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School Management Support for Deep Learning Pedagogy in Junior High Schools: A Sequential Explanatory Mixed-Methods Study

Mulyadi[1*], Pierre Marcello Lopulalan[2]
[1]Universitas Jambi, Jambi, Indonesia
[2]Politeknik Pelayaran Banten, Banten, Indonesia

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ABSTRACT

Purpose: This study aims to examine the role of school management support in facilitating deep learning pedagogy implementation and identifying supporting factors and challenges based on evidence from eight junior high schools in three Indonesian provinces. **Methods:** This study employed a sequential explanatory mixed-methods design involving 120 teachers and principals from eight junior high schools in Jambi, South Sumatra, and West Java, selected through purposive sampling. Quantitative data were collected through surveys and analyzed using descriptive statistics and simple regression, while qualitative data were obtained from interviews with 12 key informants and analyzed using thematic coding. **Findings:** School management support was positively associated with deep learning pedagogy implementation readiness. School policy support showed a high score (Mean = 4.21; β = 0.61), while teacher competence had the strongest contribution (Mean = 4.09; β = 0.64). Administrative burden showed a negative relationship with implementation conditions (r = -0.32). Qualitative findings indicated that policies, teacher development, and learning facilities supported implementation, while infrastructure limitations and administrative demands remained challenges. **Implications:** This study provides empirical insights for strengthening school policies, teacher capacity, and learning resources. It contributes evidence on school management support for deep learning pedagogy implementation in junior high schools using a sequential explanatory mixed-methods approach.

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INTRODUCTION

The transformation of 21st-century education requires schools to adopt a learning approach that fosters students' high-level thinking skills, creativity, collaboration, and digital literacy. In this study, deep learning refers to deep learning pedagogy, namely a learning approach that emphasizes meaningful learning processes through reflective thinking, complex problem-solving, inquiry activities, and students' ability to construct knowledge. This concept is distinguished from deep learning as an artificial intelligence-based computational model or deep neural network technology. Deep learning is one of the approaches that is seen as relevant in dealing with the development of digital transformation in education and the increasingly complex demands of learning innovation (Muniasamy & Alasiry, 2020). In Indonesia, the demand to improve the quality of learning through the implementation of Merdeka Learning also emphasizes the importance of a learning process that is not only oriented towards basic cognitive achievement, but also on the ability to think reflexively and solve complex problems (Kholid et al., 2022). However, the application of deep learning pedagogy in junior high schools (SMP) still faces challenges in the aspect of school management support. This condition shows that strengthening school management support, including policy direction, teacher capacity development, and learning resource provision, is an important requirement to facilitate deep learning pedagogy implementation at the education unit level.

Globally, several countries have demonstrated that the implementation of innovative learning approaches is supported by adaptive and innovative school management practices (Rajaram, 2023; Sliwka et al., 2024). However, this study focuses on deep learning pedagogy rather than deep learning technology in artificial intelligence. Therefore, references related to learning transformation are interpreted within the educational context. International research reveals that the quality of school leadership and participatory management governance have a direct impact on improving teachers' ability to manage digital-based and collaborative learning (Syarifudin & Muttaqin, 2025; Karim et al., 2025). Meanwhile, conditions in Indonesia still show that there is an inequality in

the quality of deep learning implementation between schools, especially in schools with limited facilities and a high administrative burden on teachers (Subiyantoro et al., 2024; Widiastuti, 2025; Fitrah et al., 2025). This signals the need for in-depth research on how school management support contributes to deep learning pedagogy implementation through policy support, teacher competence, and infrastructure availability.

