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ISSEC2025
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e-International
Publishing House Ltd.,
United Kingdom

International Social Sciences and Education Conference 2025
"Empowering Knowledge: Driving Change Through Social Science and Educational Research"
Virtual Conference
24-25 May 2025

Organised by: CLM PUBLISHING RESOURCES

Level of Output on the Implementation of Lesson Study

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Abstract
Lesson study was introduced in Malaysia in 2008 and adopted as part of professional learning communities in 2011. However, sustaining its classroom implementation especially in supporting students with Additional Mathematics remains a challenge. This study evaluates the output level of lesson study for Additional Mathematics based on the perceptions of 247 purposively selected teachers. Descriptive analysis revealed a high output level, with a mean score of 3.75. The findings suggest that lesson study contributes positively to enhancing teachers' professional practices and skills, ultimately supporting efforts to improve student learning outcomes in the subject.

Keywords: lesson study; output; implementation

DOI: https://doi.org/10.21834/e-bpj.v10iSI33.7079

1.0 Introduction

Lesson Study (LS), a collaborative professional development model originating in Japan (Fernandez & Yoshida, 2004), has been increasingly adopted worldwide to enhance teacher pedagogy and student learning outcomes (Dudley, 2015). Recognized for its structured approach—cyclical phases of lesson planning, observation, and reflection—LS aligns with global shifts toward teacher-led, practice-based learning (Lewis et al., 2019). In Malaysia, the Ministry of Education (MOE) has promoted LS through initiatives such as the Professional Learning Community (PLC), embedded within the Malaysia Education Blueprint 2013–2025 (MOE, 2013). The Blueprint emphasizes school-based teacher development to improve instructional quality, particularly in STEM subjects, where Malaysian students have lagged in international assessments like PISA and TIMSS (MOE, 2013; Abdullah et al., 2020).

However, LS implementation in Malaysia faces significant challenges. Structural constraints, such as excessive teacher workloads and rigid administrative schedules, often limit meaningful collaboration (Tan et al., 2020). Rural-urban disparities further exacerbate inequities; schools in remote areas (e.g., Sabah and Sarawak) frequently lack resources—trained facilitators, time allocations, or technological tools—to sustain LS cycles (Rahman et al., 2021). Culturally, hierarchical norms in Malaysian schools may inhibit open

DOI: https://doi.org/10.21834/e-bpj.v10iSI33.7071

peer feedback, a critical component of LS (Saito et al., 2015). Studies also note inconsistent teacher buy-in, with some perceiving LS as a bureaucratic mandate rather than a developmental opportunity (Isoda, 2021; Tan et al., 2022).

Current evaluations of LS in Malaysia tend to prioritize quantitative metrics (e.g., number of workshops conducted) over qualitative dimensions like collaborative depth or institutional support (Abdullah et al., 2020). This oversight aligns with broader critiques of professional development programs in low- and middle-income contexts, where input-output models dominate, neglecting systemic enablers (Opfer & Pedder, 2011). Without assessing team cohesion, organizational readiness, and process fidelity, LS interventions risk superficial adoption and limited long-term impact (Dudley, 2015).

2.0 Literature Review

Lesson Study (LS) has emerged as a prominent model for teacher professional development since its introduction in Japan, where it developed as a school-based, collaborative approach to instructional improvement (Fernandez & Yoshida, 2004). Grounded in social constructivist learning theory (Vygotsky, 1978), the LS cycle of joint planning, classroom observation, and collective reflection provides a structured mechanism for teachers to develop pedagogical content knowledge through practice-based inquiry (Lewis et al., 2019). International research has demonstrated LS's effectiveness in diverse contexts, with studies showing positive impacts on both teaching practices and student learning outcomes when implemented with fidelity to its core collaborative principles (Murata, 2011; Dudley, 2015). However, successful adaptation requires careful consideration of local educational contexts and cultural norms surrounding teacher collaboration (Saito et al., 2015).

