The Role of Teacher Leaders in Developing Effective Learning Ecosystems: A Case Study of Elementary Schools in Indonesia

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Abstract
This study examined the role of Teacher Leaders (Guru Penggerak) in developing effective learning ecosystems at SDN 1 Sumber, Cirebon Regency, Indonesia. The research employed a qualitative case study design to explore how Teacher Leaders implement the Merdeka Curriculum and create collaborative learning environments. Data were collected through systematic observations over two months, semi-structured interviews with four Teacher Leaders, two non-teacher leader educators, one principal, and six students, alongside document analysis of lesson modules and assessment reports. Thematic analysis revealed that Teacher Leaders functioned as catalysts in transforming traditional pedagogical approaches through student-centered lesson planning, integration of Pancasila Student Profile values, and implementation of innovative strategies including project-based learning (35% of observed activities), differentiated instruction (28%), and flipped classroom approaches (20%). Teacher Leaders successfully fostered collaborative partnerships among teachers, students, parents, and community members, reflecting Ki Hadjar Dewantara's Tri Pusat Pendidikan concept. Principal support through policy frameworks, professional development opportunities, and technology procurement strengthened Teacher Leader effectiveness. However, implementation faced significant challenges including infrastructure limitations, digital literacy gaps among senior teachers, and resistance to pedagogical change. Despite these barriers, Teacher Leaders demonstrated creativity in overcoming constraints through alternative strategies and resource optimization. The study contributes empirical evidence of teacher leadership effectiveness in resource-limited Indonesian elementary contexts while validating international distributed leadership theories within Southeast Asian educational settings. Findings suggest that systematic Teacher Leader program expansion, targeted infrastructure support, and institutional collaboration frameworks are essential for sustainable educational transformation. Future research should examine multi-site implementations and long-term impacts on student achievement outcomes.

INTRODUCTION

Education serves as the cornerstone of quality human resource development in contemporary society. In the era of globalization and Industry 4.0, students are required to master 21st-century skills, including critical thinking, creativity, collaboration, and digital literacy. To address these challenges, Indonesia has implemented the Merdeka Curriculum as a strategic educational transformation initiative. This curriculum emphasizes student-centered, flexible, and contextual learning, aimed at developing the Pancasila Student Profile characterized by faith, piety, noble character, independence, creativity, critical thinking, and a spirit of mutual cooperation and global diversity. Within this context, strengthening national values becomes a crucial aspect, as emphasized by Afendi (2019), who asserted that value-based education can strengthen national character. This

aligns with Faiz & Kurniawaty (2023), who emphasized the urgency of value education in the globalization era to preserve students' moral and cultural identity.

The role of teachers has become a key factor in building effective learning ecosystems. Teachers function not only as instructors but also as creators of learning climates that support active interaction, collaboration, and student creativity. Educational decentralization trends since the mid-1980s have moved away from hierarchical structures that often result in teachers feeling overburdened and alienated, toward shared governance and distributed leadership models (Evans, 1996; Frymier, 1987; Harris, 2003). This paradigm shift has led to growing interest in teacher leadership as a mechanism for educational transformation. Teacher leaders are defined as teachers who maintain classroom-based responsibilities while taking on leadership roles beyond the classroom (Wenner & Campbell, 2017), serving as agents of school change both within and outside their instructional contexts (Silva et al., 2000).

Research demonstrates that teacher leadership significantly benefits schools through improved job satisfaction, teacher buy-in for change initiatives, and notably enhanced student achievement (Nguyen et al., 2020; Schott et al., 2020; Tsai, 2015). Effective teacher leadership encompasses various behaviors including professional growth, professional development leadership, collaboration, shared leadership, and equity leadership (Cheung et al., 2018). Teacher leaders must first be excellent teachers who adopt innovative teaching strategies and evidence-informed instructional practices while engaging in continuous reflection (Wiens & Beck, 2022; Rosenshine, 2012). Beyond individual excellence, they actively collaborate with colleagues, create learning communities, and work toward building cultures of collaboration in their schools (Berg et al., 2014; Heikka et al., 2021).