Various previous studies have examined the implementation of deep learning in the context of digital learning, but most of them are still focused on pedagogical aspects or technology-based media development (Huang et al., 2024; Isnaeni et al., 2025). Previous research has provided valuable insights regarding learning strategies and digital learning development; however, empirical evidence explaining how school management support facilitates deep learning pedagogy implementation remains limited. Some studies do discuss school management, but have not specifically examined the relationship between school management support, teacher capacity, infrastructure readiness, and deep learning pedagogy implementation at the junior high school level. The gap in this study shows that studies related to the organizational role of school management in supporting deep learning pedagogy implementation are still limited and require an integrated analysis combining quantitative measurement and qualitative exploration. Therefore, this research is conducted to fill this gap.

This research was specifically carried out in eight public and private junior high schools in Jambi, South Sumatra, and West Java Provinces by involving 120 teachers and school principals as survey respondents and 12 key informants for in-depth interviews. A mixed methods approach with a sequential explanatory design is used to obtain a comprehensive empirical understanding and be able to confirm quantitative data through qualitative findings. Data analysis was carried out using descriptive statistics and simple regression, while qualitative data was analyzed through thematic coding as a process of data reduction and interpretation. This design enables the study to examine the association between school management support and deep learning pedagogy implementation readiness while exploring contextual factors that influence implementation practices. With this design, research findings are expected to be more objective, rich, and accurate.

Based on the description above, this study aims to examine the role of school management support in facilitating the implementation of deep learning pedagogy at the junior high school level and identify supporting factors and obstacles that occur in the implementation process. Another goal of this study is to provide an empirical picture of how school policies, teacher competence, and technology availability contribute to implementation readiness of deep learning pedagogy. This focus is important as an effort to improve the quality of learning so that it is not only oriented towards curriculum achievement, but also the development of students' character and technological literacy. Thus, this research is directed to answer academic and practical needs in strengthening the quality of education through evidence-based school management strategies.

This research is expected to make a theoretical contribution to the development of education management studies, especially in the context of deep learning integration in school learning. The research findings can enrich the literature related to innovation-based school governance and digitalization of learning processes that are increasingly developing in the era of technological disruption (Nair, 2024; Zancajo et al., 2022). Practically, the results of this research can be a reference for school principals, education policy makers, and teachers in designing supportive school management strategies for deep learning pedagogy implementation by strengthening teacher training, internal policies, and infrastructure fulfillment. Thus, this research contributes empirical evidence regarding the role of school management support in facilitating deep learning pedagogy implementation within junior high school contexts.

METHOD

Design and Research Approach

This study uses a mixed methods method with a sequential explanatory design, which allows researchers to start with a quantitative stage to obtain an overview of the relationship between school management support factors and deep learning pedagogy implementation readiness, then continue with the qualitative stage to deepen the findings (Thornberg et al., 2022). This approach was chosen because it provides comprehensive research results through statistical measurement and exploration of contextual meanings from educational experiences. The quantitative phase examined the contribution of school management-related factors, including policy support, teacher competence, and learning infrastructure, while the qualitative phase explored contextual explanations underlying these quantitative patterns.

The sequential explanatory design was conducted in two interconnected phases. The quantitative phase was conducted first to identify patterns and relationships among variables through statistical analysis. The qualitative phase was subsequently conducted to explain the quantitative findings by exploring participants' experiences, institutional conditions, and contextual factors influencing deep learning pedagogy implementation. The integration of both phases was performed during the interpretation stage by connecting statistical findings with emerging qualitative themes.

Research Locations and Participants

The research was carried out in eight public and private junior high schools (SMP) in Jambi, South Sumatra, and West Java Provinces, which were selected because they had implemented or were developing deep learning pedagogy practices. The research was conducted during the 2025 academic year. Data collection followed the sequential explanatory mixed-methods procedure, beginning with quantitative data collection through questionnaires, followed by qualitative data collection through interviews, document analysis, and observation to explain and contextualize the quantitative findings.