In Malaysia, the Ministry of Education formally incorporated LS into teacher development through the Malaysia Education Blueprint 2013-2025, promoting its implementation via Professional Learning Communities (Ministry of Education, 2013). While this policy commitment reflects global trends in teacher professional development, Malaysian research reveals significant implementation challenges distinct from the Japanese context of origin. Structural barriers, including excessive teacher workloads averaging 52 hours per week (Tan et al., 2022), combined with hierarchical school cultures that may inhibit open peer feedback (Abdullah et al., 2020), have constrained the model's effectiveness. Compounding these issues are persistent resource disparities, with rural schools in regions like Sabah and Sarawak receiving 37% fewer LS training opportunities than their urban counterparts (Rahman et al., 2021). These contextual factors have contributed to what scholars term "LS-lite" implementations - superficial adoptions that prioritize compliance metrics over substantive pedagogical improvement (Tan et al., 2022).

The evaluation of LS implementations in Malaysia has been hampered by several limitations in current assessment approaches. Research indicates that 78% of Malaysian LS evaluations focus primarily on quantitative participation metrics rather than measuring actual impact on teaching practices (Abdullah et al., 2020). This input-output orientation fails to capture critical process factors or organizational supports necessary for successful implementation. Only 12% of evaluation studies examine crucial dimensions like leadership support or resource allocation (Rahman et al., 2021), while virtually none address the cultural adaptation required for Western-developed models to succeed in Malaysia's more hierarchical educational context (Saito et al., 2015). The Kellogg Foundation's (2004) Logic Model, while useful for linking program inputs to outcomes, has been criticized for providing insufficient guidance on assessing implementation quality and contextual adaptation (Bennett & Rockwell, 1995).

Bennett and Rockwell's (1995) Model TOP offers a promising framework to address these evaluation gaps through its three integrated dimensions: Team (collaborative capacity and knowledge sharing), Organization (institutional support and resource allocation), and Process (implementation fidelity and iterative improvement). Recent applications in Southeast Asian educational contexts have demonstrated Model TOP's adaptability, including studies of teacher learning communities in Thailand (Wongwanich, 2014) and curriculum reform initiatives in Singapore (Hung et al., 2020). However, no existing research has applied this comprehensive framework to evaluate LS implementations in Malaysia, representing a significant gap in both research and practice.

The current literature reveals three critical needs this study addresses: First, the potential of LS remains constrained by evaluation approaches that fail to capture implementation quality. Second, Malaysian implementations face unique contextual barriers requiring specialized assessment tools. Third, Model TOP's multidimensional structure offers untapped potential for developing context-sensitive evaluation frameworks. By integrating Model TOP with the Kellogg Logic Model, this study provides a novel approach to assess LS implementations holistically while accounting for Malaysia's specific educational context and cultural norms surrounding teacher professional development. The resulting framework has important policy implications for refining Malaysia's PLC initiatives and offers methodological innovations for evaluating teacher development programs in similar cultural contexts.

3.0 Methodology

This study employed a quantitative descriptive research design to evaluate the implementation outcomes of Lesson Study (LS) for Additional Mathematics instruction in Malaysian secondary schools. Grounded in Bennett and Rockwell's (1995) Model TOP framework, the research specifically examined the Team dimension (teacher preparedness) and Process dimension (implementation frequency) of LS practices. The study design aligns with recent applications of LS evaluation in Asian contexts (Saito et al., 2015) while addressing the unique challenges of STEM education in Malaysia (Ministry of Education Malaysia, 2013).

The participant pool comprised 247 Additional Mathematics teachers selected through purposive sampling from schools actively engaged in LS programs. This sampling approach ensured representation of educators with direct experience implementing LS since its formal introduction in Malaysian mathematics education in 2008 (Tan et al., 2022). Participants ranged from novice to experienced LS practitioners, with teaching experience spanning 3-15 years in the Malaysian secondary school system.

Data collection utilized a validated 21-item questionnaire measuring: (1) perceived adequacy of LS training (Team dimension), (2) frequency and quality of classroom implementation (Process dimension), and (3) specific challenges in applying LS to Additional Mathematics content. The instrument demonstrated strong reliability (α = .89) and content validity (CVI = .91) through expert review, following established scale development protocols (DeVellis, 2016). Items employed a 5-point Likert scale anchored from 1 (Strongly Disagree) to 5 (Strongly Agree), with benchmark interpretations adapted from previous LS studies (Dudley, 2015).

Descriptive statistical analysis revealed an overall implementation mean score of 3.75 (SD = 0.62), indicating moderately high perceived effectiveness. Subscale analysis showed variation across dimensions, with Process implementation (M = 3.92, SD = 0.58) scoring higher than Team preparedness (M = 3.61, SD = 0.67). These findings suggest that while procedural adoption appears strong, training adequacy may require enhancement - a pattern consistent with regional LS research (Wongwanich, 2014).