Indonesian research has increasingly recognized the critical role of teacher leaders (Guru Penggerak) in educational transformation. Atika, Arafat, & Nurlina (2025) found that teacher leaders significantly improve student achievement through their role as instructional leaders. Similarly, Fakihuddin, Ernawati, & Wijaya (2025) demonstrated how teacher transformation through teacher leader programs creates meaningful educational change. Kempa, Sahalessy, & Rumfot (2024) analyzed the effectiveness of teacher leaders in improving learning quality, while Hasanah & Zuhaery (2025) emphasized their crucial role in enhancing educational quality at the elementary level. Furthermore, Masau & Arismunandar (2024) highlighted the essential contribution of teacher leaders in successfully implementing the Merdeka Curriculum in elementary schools.

However, field realities reveal various obstacles in realizing optimal learning ecosystems. Several schools face facility limitations, weak inter-teacher collaboration, low student motivation, and insufficient comprehensive implementation of Merdeka Curriculum principles. Taole et al. (2024) emphasized that the main challenge in developing learning ecosystems lies in weak instructional leadership. Meanwhile, Faiz (2019) stressed that external factors such as media influence, weak parental control, and changing social habits also hinder character education in schools. Research by Afendi & Sugesti (2022) demonstrated that interactive digital media innovation can enhance mathematics learning effectiveness, while Faiz, Kurniawaty, & Hadian (2025) showed that educational digital platform utilization significantly improves teachers' pedagogical competencies.

Contemporary educational environments are increasingly characterized by innovative learning environments (ILEs) that abandon traditional classroom designs in favor of flexible, student-centered spaces (OECD, 2017; Dovey & Fisher, 2014). These environments require teachers to develop new pedagogical approaches that emphasize student agency, collaborative learning, and adaptive instruction (Goodyear, 2022; Saltmarsh et al., 2015). The flexibility of learning environments creates new affordances for teachers to implement varied teaching methods, accommodate different group sizes, and address individual student needs (Baars et al., 2023; Benade, 2019). However, transitioning to flexible learning environments also presents challenges, requiring teachers to develop new competencies in space management, collaborative teaching, and student-centered pedagogies (Campbell, 2020; Grannäs & Stavem, 2021).

To address these multifaceted challenges, the Indonesian government established the Teacher Leader (Guru Penggerak) Program to enhance teacher competencies in planning, implementing, evaluating, and reflecting on data-driven learning while mentoring school communities. This program emphasizes teachers' roles as instructional leaders and change agents within schools. Afendi et al. (2024) through techno-Islamic pedagogy studies confirmed that technology integration with Islamic values can strengthen teachers' roles as catalysts for educational transformation. The program's effectiveness is further validated by Pamungkas Alamsyah & Rafianti (2025), who found that Teacher Leader Program alumni significantly impact student leadership, inter-teacher collaboration, and practitioner community development.

Recent studies have further validated the importance of teacher leaders in Indonesian educational contexts. Munfiatik (2025) explored the multifaceted role of teacher leaders in school learning processes, while Rahmawati et al. (2023) demonstrated how teacher leaders enhance student motivation through Merdeka Curriculum implementation. Rijaluddin & Aziz (2023) examined teacher leader roles in secondary education, and Supit et al. (2023) investigated their contribution to independent learning quality. These studies collectively underscore the transformative potential of teacher leadership in diverse educational settings.

Based on this comprehensive background, this research focuses on the role of Teacher Leaders in developing effective learning ecosystems at SDN 1 Sumber. This school was selected due to its active implementation of the Merdeka Curriculum with support from engaged teacher leaders and a principal committed to learning innovation. The study examines implemented learning strategies, forms of stakeholder collaboration, and challenges and opportunities in building adaptive and sustainable learning ecosystems. Research findings are expected to provide substantial contributions to elementary education development, particularly in resource-limited schools, while strengthening Teacher Leaders' roles as catalysts for educational transformation in Indonesia.

METHODS

This study employed a qualitative research approach with a case study design to comprehensively explore the role of Teacher Leaders in developing effective learning ecosystems at SDN 1 Sumber, Sumber District, Cirebon Regency, Indonesia. The qualitative approach was selected to provide holistic understanding of phenomena within natural contexts, including interactions among teachers, students, principals, and other stakeholders, while the case study design enabled in-depth focus on a single educational institution to reveal contextual dynamics of Merdeka Curriculum implementation. The researchers maintained reflexive awareness of potential subjective bias through continuous reflection, structured research protocols, and data triangulation to ensure methodological rigor.

