increased confidence, openness, and willingness to experiment. As Teacher 3 reflected, *"Lesson study instilled confidence and self-esteem as an approach that we as teachers need one another. If I am not able to present a certain concept, I will call my colleague to present the same concept while I am listening and observing."* Additionally, Teacher 8 reported, *"It has empowered me regarding teaching approaches."* Teachers also reported greater willingness to seek support and engage in professional dialogue.

3.5. Collaboration as a relational capability and enabling condition

Teachers described collaboration as both transformative and enabling. For example, Teacher 14 noted, *"Assumptions about knowing certain things opened my eyes that we can learn from each other as teachers. Previously, people [teachers] used to skip what they were not able to teach, but now it is not possible after participating in lesson study. If I do not know a topic, I consult with my colleagues, inside and outside the school,"* while Teacher 13 reported increased confidence in opening their classroom to others, *"Previously I was not free in my classroom in the presence of my colleagues but having experienced sharing with them in lesson study I am now free even if someone can come into my class from outside the school."* However, collaboration required effort, as can be seen in these accounts:

"Time does not allow us..., but we come early or stay late to plan together." (Teacher 1)

"Sometimes teachers are unable to attend because of other school activities." (Teacher 4)

3.6. Anticipatory capability and the intensification of practice

LS influenced teachers' lesson preparation, encouraging more intentional, research-informed planning. Teachers emphasized the importance of drawing on clear objectives, using diverse resources, and planning for learner diversity. The following excerpts illustrate this:

"We were encouraged to research different ways of teaching." (Teacher 12)

"Lesson study taught me that the lesson plan must align with the objectives." (Teacher 13)

"We tend to forget to infuse resources into teaching and learning. In lesson study, we learned about teaching in the context of using resources in lessons." (Teacher 2)

3.7. Situating communities of practice as relational learning

Teachers' experiences reflected elements of a community of practice, including shared learning and mutual engagement. For instance, several teachers noted:

"Lesson study improved my teaching a lot. Now I am not scared to ask if I don't understand as I prepare for my lessons. If I am having a problem with my lesson, I will be able to share it with my colleagues." (Teacher 9)

"We experienced a lesson in a certain way, and another teacher experiences it differently. When we shared our experiences, we were able to advise one another on seeing one's shortcomings. You could learn other things from other teachers." (Teacher 14)

"Lesson study showed that we need one another." (Teacher 7)

3.8. Conversion factors that limit capability realization

Despite the benefits, teachers identified significant constraints, including time pressure, workload, and resource shortages. Teacher 5 explained, *"We are too committed. There is a lot of paperwork, and we don't focus much on lesson study practice. Overcrowding in classrooms and a shortage of learning materials and textbooks are also factors that make lesson study implementation difficult,"* while Teacher 14 highlighted responsibilities, *"We are also having extra classes in the afternoons and sports activities on Wednesdays, which compete with lesson study."* Teacher 7 added non-compliance by some teachers, *"Some teachers are not willing to take part."* Meanwhile, teachers demonstrated agency:

"We always try our best to create time." (Teacher 1)

"We need to change and try new things." (Teacher 2)

4. DISCUSSION

This section presents an interpretation of the results through the capabilities approach, which is used to explain how LS experiences expand or constrain teachers' professional capabilities and agency. Participants' reported experiences suggest that LS created a collaborative professional space in which teachers could collectively interrogate instructional practices and learners' understanding. This illustrates that LS supported the creation of structured opportunities for collaboration that function as a relational capability, enabling teachers to move beyond individualized practice towards shared professional engagement. This shift appears to be driven by the repeated requirement to jointly plan, observe, and reflect on lessons, which gradually builds trust and interdependence.

However, sustaining collaborative practice depends on teachers' willingness to participate and on institutional support such as time allocation and supportive leadership. This reveals a tension between collaboration as collective empowerment and collaboration as potential dependency on more active or knowledgeable peers, suggesting that LS may simultaneously redistribute and reproduce professional inequalities. The findings suggest that LS may begin to shift teachers' professional practices from individualized approaches towards increased interdependence. This shift is especially significant in contexts, such as South Africa, where teaching has historically been characterized by isolation and compliance-driven accountability systems. This transformation reflects not only expanded opportunities for collaboration but also a change in teachers' valuation space, that is what they perceive as legitimate and worthwhile professional practice [2]. Importantly, this shift is relational and emergent rather than formally institutionalized, raising questions about the sustainability of these practices in contexts where individual performance remains emphasized.