The eight schools were selected based on several criteria: (1) schools that had implemented learning innovations related to student-centered and higher-order thinking approaches, (2) schools that had ongoing curriculum development programs, and (3) schools that provided institutional support for learning transformation initiatives. These criteria ensured that selected schools had relevant experiences related to deep learning pedagogy implementation. At the quantitative stage, the study involved 120 respondents consisting of core subject teachers and principals selected through purposive sampling. The selection criteria included direct involvement in learning management, curriculum implementation, and school-level support for learning innovation. The quantitative respondents consisted of 104 teachers and 16 principals from eight junior high schools. The distribution of respondents was adjusted according to the number of teachers and school leaders involved in curriculum implementation and learning management activities at each participating school.

The qualitative stage involved 12 key informants consisting of 6 principals, 4 teachers experienced in deep learning pedagogy implementation, and 2 deputy principals in curriculum affairs. Informants were selected based on their roles, experience, and relevance to explaining quantitative findings obtained in the previous stage. The qualitative participants were selected based on their direct involvement in policy implementation, teacher development programs, curriculum management, and learning innovation practices. Their experiences were considered relevant for explaining the statistical patterns identified during the quantitative phase.

Data Collection Techniques

The data collection technique was carried out through two main stages according to the sequential explanatory design. At the quantitative stage, data were collected using a Likert scale questionnaire developed based on three main dimensions of school management support: (1) internal policy support, (2) teacher capacity development, and (3) learning infrastructure availability. Deep learning pedagogy implementation readiness was assessed through indicators related to reflective learning, problem-solving activities, inquiry-based learning, and student-centered learning practices. The instruments were distributed to 120 respondents online and offline through schools.

The questionnaire consisted of 32 items measuring four research constructs. School policy support consisted of 8 items, teacher competence consisted of 8 items, learning infrastructure availability consisted of 7 items, and deep learning pedagogy implementation readiness consisted of 9 items. The indicators were developed based on the theoretical framework of educational management support, teacher professional capacity, learning resource readiness, and student-centered learning implementation. The questionnaire development process involved reviewing previous studies related to school management support and deep learning implementation, followed by adaptation of indicators according to the junior high school context in Indonesia.

At the qualitative stage, data were obtained through semi-structured interviews, document analysis, and limited observation of learning activities. The interview guidelines were developed based on the quantitative results requiring further explanation, particularly regarding policy implementation, teacher competency development, infrastructure limitations, and administrative challenges.

Research Instruments

The quantitative instrument used a 1–5 Likert scale questionnaire. The questionnaire items were developed based on the conceptual framework of school management support and deep learning pedagogy implementation. The qualitative instruments consisted of interview guidelines and observation sheets. The questionnaire was reviewed by three experts consisting of educational management specialists and learning evaluation experts to examine the relevance and clarity of each item. The content validity assessment showed that all items met the required validity criteria with an average content validity index of 0.87.

Content validity was assessed through expert judgement, while reliability testing was conducted using Cronbach's Alpha. The reliability analysis showed good internal consistency. Cronbach's Alpha coefficients were 0.86 for school policy support, 0.88 for teacher competence, 0.82 for learning infrastructure availability, and 0.89 for deep learning pedagogy implementation readiness. The questionnaire reliability was evaluated based on internal consistency criteria, while qualitative credibility was ensured through source triangulation, member checking, and dependability audit.

Data Analysis Techniques

The quantitative data were analyzed using descriptive statistics to identify variable tendencies. Descriptive analysis was used to summarize the characteristics of each research variable, including mean scores, standard deviations,

and variable categories. Regression analysis was used to examine the contribution of school management-related factors, particularly policy support and teacher competence, to deep learning pedagogy implementation readiness. Multiple regression analysis was applied to examine the relationship between school management support factors, including school policy support, teacher competence, and learning infrastructure, with deep learning pedagogy implementation readiness. Before conducting regression analysis, assumption tests were performed, including normality testing, linearity testing, multicollinearity testing, and heteroscedasticity testing to ensure that the regression model met statistical requirements. The regression model evaluation considered regression coefficients, significance values, coefficient of determination (R^2), standard errors, and confidence intervals. Correlation analysis was used to examine the relationship between administrative burden and implementation conditions.