Several methodological limitations warrant consideration. First, the exclusive reliance on self-report measures may introduce social desirability bias (Podsakoff et al., 2003). Second, the cross-sectional design precludes causal inferences about LS impact. Third, the purposive sampling approach limits generalizability to non-participating schools. Future research should incorporate classroom observations and longitudinal assessment to address these constraints.

Despite these limitations, the study makes significant methodological contributions by adapting Model TOP for STEM-specific LS evaluation, establishing baseline implementation metrics for Additional Mathematics, identifying targeted areas for professional development improvement. The findings provide empirical support for refining Malaysia's PLC initiatives while offering a replicable assessment framework for similar educational contexts facing STEM implementation challenges.

2.0 Findings

This study examined the implementation of Lesson Study (LS) for Additional Mathematics instruction in Malaysian secondary schools, focusing on teachers' perceptions of its effectiveness. Analysis of responses from 247 purposively sampled teachers revealed significant insights into both the strengths and challenges of LS adoption in STEM education. The output components are tabulated in Table 1 below.

Table 1. Level of Output on The Implementation of Lesson Study

Output Component	Min	SD	Level
Adequacy of exposure & training for teachers	3.61	0.67	High
Frequency of application of lesson study	3.92	0.58	High
Overall Implementation	3.75	0.62	High

(Source: Author)

The data indicated moderately high levels of LS implementation, with an overall mean score of 3.75 (SD = 0.62) on a 5-point Likert scale. This suggests that teachers generally perceive LS as a valuable professional development approach, consistent with Malaysia's emphasis on collaborative learning in the Malaysia Education Blueprint 2013-2025 (Ministry of Education Malaysia, 2013). However, closer examination revealed important variations across different dimensions of implementation.

For the Team dimension, which assessed teachers' preparedness and training adequacy, the mean score was 3.61 (SD = 0.67). While this indicates generally positive perceptions, qualitative responses highlighted specific challenges in applying LS to advanced mathematical concepts. Approximately 35% of participants reported difficulties in adapting LS techniques to topics like calculus and algebra, suggesting a need for more content-specific training modules. These findings align with Abdullah et al.'s (2020) identification of subject-matter barriers in STEM-focused LS implementation.

The Process dimension, measuring classroom application frequency, showed stronger results with a mean of 3.92 (SD = 0.58). A majority of teachers (68%) reported implementing LS strategies at least biweekly in their Additional Mathematics classes. However, only 42% indicated they consistently used LS to address specific student learning difficulties, revealing a potential gap between procedural adoption and targeted pedagogical application. This observation supports Dudley's (2015) caution about the risk of LS becoming a mechanical exercise rather than a transformative practice.

Notably, teachers strongly endorsed the professional development benefits of LS, particularly in enhancing collaborative lesson planning (82% agreement) and student-centered problem-solving approaches (76% agreement). These positive perceptions were especially pronounced among teachers with more than three years of LS experience, suggesting that the benefits of participation may accumulate over time.

3.0 Discussion

The findings of this study provide valuable insights into the implementation of Lesson Study (LS) for Additional Mathematics instruction in Malaysian secondary schools, while also contributing to broader conversations about teacher professional development in STEM education. Several key discussion points emerge from our analysis.

5.1 Implementation Successes and Challenges

Our results demonstrate that Malaysian Additional Mathematics teachers generally perceive LS as an effective professional development approach (M=3.75), particularly for enhancing collaborative lesson planning and student-centered pedagogies. These positive perceptions align with global research on LS benefits (Dudley, 2015; Lewis et al., 2019), while also supporting Malaysia's national education strategy of employing collaborative professional learning (Ministry of Education Malaysia, 2013). However, the lower scores for training adequacy (M=3.61) compared to application frequency (M=3.92) suggest that many teachers may be implementing LS procedures without complete pedagogical understanding - what Saito et al. (2015) term "surface compliance" in non-Japanese contexts.

5.2 Subject-Specific Considerations

The challenges reported in applying LS to advanced mathematical concepts (e.g., calculus, algebra) highlight the need for STEM-specific adaptations of the LS model. While LS has shown success in primary mathematics and basic STEM instruction (Fernandez & Yoshida, 2004), our findings suggest that Additional Mathematics - with its abstract concepts and cognitive demands - may require modified approaches. This extends the work of Abdullah et al. (2020) on Malaysian STEM education by identifying specific content barriers in post-elementary mathematics.

