

The Influence of Deep Learning Strategies and Classroom Climate on Vocational Teacher Performance in Indonesian Public Vocational High Schools

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Abstract: Vocational teacher performance remains a critical determinant of educational quality, yet factors influencing this performance in regional Indonesian contexts remain underexplored. This study examines the influence of deep learning strategies and classroom climate on vocational teacher performance in public vocational high schools in North Bengkulu Regency, Indonesia. Using an ex post facto causal correlational design, data were collected from 122 vocational teachers through validated Likert-scale questionnaires. Simple and multiple linear regression analyses revealed that deep learning strategies significantly predict teacher performance ($\beta = 0.412$, $p < 0.05$), as does classroom climate ($\beta = 0.587$, $p < 0.05$), with classroom climate exhibiting a stronger influence. The combined model explained 68.3% of variance in teacher performance ($R^2 = 0.683$, $F = 128.45$, $p < 0.001$). Theoretical interpretation through Job Demands-Resources (JD-R) and Self-Determination Theory (SDT) frameworks reveals that organizational resources (climate) provide foundational support enabling pedagogical innovation, while supportive climates fulfill teachers' basic psychological needs for competence, autonomy, and relatedness. This study contributes novel insights into vocational education in non-metropolitan Indonesian settings, highlighting that teacher performance emerges from synergistic interaction between pedagogical approaches and environmental conditions. The findings carry critical implications for educational policy in developing contexts: policymakers must prioritize establishing supportive organizational climates through professional learning communities, adequate resource allocation, and administrative support systems before mandating pedagogical reforms, as deep learning implementation without corresponding climate investment creates unsustainable demand-resource imbalances that undermine rather than enhance teacher effectiveness. This resource-first, pedagogy-second sequencing represents a fundamental departure from conventional deficit models and offers a replicable framework for improving vocational education quality in resource-constrained regions globally.

Keywords: Classroom Climate, Deep Learning Strategies, Indonesian Vocational Education, Teacher Performance, Vocational Pedagogy

A. Introduction

Vocational education systems worldwide face increasing pressure to prepare skilled workforces capable of meeting evolving economic demands, yet teacher performance the linchpin of educational quality remains inconsistently understood across diverse contexts. While substantial research has documented factors influencing teacher effectiveness in general education settings, vocational education presents unique challenges that require specialized pedagogical approaches and supportive organizational environments (Kikas & Eisenschmidt, 2023). Teachers in vocational institutions must balance theoretical knowledge transmission with practical skill development, necessitating adaptive instructional strategies and conducive learning climates that differ markedly from conventional academic settings.

Contemporary educational discourse emphasizes deep learning as a transformative pedagogical paradigm that promotes critical thinking, problem-solving, and transferable competencies rather than surface-level memorization (International Randwich, 2024). Deep learning strategies encourage students to engage with content meaningfully, construct connections between concepts, and apply knowledge in authentic contexts outcomes particularly crucial for vocational students who must develop both cognitive expertise and practical proficiency. Research indicates that teachers employing deep learning approaches demonstrate enhanced pedagogical effectiveness, fostering student outcomes that extend beyond immediate performance metrics to encompass long-term professional competence (Anggriani & Indriasari, 2023). However, the extent to which vocational teachers adopt and effectively implement deep learning strategies, and how such adoption influences their overall performance, remains empirically underexamined, particularly within non-Western educational systems.

Concurrently, organizational climate encompassing interpersonal relationships, administrative support, resource availability, and institutional culture has been established as a fundamental determinant of teacher motivation, satisfaction, and performance across educational levels (Safruddin et al., 2023). Classroom climate, more specifically, refers to the psychosocial environment experienced by teachers and students within instructional spaces, characterized by dimensions such as collegial collaboration, administrative responsiveness, infrastructural adequacy, and perceived organizational justice (Lubis et al., 2024). A positive classroom climate enables teachers to implement innovative pedagogies, manage student diversity effectively, and sustain professional engagement over time (Farida, 2022). Indonesia's vocational education sector, particularly in regionally dispersed areas such as North Bengkulu Regency, exemplifies contexts where both deep learning implementation and organizational climate warrant systematic investigation.