The study population encompassed all teachers and students at SDN 1 Sumber, with participants selected through purposive sampling based on their direct involvement in Merdeka Curriculum implementation and contribution to the learning ecosystem. Participants included four Teacher Leaders (Mrs. Hetty Marianah, Grade VI-B homeroom teacher, Mrs. Heni, Grade I-B homeroom teacher, and two additional teacher leaders), two non-teacher leader educators (Mrs. Nuraeli and Mrs. Lutviah Handayani), the school principal, and six Grade VI-B students. This purposive selection ensured representation of key stakeholders while maintaining focus on individuals most relevant to the research objectives.

Data collection employed multiple methods to ensure comprehensive understanding and methodological triangulation. Systematic observations were conducted over two months with bi-weekly frequency to examine Teacher Leaders' planning processes, instructional strategies, and classroom implementation. Observation indicators included lesson module development aligned with Merdeka Curriculum principles, integration of Pancasila Student Profile values, implementation of formative and summative assessments, utilization of varied teaching methods, student engagement

levels, technology integration, and creation of inclusive classroom environments. Field notes and photographic documentation complemented observational data. Semi-structured interviews were conducted individually and in groups, lasting 30-60 minutes each, to gather participants' perceptions and experiences regarding Teacher Leader roles. Interview questions addressed three primary indicators: learning ecosystem development planning, role implementation strategies, and identification of challenges, obstacles, and opportunities. All interviews were audio-recorded and transcribed for analysis. Document analysis examined lesson modules, lesson plans, assessment reports, and related materials to evaluate alignment with Merdeka Curriculum principles.

Data analysis followed thematic analysis procedures incorporating five systematic stages: data transcription and verification, comprehensive reading for contextual understanding, initial coding based on emerging themes, categorization of codes into thematic groups including Teacher Leader roles, learning strategies, collaboration patterns, and implementation challenges, and interpretation of findings through relevant theoretical frameworks. Data validity and reliability were ensured through triangulation of observation, interview, and document data, member checking with participants to verify interpretation accuracy, and peer debriefing with colleagues to minimize interpretive bias. Field notes supported descriptive accuracy while visual documentation provided empirical evidence. Ethical considerations included obtaining informed consent from all participants, maintaining confidentiality and privacy, and securing data for academic purposes exclusively. All research procedures adhered to established ethical guidelines for educational research involving human participants.

RESULTS AND DISCUSSION

Results

Teacher Leader Planning and Ecosystem Development

Data from observations and interviews revealed that Teacher Leaders at SDN 1 Sumber functioned as catalysts in creating student-centered learning ecosystems while promoting inter-teacher collaboration and integrating Pancasila Student Profile values. Mrs. Hetty and Mrs. Heni developed lesson modules aligned with Merdeka Curriculum principles using the *Platform Merdeka Mengajar* and *Ruang GTK* platforms as primary resources. The planning process began with comprehensive student needs assessment through various evaluation methods, including learning styles, interests, and background analysis, supplemented by informal discussions to understand individual student requirements. Mrs. Hetty explained that "lesson module development always adheres to learning objectives while considering individual student characteristics, ensuring contextual and meaningful activities." Similarly, Mrs. Heni emphasized that "module development cannot solely reference the curriculum but must also consider students' talents and interests for appropriate grouping based on student needs."

Document analysis of developed lesson modules revealed several distinctive characteristics. First, modules integrated Pancasila Student Profile values through learning activities, such as instilling mutual cooperation through group work, independence through individual tasks, and environmental awareness through thematic projects. During reflection activities, students were guided to recognize their potential and develop noble character. Second, modules employed differentiated approaches enabling students to learn according to their individual learning styles through visual, audio, and audiovisual media. Third, assessments encompassed knowledge, attitude, and skill aspects, emphasizing formative assessment to monitor continuous student learning progress.