Although LS appears to create opportunities for professional learning, participants' reported experiences also highlighted institutional and structural conditions perceived to constrain sustained engagement. LS may have created opportunities for reflective learning as a capability, but the depth of achieved learning varies significantly across teachers. This variation can be explained by differences in how

teachers exercise freedom to act and engage with reflective processes. While some teachers actively interrogate their practice and engage with feedback, leading to deeper pedagogical shifts, others engage at a more procedural level, resulting in limited transformation. These differences are further shaped by factors such as prior knowledge, motivation, and the quality of professional dialogue within schools. This challenges the assumption that participation in LS leads to uniform learning outcomes, instead highlighting that PD may reinforce existing differences in teacher capacity rather than consistently transforming practice. At the same time, the findings indicate that, beyond knowledge acquisition, some teachers reported developing an increased capacity to reflect on and question their own practice. This distinction is particularly relevant in global debates on teacher quality, where there is growing emphasis on adaptive expertise rather than on knowledge accumulation alone.

The findings suggest that LS supported the development of professional knowledge by enabling teachers to reflect critically on instructional strategies and learner responses. LS appears to have contributed to the expansion of teachers' epistemic capabilities by exposing them to diverse instructional approaches and creating opportunities to observe and discuss practice. This process appears to operate through comparison and reflection, whereby teachers reconsider their own teaching in light of alternative strategies. However, translating these expanded capabilities into classroom practice depends on teachers' willingness to experiment and on the extent to which contextual conditions—such as curriculum demands and resource availability—support such experimentation. The findings reveal uneven outcomes: some teachers report transformative shifts, while others experience incremental change. This suggests that epistemic development is not an automatic outcome of LS but is contingent on both individual engagement and contextual support. These findings extend existing LS literature by suggesting that professional knowledge develops through collaborative interpretation and experimentation rather than through the passive acquisition of content knowledge alone [4], [24], [52], [53]. By expanding teachers' epistemic capabilities, they develop more flexible ways of engaging with knowledge, shifting from knowledge acquisition to knowledge production as active interpreters and generators. Importantly, these epistemic gains are socially distributed, emerging through interaction and exposure to multiple teaching situations. This challenges traditional notions of teacher expertise as individually accumulated and instead highlights the collective nature of professional knowledge construction.

Beyond knowledge development, the findings indicate that participation in LS may have influenced how teachers perceived their professional capacity to make instructional decisions. LS may contribute to the development of teacher professional confidence, initiative, and willingness to experiment with classroom practice through participation rather than being a pre-existing attribute, as teachers gain confidence from engaging with peers and observing alternative practice. However, this enactment is shaped by contextual factors such as institutional expectations, time pressures, and curriculum demands, which may limit teachers' ability to act on new ideas. This reveals a contradiction between perceived empowerment and practical constraint, suggesting that LS may expand teachers' sense of agency without fully enabling its sustained realization in practice. The findings also indicate that teachers developed greater confidence, professional judgement, and willingness to experiment with practice through collaborative participation in LS. Agency, therefore, emerged relationally through interaction with colleagues rather than as a fixed individual attribute. This shift aligns with broader global calls for PD models that prioritize professional judgment and adaptive expertise over compliance-driven training [13]. It also suggests that LS may influence how teachers conceptualize their professional responsibilities, shifting from compliance-oriented practice towards a greater sense of ownership.

The findings further indicate that sustained learning depended not only on individual participation but also on the quality of collegial relationships and ongoing collaborative engagement. LS seems to contribute to the reported development of relational capabilities, including trust, openness, and mutual accountability. However, sustaining these practices depends on teachers' personal commitment and the availability of institutional support. This highlights the tension between the ideal of collaborative professional learning and the practical realities of teachers' working conditions. This suggests that collaboration in LS may function as a pedagogical strategy and a normative shift in professional accountability, in which responsibility for teaching quality is collectively rather than individually owned. This is consistent with international literature, which highlights the role of collaboration in supporting shared problem-solving and instructional improvement [15], [17], [54]. At the same time, the findings draw attention to the labor required to sustain such collaboration, particularly in under-resourced contexts.

The results further suggest that participation in LS influenced not only teachers' reported current instructional practices but also their anticipation, preparation, and responses to future pedagogical challenges. In this sense, professional learning extended beyond immediate classroom enactment to include forward-looking forms of instructional planning and decision making. However, the realization of this opportunity is shaped by contextual constraints, particularly time and workload pressures. While teachers reported

implementing more rigorous planning approaches, these efforts often intensify their workload, creating tension between improved practices and practical feasibility. These findings suggest that PD may simultaneously enhance teaching quality while generating new constraints. Although this aligns with global frameworks for effective teaching [5], it also raises questions about the sustainability of such improvements in resource-constrained environments. Without sufficient institutional support, such capability gains may remain episodic rather than cumulative. This is particularly relevant in South African contexts, where systemic pressures already place significant demands on teachers' time and capacity.