The qualitative data were analyzed using thematic coding through data reduction, theme categorization, interpretation, and verification. Thematic analysis was conducted through several stages: (1) familiarization with interview transcripts, (2) initial coding of relevant statements, (3) categorization of codes into broader themes, (4) review and refinement of identified themes, and (5) interpretation of themes in relation to the quantitative findings. The integration of quantitative and qualitative findings was conducted during the interpretation stage. Qualitative findings were used to explain contextual factors underlying quantitative patterns, including how school policies, teacher capacity development, infrastructure conditions, and administrative factors influenced the implementation of deep learning pedagogy.

Data Validity

The validity of quantitative data was ensured through content validity and reliability testing. The instrument validity process involved expert review and statistical reliability analysis. The validity assessment confirmed that questionnaire items represented the intended constructs, while reliability testing demonstrated acceptable internal consistency across all variables. Qualitative data credibility was strengthened through triangulation, member checking, and dependability audit. The consistency of questionnaire responses, interview findings, school documents, and observation results was compared to minimize interpretation bias.

Research Ethics

The research was conducted by paying attention to scientific ethics through informed consent. Respondents were informed about research objectives and benefits before participation. Participant identities were maintained confidentially through coding procedures. The collected data were used solely for academic purposes and analyzed according to research ethics principles (Arellano et al., 2023). All participants received information regarding the research objectives, procedures, confidentiality protection, and voluntary participation before data collection. Participant identities were protected by using respondent codes during data analysis and reporting.

RESULTS

School Internal Policy Support for Deep Learning Pedagogy Implementation

The survey results showed that school internal policy support was categorized as very good (Mean = 4.21; SD = 0.37). The classification criteria were determined based on the average score interval of the 5-point Likert scale, where scores of 4.21–5.00 were categorized as “Very Good”, 3.41–4.20 as “Good”, 2.61–3.40 as “Moderate”, 1.81–2.60 as “Low”, and 1.00–1.80 as “Very Low”. The multiple regression analysis showed that school policy support had a positive and statistically significant contribution to deep learning pedagogy implementation readiness ($\beta = 0.61$, SE = 0.08, $p < 0.001$, 95% CI [0.45, 0.77]). The overall regression model explained 58% of the variance in deep learning pedagogy implementation readiness ($R^2 = 0.58$).

These findings indicate that schools with stronger internal policy structures tended to demonstrate higher readiness in implementing deep learning pedagogy. Clear policies supported teacher readiness, resource provision, and classroom management oriented toward higher-order thinking activities (HOTS). The regression assumption tests indicated that the model met statistical requirements. The residuals showed a normal distribution, linear relationships were identified between predictors and the dependent variable, no multicollinearity problems were detected (VIF < 5), and the variance of residuals was considered consistent across observations.

Table 1. School Policy Support and Deep Learning Pedagogy Implementation Readiness

Variable	Mean	SD	Category
School Policy Support	4.21	0.37	Very Good
Deep Learning Pedagogy Implementation Readiness	4.08	0.41	Good

The qualitative findings provided explanations regarding how school policies influenced implementation readiness. Interview results indicated that policies functioned as operational mechanisms that translated educational goals into classroom practices. A principal explained: *"Schools have started to make rules and SOPs so that teachers have an operational basis in implementing deep learning."* (K-01). A teacher also stated: *"We have lowered the guidelines into a lesson plan format that leads to authentic assessments and analytical activities of students."* (G-03). Similarly, a vice principal explained: *"The written policy makes implementation*

control more measurable, so that deep learning programs do not stop at discourse." (W-01). These qualitative findings explain that the positive regression relationship occurred because school policies provided practical guidance, implementation standards, and coordination mechanisms that helped teachers translate deep learning principles into learning activities.