Implementation of Learning Strategies and Methods

Classroom observations demonstrated that Teacher Leaders implemented diverse innovative strategies centered on student agency, moving from conventional to more interactive, inclusive, and student-oriented learning paradigms. Mrs. Hetty utilized flipped classroom, project-based learning, and problem-solving approaches, as she stated: "I only facilitate while students must actively ask questions, experiment, and solve problems independently." This statement reflects the shift from

teacher as primary knowledge source to facilitator empowering students to construct knowledge autonomously.

Table 1 presents the distribution of instructional strategies observed during the study period:

Table 1. Instructional Strategies Implemented by Teacher Leaders

Strategy Type	Frequency (%)	Primary Teacher	Learning Outcome Focus
Project-Based Learning	35%	Mrs. Hetty, Mrs. Heni	Critical thinking, collaboration
Differentiated Instruction	28%	Mrs. Hetty, Mrs. Heni	Individual needs accommodation
Flipped Classroom	20%	Mrs. Hetty	Self-directed learning
Group Discussion	12%	Mrs. Heni	Communication skills
Hands-on Activities	5%	Both teachers	Practical application

The data in Table 1 demonstrates that project-based learning dominated instructional approaches (35%), reflecting Teacher Leaders' commitment to developing 21st-century skills. Classroom observations revealed effective educational technology integration through animated learning videos, interactive presentations, and digital platforms. Student grouping systems were adapted to individual learning styles, ensuring each child received appropriate learning approaches. The implementation of positive feedback through reward systems proved effective in enhancing student learning motivation.

Student interview data indicated high satisfaction levels with implemented teaching methods, with the majority preferring learning involving projects, educational games, and outdoor activities. Musa, a Grade VI student, stated: "I enjoy learning while playing and creating projects together," while Shobihatun expressed interest in discussion methods and audiovisual learning approaches.

Principal Leadership Support

Interview and document analysis revealed that principal support for Teacher Leader roles manifested through various forms including policies, facilities, and work climate enhancement. The principal prioritized Teacher Leader participation in training and workshops related to the Merdeka Curriculum, as stated: "We provide full opportunities for Teacher Leaders to attend training because they will later share their knowledge with other teachers" (Principal Interview, July 15, 2024). Additionally, the principal allocated School Operational Assistance (BOS) funds for educational technology procurement, including laptops and speakers. However, limited projector availability created scheduling conflicts among classes, as Mrs. Hetty noted: "Sometimes we take turns using projectors. When unavailable, I use my personal laptop or bring alternative media" (Interview, July 20, 2024).

The principal fostered an innovative work climate by granting Teacher Leaders autonomy to experiment with new learning models, implement project-based learning, and utilize digital media. Monthly teacher learning community meetings positioned Teacher Leaders as resource persons for sharing experiences and learning strategies. Monthly meeting documentation revealed regular "Learning Innovation Sharing" sessions facilitated by Teacher Leaders, strengthening their roles as change agents and enhancing collaboration between Teacher Leaders and non-Teacher Leaders.

Challenges, Obstacles, and Opportunities

Data revealed multiple challenges in implementing innovative learning ecosystems. Infrastructure limitations emerged as primary obstacles, including restricted digital learning media, inadequate classroom comfort, and limited practical learning tools. These conditions were exacerbated by imbalanced classroom-to-student group ratios. Mrs. Heni explained: "Grade 1 has only one classroom while there are two student groups, creating time constraints in teaching." Internet access and digital device limitations further complicated technology-based learning implementation.

Cultural aspects presented more complex barriers, with colleague resistance remaining prevalent. Many teachers preferred traditional methods and struggled adapting to more flexible, student-needs-based approaches. Limited digital literacy among teachers created additional challenges, as "not all teachers possess technological skills, making learning application usage difficult" (Mrs. Hetty

Interview). Mrs. Hetty identified multiple inhibiting factors: "Limited facility support including technology-based learning media, comfortable classrooms, and practical learning tools remains restricted in several schools. Time constraints due to dense learning activities and numerous school schedules limit opportunities for developing more creative learning ecosystems. Insufficient technological knowledge among teachers affects effective technology integration in learning processes."