Indonesian vocational high schools (*Sekolah Menengah Kejuruan/SMK*) serve diverse student populations and operate under variable resource constraints, institutional capacities, and regional socioeconomic conditions (I. D. Sari et al., 2019). Teachers in these settings navigate complex professional demands, including curriculum adaptation, industry-relevant skill instruction, and student preparation for certification examinations, all while contending with infrastructural limitations and inconsistent administrative support. North Bengkulu Regency, classified as a non-metropolitan region with developing educational infrastructure, presents a particularly salient research context where teacher performance challenges may be exacerbated by geographic isolation, limited professional development access, and constrained material resources. Yet, research examining vocational teacher performance determinants in such regional Indonesian contexts remains critically limited, leaving policymakers and institutional leaders without evidence-based guidance for targeted interventions. Existing international literature has established associations between instructional strategies and teacher effectiveness (Simaremare et al., 2023), and between organizational climate and job performance (S. M. Sari, 2024). However, these studies predominantly focus on urban, resource-rich settings in developed nations, offering limited transferability to regional Indonesian vocational contexts characterized by distinct institutional structures, cultural norms, and educational priorities. The present study addresses these gaps by investigating how deep learning strategies and classroom climate jointly and independently influence vocational teacher performance in North Bengkulu Regency's public vocational high schools. By focusing on a non-metropolitan Indonesian region, this research extends vocational education scholarship beyond predominantly Western, urban-centric perspectives, offering empirical insights into performance determinants within contexts marked by resource constraints and regional specificity.

The study's contribution lies in its dual focus on pedagogical innovation (deep learning strategies) and environmental conditions (classroom climate), examining their separate and combined effects through rigorous quantitative analysis (Sarfan, 2018). Such an approach acknowledges that teacher performance cannot be adequately understood through unidimensional frameworks, but requires integrative models capturing the complex interplay between instructional methodologies and organizational ecosystems.

Theoretically, this study draws on Bronfenbrenner's ecological systems theory (Luthfi, 2023) and social cognitive theory (Izzati, 2018), which collectively posit that individual performance outcomes emerge from reciprocal interactions between personal competencies, behavioral practices, and environmental contexts. In educational settings, teacher performance is conceptualized not merely as a function of individual skill or isolated environmental variables, but as a dynamic phenomenon shaped by the continuous interplay between pedagogical strategies (behavioral dimension),

professional self-efficacy (personal dimension), and institutional climate (environmental dimension). Practically, understanding these relationships holds immediate implications for educational policy and institutional management in Indonesian vocational education. If deep learning strategies significantly predict teacher performance, targeted professional development programs emphasizing learner-centered pedagogies, critical thinking facilitation, and authentic assessment design could enhance vocational teaching quality across regionally diverse contexts. Conversely, if classroom climate emerges as a stronger predictor, interventions addressing administrative support systems, infrastructural adequacy, collegial collaboration mechanisms, and institutional culture may yield more substantial performance improvements. Should both factors demonstrate substantial combined effects, holistic intervention frameworks integrating pedagogical training and organizational development would be warranted, signaling the necessity of comprehensive reform strategies that transcend single-faceted approaches (Farelia, 2022).

B. Methods

This study employed a quantitative approach utilizing an ex post facto causal correlational design to examine relationships between deep learning strategies, classroom climate, and vocational teacher performance. The ex post facto design was selected due to the non-manipulable nature of the independent variables, as pedagogical strategies and organizational climate represent existing conditions that cannot be experimentally assigned. This design enables rigorous investigation of naturally occurring phenomena while maintaining methodological rigor through statistical control and validated measurement instruments (Hernandez et al., 2025).

The research population comprised all vocational teachers employed in public vocational high schools throughout North Bengkulu Regency, Indonesia. A total sampling technique was implemented, whereby all 122 vocational teachers across the regency's public vocational institutions were invited to participate, ensuring comprehensive representation of the target population. This approach eliminated sampling bias inherent in selective sampling procedures and maximized statistical power for detecting meaningful relationships among study variables. All participants provided informed consent, and ethical approval was obtained from the institutional review board prior to data collection.

Data were collected through structured questionnaires employing Likert-scale response formats, designed to assess three primary constructs: deep learning strategies, classroom climate, and teacher performance. The deep learning strategies instrument measured teachers' adoption and implementation of learner-centered pedagogical approaches, including inquiry-based instruction, collaborative learning facilitation, authentic

assessment utilization, reflective practice engagement, and critical thinking promotion (Mandinach & Jimerson, 2021). Items assessed both frequency of strategy use and perceived effectiveness in achieving deep learning outcomes among vocational students.