The analysis also demonstrates that professional learning emerges through ongoing relational engagement among teachers rather than through isolated individual participation. Teachers reported becoming more willing to engage with one another, share challenges, and learn collaboratively. However, these professional communities remain highly context-dependent and are not fully institutionalized within school structures. As a result, their sustainability is uncertain and often reliant on ongoing participation and support. This contrasts with the literature that presents LS as leading to stable professional communities. Instead, the findings suggest that such communities are fragile and contingent, shaped by the broader organizational environment in which they are embedded. While this aligns with global LS literature [22], [55], the findings extend this work by highlighting the vulnerability of professional learning communities in contexts with limited systemic support.

Additionally, the findings reveal how institutional realities mediated teachers' ability to convert professional learning opportunities into enacted classroom practice. While LS creates opportunities for capability expansion, structural constraints such as time limitations, heavy workloads, resource shortages, and uneven participation restrict the extent to which these capabilities are translated into realized practices. Teachers' efforts to create time for collaboration reflect the exercise of agency, but they also highlight the limits of individual action in the absence of systemic support. This challenges the assumption that access to PD is sufficient for improving practice. Instead, the findings emphasize that outcomes depend on the alignment between program design and the realities of teachers' working conditions. In this sense, conversion factors do not merely constrain action but actively shape whether capabilities remain potential or become realized practices [10].

Overall, the findings indicate that LS is not uniformly transformative but operates as a context-sensitive form of professional learning. Its influence depends on how teachers engage with collaborative opportunities and on the institutional conditions that support or constrain the enactment of new practices. LS generated differentiated experiences shaped by workload, participation, school culture, and leadership support. Rather than treating participation in PD as inherently beneficial, the findings demonstrate how institutional, relational, and contextual conditions shape teachers' opportunities to learn and enact new practices. Viewed through this lens, LS is not simply a PD activity but a socially situated process in which teachers' capabilities are either enabled or constrained by factors such as workload, time availability, collegial support, and school leadership. This study, therefore, shifts attention from whether LS works to the conditions under which it supports meaningful professional learning and pedagogical change.

Practically, the findings suggest that PD initiatives are unlikely to produce sustained instructional improvement unless schools create conditions that support collaborative engagement and reflective practice. Participants' experiences indicate that LS was most meaningful when teachers had opportunities for sustained participation, professional dialogue, and shared inquiry into classroom practice. This highlights the importance of leadership support, protected collaborative time, manageable workloads, and institutional commitment in enabling teachers to translate professional learning opportunities into classroom enactment. In under-resourced school settings, these enabling conditions are particularly significant because structural constraints may limit teachers' ability to engage in collaborative professional learning consistently. The study also has implications for future research on teacher PD. Future studies could explore how LS operates across different educational contexts, subject areas, and levels of institutional support. Longitudinal research may provide deeper insight into how teachers sustain, adapt, or discontinue practices developed through collaborative professional learning over time. Such research would strengthen understanding of how professional learning opportunities are converted into sustained instructional practice within diverse schooling environments.

5. LIMITATIONS

The retrospective nature of the study may introduce recall bias, yet it offers insights into how teachers perceive the sustained expansion of their capabilities, particularly opportunities for collaboration and reflection. Although reliance on self-reported data and a cross-sectional design limit causal inferences and may reflect social desirability, they capture how teachers exercise their agency in interpreting and valuing their professional learning over time. Drawing the sample from similar contexts limits the extent to which findings can be generalized to other contexts. Moreover, the absence of observational and learner

achievement data limits triangulation and restricts conclusions about how enhanced teacher practices translate into learner outcomes. In addition, variations in implementation fidelity across schools may have shaped the extent to which teachers reported converting opportunities into practice. Without observational or artefact-based evidence, it is difficult to determine the extent to which reported changes were sustained in classroom practice. Future research could build on this study by incorporating classroom observations and longitudinal tracking of instructional change. Research may also examine how expanded teacher capabilities influence learner capabilities and achievement in diverse educational contexts.