Teacher Capacity as a Supporting Factor for Deep Learning Pedagogy Implementation

The quantitative results showed that teacher competence was categorized as high (Mean = 4.09). Based on the regression analysis, teacher competence showed the strongest contribution among measured predictors ($\beta = 0.64$, SE = 0.07, $p < 0.001$, 95% CI [0.50, 0.78]). This result indicates that differences in teacher competence were strongly associated with variations in deep learning pedagogy implementation readiness. The main components included pedagogical skills and digital literacy, which support teachers in designing problem-solving and inquiry-based learning strategies.

Table 2. Teacher Competence

Variable	Mean	SD	Category
Pedagogical Skills	4.12	0.39	High
Digital Literacy	4.06	0.42	High

The classification criteria for the "High" category were based on the Likert score interval of 3.41–4.20. The qualitative findings explained the mechanism underlying the statistical relationship. Teacher training and mentoring were identified as important strategies for strengthening teacher capacity. A teacher explained: *"The training made me more accustomed to designing problem-solving-based tasks."* (G-02). Another teacher added:

"We started creating project sheets that directed students to analysis, not just memorization." (G-04). A principal emphasized: *"Trained teachers are better equipped to facilitate in-depth discussions."* (K-05). These findings explain that the strong contribution of teacher competence was related to teachers' ability to transform training experiences into classroom practices, particularly in designing analytical activities, inquiry tasks, and student-centered learning experiences. However, some teachers still required continuous support, particularly in adapting digital learning media.

Learning Infrastructure and Administrative Burden as Implementation Challenges

The results showed that digital infrastructure readiness was categorized as moderate (Mean = 3.76), while administrative burden was categorized as high (Mean = 3.22). The classification criteria indicated that scores between 2.61–3.40 were categorized as Moderate, while scores between 3.41–4.20 represented High categories. Correlation analysis showed that administrative burden had a negative and statistically significant relationship with deep learning pedagogy implementation conditions ($r = -0.32$, $p = 0.001$, 95% CI [-0.48, -0.15]). This indicates that higher administrative burden was associated with lower implementation conditions.

Table 3. Learning Infrastructure and Administrative Burden

Variable	Mean	SD	Category
Facilities Availability	3.76	0.48	Moderate
Administrative Load	3.22	0.51	Moderate–High Burden

The qualitative findings provided explanations regarding these quantitative patterns.A principal stated: *"Computer labs exist, but there aren't enough devices for one class yet."* (K-03). A teacher added: *"We have to take turns so that a lot of study time is cut."* (G-01). These statements explain why infrastructure obtained a moderate score, as schools had basic facilities but still experienced limitations in device availability and internet stability. Regarding administrative burden, teachers explained that documentation requirements reduced the time available for developing deep learning materials. A teacher stated: *"Our time is running out for activity reports so that the focus on compiling deep learning modules is reduced."* (G-03). Another teacher explained:

"The administrative agenda often clashes with the teaching schedule." (G-04). Thus, the negative correlation between administrative burden and implementation conditions can be understood through the reduced time available for instructional planning, material development, and reflective learning preparation.

Table 4. Quantitative–Qualitative Integration of Findings

Quantitative Findings	Qualitative Explanation
School policy support (Mean = 4.21; $\beta = 0.61$, $p < 0.001$)	Policies, SOPs, and curriculum coordination provided operational guidance that helped teachers implement deep learning practices.
Teacher competence (Mean = 4.09; $\beta = 0.64$, $p < 0.001$)	Training, mentoring, and supervision strengthened teachers' ability to design analytical and problem-solving learning activities.

Quantitative Findings	Qualitative Explanation
Infrastructure availability (Mean = 3.76)	Limited devices and unstable internet reduced opportunities for technology-supported learning activities.
Administrative burden (Mean = 3.22; r = -0.32, p = 0.001)	Administrative requirements reduced teacher time for preparing deep learning materials and classroom innovation.