Despite these challenges, strategic opportunities emerged for overcoming barriers. Principal support served as a key factor, with commitment to gradually transforming mindsets and enhancing learning media through available BOS funding. The principal stated: "We're purchasing laptops for teachers, with 75% implementation achieved. We aim for each grade level and subject teacher to have dedicated laptops, enabling innovative digital learning media access." Additional opportunities included utilizing accessible free technology and strengthening parent partnerships through digital communication platforms.

Discussion

The findings demonstrate that Teacher Leaders at SDN 1 Sumber functioned not merely as instructors but as catalysts shaping student-centered, collaborative learning ecosystems integrated with Pancasila Student Profile values. The lesson module development by Mrs. Hetty and Mrs. Heni aligned with Merdeka Curriculum principles emphasizing flexibility, relevance, and student-needs orientation, reinforcing findings by Jannati et al. (2023) that elementary Teacher Leaders develop adaptive lesson modules responsive to student characteristics. The integration of mutual cooperation and independence values through art projects and 3R implementation demonstrated Teacher Leaders' contribution to character formation, supporting Faiz (2019)'s emphasis on systematic character education habituation in schools.

These findings align with contemporary teacher leadership theory, which positions teachers as change agents both within and beyond classroom contexts (Silva et al., 2000). The Teacher Leaders' role in developing differentiated learning modules reflects the distributed leadership model that moves away from hierarchical structures toward collaborative governance (Harris, 2003). Their ability to integrate Pancasila values while implementing innovative pedagogies demonstrates the multifaceted nature of teacher leadership encompassing professional growth, collaboration, and equity leadership (Cheung et al., 2018). The evidence supports Wiens & Beck (2022)'s assertion that teacher leaders must first be excellent teachers, as demonstrated through their systematic needs assessment and reflective planning practices.

The implementation of Project-Based Learning (PjBL), differentiated instruction, flipped classroom, discussion, and hands-on activities demonstrated Teacher Leaders' efforts to enhance student engagement and learning autonomy. These findings align with Juraidah and Hartoyo (2022)'s emphasis that PjBL promotes critical thinking and problem-solving skills. Technology utilization, despite limitations, reflected Teacher Leaders' creativity in maximizing resources, supporting Hutabarat et al. (2024)'s assertion that educational technology can enhance learning interactivity when used contextually.

The observed shift from teacher-centered to student-centered approaches reflects constructivist learning principles, particularly Vygotsky's Zone of Proximal Development theory, where students learn optimally with adult or peer assistance (Vygotsky, 1978). Teacher Leaders implemented this principle through heterogeneous group discussions enabling collaborative project completion. However, gaps between theory and field implementation persisted, with teachers occasionally reverting to one-way instruction despite their facilitator roles, potentially due to high administrative burdens limiting preparation time.

The flexible classroom arrangements observed in this study align with contemporary trends toward innovative learning environments (ILEs) that support varied teaching methods and student-centered pedagogies (OECD, 2017; Dovey & Fisher, 2014). The U-shaped seating arrangement in

Grade I-B facilitated comprehensive teacher-student eye contact and active interaction monitoring, reflecting principles of collaborative learning where classroom spaces are designed to facilitate two-way communication and group cooperation (Saltmarsh et al., 2015). This spatial flexibility created new affordances for teachers to implement varied instructional approaches while accommodating different group sizes and individual needs (Baars et al., 2023).

The learning ecosystem implementation reflected Ki Hadjar Dewantara's Tri Pusat Pendidikan concept, emphasizing education as a collaborative responsibility among schools, families, and communities. Teacher Leaders at SDN 1 Sumber demonstrated school-centered education through student-centered, active, collaborative, and contextual learning approaches. They facilitated project-based learning, experiments, discussions, and simple digital media utilization that enhanced active student participation, aligning with Sudrajat (2011)'s assertion that effective schools develop not only cognitive aspects but also create environments supporting active participation and healthy interpersonal relationships.

Family involvement as the second educational center was actively promoted through WhatsApp groups, parent meetings, and learning progress reports, encouraging parental participation as home learning partners. Community engagement as the third educational center occurred contextually through involvement of local reading community resource persons and district library visits, reflecting Dewi et al. (2018)'s perspective that community roles in education create meaningful learning through direct social involvement and diversity value experiences.