6. CONCLUSION

This study examined teachers' experiences of LS through the capabilities approach, demonstrating that LS may function as a capability-enhancing model of PD. The findings show that LS appears to expand teachers' opportunities for collaboration, reflection, and pedagogical development, while also strengthening forms of agency, epistemic engagement, and professional identity. However, these capabilities are not uniformly realized. Their translation into practice depends on teachers' engagement and on contextual and structural conditions such as time, workload, school culture, and resource availability. As such, LS may not operate as a universally transformative intervention, but rather as a context-sensitive process that generates uneven outcomes shaped by the interaction between its design and the conditions of implementation. This shifts the focus from whether LS works to how, for whom, and under what conditions it enables meaningful professional learning.

In light of these findings, it is recommended that PD policies and practices move beyond access-based models towards approaches that explicitly address the conditions required for capability realization. This includes institutionalizing collaborative, practice-based professional learning within school structures, ensuring dedicated time and support for teacher collaboration, and strengthening leadership practices that foster trust and reduce performance pressures. Additionally, PD should prioritize the development of epistemic and relational capabilities, creating sustained opportunities for reflection, inquiry, and collective knowledge construction. Without such systemic support, the benefits of LS are likely to remain partial and uneven. Conversely, when embedded in enabling environments, LS offers a promising, contextually responsive model for supporting meaningful and sustainable teacher professional learning.

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Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Mzamo Wilson Jacobs		✓	✓	✓	✓	✓	✓	✓		✓			✓	
Thuthukile Jita	✓	✓		✓	✓			✓		✓	✓	✓		
Loyiso Currell Jita	✓	✓		✓	✓			✓		✓	✓	✓		
Thumah Mapulanga	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		

C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : **O**riginal Draft

E : **E**diting

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

Informed consent was obtained from all individuals who voluntarily participated in this study.

ETHICAL APPROVAL

The study received ethical approval from the University of the Free State Ethics Committee-General Human Research Ethics Committee (Approval Number: UFSHSD2017/0956; Approval Date: 20/11/2017). All research procedures were performed in accordance with the ethical guidelines and regulations of the University of the Free State and the principles outlined in the Protection of Personal Information Act (POPIA) 4 of 2013. It complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [TM], upon reasonable request.

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BIOGRAPHIES OF AUTHORS



Mzamo Wilson Jacobs    holds a doctoral degree with Specialization in Curriculum Studies from the University of the Free State in South Africa. He currently holds the position of Director for Strategic Planning, Research Coordination, and Monitoring and Evaluation in the Free State Department of Education. His experience in the field of education includes curriculum management, teacher professional development, examinations and assessment, materials development, school improvement initiatives, development of planning documents, performance oversight, and monitoring and evaluation. He is a co-author of history school textbooks for grades 10-12. His research interests include curriculum studies and teacher professional development. He can be contacted at email: m.jacobs@fseducation.gov.za.



Thuthukile Jita    is a professor in the Department of Curriculum Studies and Higher Education at the University of the Free State (UFS), South Africa. She is the Programme Director for Teaching Practice/Practicum and Research Coordinator of the Instructional Leadership and Curriculum Implementation Studies (ILCIS) group. Her research focuses on curriculum studies, pre-service teacher education, digital technologies in teaching and learning, work-integrated learning (WIL), and science education. She has published in high-impact international journals, presented at national and global conferences, and supervised Master's and Doctoral students to completion. Prof. Jita also serves as Co-Chair of the International Perspectives SIG at the SITE conferences (2026–2027). She can be contacted at email: jita.t@ufs.ac.za.



Loyiso Currell Jita    graduated from Michigan State University in the United States with a Doctorate in Curriculum, Teaching, and Educational Policy. He currently serves as the Dean of the Faculty of Education and SANRAL Chair in Mathematics, Natural Sciences, and Technology Education at the University of the Free State. Prof. Jita has published over 180 articles on various topics, including curriculum reform, science and mathematics education, teacher professional development, and instructional leadership. Additionally, he has delivered more than fifty papers at regional and international conferences and has successfully supervised over 40 Ph.D. graduates. He can be contacted at email: jitalc@ufs.ac.za.



Thumah Mapulanga    is a biology education scholar and researcher with 15 years of teaching experience. He holds a Ph.D. in Biology Education from the University of Rwanda. His master's degree in Biology Education was obtained from the Copperbelt University, Zambia. He is currently a postdoctoral fellow in the SANRAL Chair in Mathematics, Science, and Technology Education at the University of the Free State in South Africa. He has published over 18 articles in a variety of Scopus-indexed journals. His research interests include science and mathematics learning environments, teacher professional development, pedagogical content knowledge, and technological pedagogical content knowledge. He can be contacted at email: mapulanga.t@ufs.ac.za; thumahm@gmail.com.