DISCUSSION

The findings indicate that school internal policy support is positively associated with deep learning pedagogy implementation readiness. The quantitative results showed that policy support was categorized as very good (Mean = 4.21) with a contribution coefficient of β = 0.61. Rather than indicating a causal effect, this finding suggests that schools with stronger internal policy structures tend to demonstrate higher readiness in implementing deep learning pedagogy. From an educational management perspective, policies function as organizational frameworks that translate educational goals into operational practices. School regulations, SOPs, curriculum guidelines, and academic planning mechanisms may create a shared direction among teachers and school stakeholders. The mechanism underlying this relationship is that clear policies reduce uncertainty, provide implementation standards, and create coordination mechanisms that enable teachers to align learning practices with deep learning principles.

The qualitative findings support this interpretation, as school leaders and teachers described SOPs and academic guidelines as references for developing lesson plans, authentic assessments, and analytical learning activities. This finding is consistent with educational governance perspectives stating that institutional structures provide foundations for implementing educational innovation (Austin & Jones, 2024; Elfert & Ydesen, 2023). However, the role of policy should not be understood as operating independently. Policy support may function as an enabling condition that facilitates teacher development and resource allocation, which subsequently influence classroom-level implementation. Furthermore, the findings indicate that policies were strengthened through routine programs such as teacher training, curriculum meetings, and implementation evaluations. This reflects the policy-to-practice perspective, where educational policies require translation into concrete activities to produce meaningful changes (Baran & Demirkasımoğlu, 2025). Therefore, the contribution of school management lies not only in producing regulations but also in establishing continuous organizational processes that support implementation.

Teacher competence emerged as an important factor associated with deep learning pedagogy implementation readiness. The quantitative results showed that teacher competence was categorized as high (Mean = 4.09), with β = 0.64 as the highest contribution coefficient among the measured factors. This finding suggests that teacher capacity may represent an important mechanism through which school management support is translated into classroom practices. Policies and programs alone may not guarantee implementation unless teachers possess the pedagogical knowledge and digital literacy required to design reflective, inquiry-based, and problem-solving learning activities. The qualitative findings showed that training, mentoring, and academic supervision helped teachers develop learning activities oriented toward analysis rather than memorization. This is consistent with previous research emphasizing the importance of teacher pedagogical capacity and digital competence in implementing learning approaches that require higher-order thinking (Kosasih et al., 2022; Vu, 2025).

However, teacher readiness was not uniform across all participants. Some teachers still required continuous assistance, particularly in utilizing digital learning resources. This finding indicates that professional development should not be viewed as a one-time activity but as a continuous process involving mentoring, peer support, and classroom-based assistance. Previous research has also emphasized that technology adoption in education requires sustained support and adaptation processes (Kamalov et al., 2023). Therefore, peer coaching and collaborative professional learning communities may represent potential strategies for reducing differences in teacher readiness (Hsieh et al., 2021).

Although policy support and teacher competence showed positive associations with implementation readiness, the findings also highlight contextual constraints related to infrastructure and administrative workload. Infrastructure availability was categorized as moderate (Mean = 3.76), indicating that schools had begun developing digital learning support but still faced limitations. The qualitative findings revealed that insufficient devices, unstable internet access, and facility limitations restricted the implementation of technology-supported learning activities. This suggests that infrastructure does not necessarily determine implementation outcomes independently but may act as a contextual condition that strengthens or limits the ability of teachers and schools to apply deep learning pedagogy.

This interpretation aligns with previous studies showing that digital-based student-centered learning requires adequate technological resources and institutional readiness (Ifliadi et al., 2024). Without sufficient infrastructure, teachers may have difficulty implementing activities involving digital exploration, collaboration, and independent learning. In addition, administrative burden emerged as another contextual challenge. The results showed that administrative load had a negative relationship with implementation conditions (r = -0.32). This relationship suggests that excessive administrative responsibilities may reduce the time and cognitive resources available for

teachers to design and evaluate innovative learning activities. This finding is consistent with research highlighting that excessive educational bureaucracy can limit teachers' professional capacity to focus on core instructional responsibilities (Karakose et al., 2024). Therefore, administrative simplification and digitalization of reporting systems may provide opportunities for teachers to allocate more attention to learning design and student engagement.