5.3 Contextual Factors in Implementation

The Malaysian educational context presents both opportunities and constraints for LS implementation. On one hand, the centralized education system enables rapid policy adoption, as seen in the relatively high application frequency scores. On the other hand, the examination-oriented curriculum and time constraints reported by teachers reflect systemic challenges also noted in other high-stakes assessment environments (Tan et al., 2022). These findings support Wongwanich's (2014) argument that LS success depends on alignment with local educational cultures and structures.

5.4 Professional Development Implications

The strong endorsement of LS's professional development benefits (particularly among experienced users) suggests that sustained engagement with LS may lead to greater pedagogical transformation. This finding reinforces Dudley's (2015) emphasis on LS as a long-term developmental process rather than a quick-fix intervention. However, the reported difficulties in differentiating instruction for diverse learners indicate areas where LS training could be strengthened, particularly for STEM subjects.

4.0 Conclusion& Recommendations

This study provides compelling evidence regarding the implementation of Lesson Study (LS) for Additional Mathematics instruction in Malaysian secondary schools. The findings reveal that while teachers generally value LS as a professional development approach, significant challenges remain in adapting it effectively to advanced mathematical concepts. Teachers demonstrated strong procedural compliance with LS implementation, yet many struggled to translate this into targeted pedagogical improvements for challenging curriculum content. These results underscore the importance of developing subject-specific LS models that account for the unique cognitive demands of Additional Mathematics, particularly in examination-oriented systems like Malaysia's. The study highlights how contextual factors, including time constraints and curriculum coverage pressures, significantly mediate LS effectiveness, suggesting that successful adoption requires systemic support beyond individual teacher commitment.

The findings yield several important recommendations for practice and policy. At the institutional level, schools should prioritize creating protected collaboration time for STEM teachers and establish subject-based LS communities focused on Additional Mathematics. Professional development programs need to move beyond generic LS training to provide content-specific guidance on applying LS principles to abstract mathematical concepts. Policy makers should consider establishing mentoring networks to support rural schools and developing guidelines for incorporating student outcome data into LS cycles. For classroom implementation, teachers would benefit from protocols that emphasize diagnostic assessment and differentiated instruction techniques tailored to Additional Mathematics.

Future research should investigate the longitudinal impact of content-adapted LS models on both teaching practices and student achievement in STEM subjects. Particularly valuable would be studies examining hybrid LS approaches that combine in-person collaboration with digital platforms, as well as research exploring how to balance LS implementation with curriculum coverage demands. The development of observation tools specifically designed to assess LS quality in mathematics classrooms would significantly advance both practice and research.

This study makes a significant contribution to understanding how LS can be adapted for advanced secondary STEM subjects in examination-driven systems. The findings suggest that while LS shows considerable promise for improving Additional Mathematics instruction, its full potential will only be realized through targeted adaptations that address both subject-specific pedagogical challenges and systemic implementation barriers. The recommendations outlined here provide a roadmap for enhancing LS effectiveness while maintaining fidelity to its core principles of collaborative, practice-based professional learning. By addressing these challenges, Malaysian educators can develop LS models that not only improve teacher expertise but also lead to measurable gains in student understanding of complex mathematical concepts.

Acknowledgement
Researchers acknowledge the contribution of all subject matter experts who voluntarily support this study.

Paper Contribution to Related Field of Study
This study makes three key theoretical contributions. First, it validates the applicability of the Targeting Outcomes of Programs (TOP) Model developed by Bennett and Rockwell (1995) as a useful framework for evaluating the implementation of STEM-focused Lesson Study (LS). The model effectively captures the progression from training and participation to changes in teacher practice, making it suitable for structured program evaluations in educational settings. Second, the study highlights the importance of subject-matter specificity in influencing the effectiveness of Lesson Study. It reveals that the impact of LS may vary depending on the content area, suggesting that tailored approaches are necessary to address the unique pedagogical demands of different disciplines, particularly in STEM education. Third, the findings demonstrate how national educational policies interact with the adoption and implementation of Lesson Study, especially in centralized education systems. The study shows that policy direction, administrative structure, and systemic support play a significant role in shaping how LS is understood, practiced, and sustained at the school level.

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