However, implementation of Tri Pusat Pendidikan remained suboptimal. Family involvement was limited by work constraints and insufficient understanding of learning support importance, while community support remained incidental rather than institutionalized through long-term collaboration. This suggests need for strategic school policies strengthening parent and community roles as primary partners in learning ecosystems.

Infrastructure limitations including projectors and internet networks, along with senior teachers' technological adaptation difficulties, emerged as primary barriers, supporting Tangahu (2022)'s findings that resistance to change and facility limitations often hinder Merdeka Curriculum implementation. Time constraints due to classroom space sharing also impacted learning effectiveness. However, Teacher Leaders' creativity in overcoming barriers, such as outdoor teaching, demonstrated that teacher innovation factors can minimize structural limitations.

The identified opportunities including strengthening teacher learning communities, technology optimization, and local wisdom-based PjBL development support Sapna et al. (2025)'s emphasis on local culture-based projects for building character and 21st-century skills. Principal support through innovation policies and facility provision, despite limitations, reinforced learning ecosystems, aligning with Hutasoit (2025)'s finding that principal support significantly influences Teacher Leader success as instructional leaders.

The challenges faced in transitioning to flexible learning environments mirror those identified in international literature, where teachers struggle with spatial pedagogical methods and resource management in shared spaces (Campbell, 2020; Grannäs & Stavem, 2021). The need for teacher support in understanding how to effectively utilize flexible learning environments and their affordances (Attai et al., 2021; Mäkelä & Leinonen, 2021) was evident in the technological literacy gaps observed among senior teachers.

These findings contribute to the growing body of evidence supporting teacher leadership's transformative potential in educational settings, while highlighting the contextual factors that influence successful implementation. The study validates Atika, Arafat, & Nurlina (2025)'s findings regarding teacher leaders' impact on student achievement and Masau & Arismunandar (2024)'s emphasis on their crucial role in Merdeka Curriculum implementation, while identifying specific barriers and opportunities unique to resource-limited elementary school contexts.

CONCLUSION

This study demonstrates that Teacher Leaders at SDN 1 Sumber serve as pivotal catalysts in developing effective learning ecosystems through systematic implementation of the Merdeka Curriculum. The research reveals that Teacher Leaders successfully transformed traditional pedagogical approaches by designing student-centered lesson modules, integrating Pancasila Student Profile values, and implementing innovative strategies including project-based learning, differentiated instruction, and technology-enhanced teaching methods. Their collaborative partnerships with principals, non-teacher leader colleagues, parents, and local communities created inclusive and contextually relevant learning environments that significantly enhanced student engagement and academic outcomes.

The study contributes to educational leadership literature by providing empirical evidence of teacher leadership effectiveness in Indonesian elementary school contexts, particularly within resource-constrained environments. The findings extend existing theoretical frameworks by demonstrating how Teacher Leaders operationalize Ki Hadjar Dewantara's Tri Pusat Pendidikan concept through practical collaboration among school, family, and community stakeholders. Additionally, the research validates international teacher leadership theories within Southeast Asian cultural and educational contexts, offering insights into the adaptability of distributed leadership models across diverse educational systems.

The practical implications suggest that educational policymakers should prioritize systematic Teacher Leader program expansion, provide targeted technology infrastructure support, and establish institutional frameworks for sustained inter-stakeholder collaboration. School administrators should foster innovation-supportive climates while addressing infrastructure limitations that constrain pedagogical creativity. Teacher education programs should emphasize digital literacy development and collaborative leadership competencies to prepare educators for contemporary learning ecosystem demands.

However, this study's limitations include its single-case design, which restricts generalizability across diverse Indonesian elementary school contexts, and its two-month observation period, which may not capture long-term implementation sustainability. Future research should employ multi-site comparative studies examining Teacher Leader effectiveness across varying socioeconomic and geographic contexts, longitudinal investigations tracking sustained impact on student achievement and school culture transformation, and mixed-methods approaches quantifying relationships between teacher leadership practices and measurable learning outcomes. Additionally, research exploring optimal professional development models for scaling Teacher Leader programs nationwide would inform policy development and implementation strategies for Indonesian educational transformation initiatives.

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