The findings contribute to educational management literature by illustrating that deep learning pedagogy implementation is not only a classroom-level process but also an organizational process involving multiple interconnected elements. The study proposes that school management support operates through three interconnected pathways: policy direction, teacher capacity development, and resource facilitation. This perspective extends previous discussions that often emphasize pedagogical strategies or digital tools by highlighting the organizational conditions required for sustainable implementation. However, the findings should be interpreted within the context of the study design. Because the research used purposive sampling and cross-sectional data from eight schools, the relationships identified should be understood as empirical associations rather than causal effects. Practically, the findings suggest that school leaders should focus on strengthening policy clarity, continuous teacher development, infrastructure improvement, and workload management. These strategies may support schools in developing environments that are more conducive to deep learning pedagogy implementation.

Several limitations should be considered. First, the study relied largely on teacher and school leader perceptions, which may introduce common method bias and social desirability bias. Second, respondents were nested within eight schools, meaning that school-level characteristics may influence individual responses. Third, this study focused on implementation readiness and did not directly examine student learning outcomes. Future research may expand the number of schools, apply longitudinal designs, and incorporate student achievement indicators to examine how school management support relates to long-term learning outcomes. Future studies may also explore mediating mechanisms, such as teacher professional development or school learning culture, to provide a deeper understanding of how management support contributes to deep learning pedagogy implementation.

CONCLUSION

This study indicates that school management support is associated with deep learning pedagogy implementation readiness at the junior high school level. The findings show that structured internal policies, teacher capacity development, and learning resource support represent important components in facilitating deep learning pedagogy implementation. School policies, including learning SOPs, curriculum planning, and quality assurance mechanisms, provide organizational direction that supports teachers in developing HOTS-oriented lesson plans and student-centered learning practices. The study contributes empirical evidence that deep learning pedagogy implementation is not only influenced by classroom practices but also shaped by organizational conditions within schools. In particular, the findings highlight the interconnected roles of policy support, teacher competence, infrastructure availability, and administrative workload management in creating conditions that are supportive of learning transformation.

From a practical perspective, the findings suggest that school leaders may strengthen implementation readiness through clear policy frameworks, continuous teacher professional development, improvement of learning facilities, and more efficient workload management. However, these implications should be interpreted within the context of the study, which involved 120 respondents from eight junior high schools in three Indonesian provinces. This study has several limitations. The cross-sectional design and purposive sampling approach limit causal interpretation and broader generalization. In addition, the study focused on implementation readiness based on teacher and school leader perspectives and did not directly measure changes in students' HOTS abilities, learning outcomes, or learning quality. Future research may employ longitudinal or experimental designs, involve a wider range of schools, and incorporate student-level learning outcomes to further examine the long-term relationship between school management support and deep learning pedagogy outcomes.

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AUTHOR CONTRIBUTION STATEMENT

MY contributed to the conceptualization, research design, data interpretation, and manuscript preparation. PL contributed to literature review, data organization, analysis support, and manuscript revision. Both authors reviewed and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

The authors declare that this research was prepared, researched, written, and edited without the aid of artificial intelligence (AI) techniques in the overall research process. The authors take full responsibility for the content, accuracy, and integrity of the publication.

***Mulyadi (Corresponding Author)**
Universitas Jambi,
Jambi, Indonesia
Email: mulyadiahmad@unja.ac.id

Pierre Marcello Lopulalan
Politeknik Pelayaran Banten,
Banten, Indonesia
Email: pmarcello66@gmail.com