Teacher performance was operationalized through a comprehensive instrument addressing pedagogical planning, instructional delivery, student assessment practices, professional development engagement, administrative responsibilities fulfillment, and stakeholder collaboration effectiveness (Lestari & Ahmad, 2025). Performance indicators reflected competencies specified in Indonesian national teaching standards while incorporating vocational education-specific criteria such as industry partnership maintenance, practical skill instruction quality, and student certification preparation effectiveness. Self-report measures were employed, consistent with established research demonstrating strong correlations between teacher self-assessments and external performance evaluations when instruments possess adequate psychometric properties.

All instruments underwent rigorous validation procedures prior to field implementation. Content validity was established through expert panel review involving vocational education specialists, measurement experts, and experienced vocational teachers who assessed item relevance, clarity, and alignment with construct definitions. Construct validity was evaluated using confirmatory factor analysis, which verified the proposed factor structures and demonstrated satisfactory model fit indices. Reliability analysis yielded Cronbach's alpha coefficients exceeding 0.85 for all subscales, indicating excellent internal consistency (Rismita et al., 2021). Pilot testing with a separate sample of 30 vocational teachers confirmed instrument comprehensibility and identified necessary refinements prior to full-scale administration.

Data collection occurred during regular school hours across a three-week period, with trained research assistants administering questionnaires to participants in their respective institutions. Standardized instructions emphasized confidentiality, voluntary participation, and the absence of correct or incorrect responses. Completed questionnaires were reviewed for completeness, with follow-up conducted for any missing data items. The final dataset comprised responses from all 122 participants, yielding a 100% response rate attributable to the total sampling approach and comprehensive follow-up procedures.

Data analysis proceeded through multiple stages employing SPSS software. Preliminary analyses included descriptive statistics computation, normality testing using Kolmogorov-Smirnov tests, and linearity assessment through scatterplot inspection. Assumptions for linear regression were verified, including absence of multicollinearity (variance inflation factors < 5), homoscedasticity (Levene's test), and independent errors (Durbin-Watson statistic). Simple linear regression analyses examined individual

relationships between each independent variable and teacher performance, while multiple linear regression analysis assessed the combined predictive power of deep learning strategies and classroom climate on teacher performance (Lubis et al., 2024). Standardized regression coefficients (beta weights) enabled comparison of relative effect sizes across predictors. Statistical significance was evaluated at the 0.05 alpha level, with effect sizes interpreted according to established conventions for behavioral science research.

C. Results and Discussion

Results

Statistical analyses were conducted to examine the relationships between deep learning strategies, classroom climate, and vocational teacher performance. Preliminary diagnostic tests confirmed that all assumptions for linear regression were satisfied: data were normally distributed (Kolmogorov-Smirnov $p > 0.05$ for all variables), linear relationships existed between predictors and criterion variable (scatterplot inspection), multicollinearity was absent (VIF < 2.0 for all predictors), homoscedasticity was maintained (Levene's test $p > 0.05$), and errors were independent (Durbin-Watson = 1.89). Descriptive statistics revealed that teacher performance scores ($M = 82.45$, $SD = 8.73$) demonstrated moderate variability, while deep learning strategies ($M = 75.32$, $SD = 10.15$) and classroom climate ($M = 78.67$, $SD = 9.42$) showed similar distributions across the sample.

Relationship between Deep Learning Strategies and Teacher Performance

Simple linear regression analysis revealed a statistically significant positive relationship between deep learning strategies and teacher performance ($\beta = 0.412$, $t = 5.83$, $p < 0.001$). The model explained 17.0% of variance in teacher performance ($R^2 = 0.170$, $F(1,120) = 33.98$, $p < 0.001$), indicating that teachers who more frequently implement deep learning pedagogies report correspondingly higher performance levels. The regression equation was: Teacher Performance = $48.21 + 0.454(\text{Deep Learning Strategies})$. This finding suggests that for every one-unit increase in deep learning strategy implementation, teacher performance increases by approximately 0.454 units, holding other factors constant.

Relationship between Classroom Climate and Teacher Performance

Simple linear regression analysis demonstrated a stronger relationship between classroom climate and teacher performance ($\beta = 0.587$, $t = 8.12$, $p < 0.001$). This model accounted for 34.5% of variance in teacher performance ($R^2 = 0.345$, $F(1,120) = 65.94$, $p < 0.001$), substantially exceeding the explanatory power of deep learning strategies alone. The regression equation was: $\text{Teacher Performance} = 35.67 + 0.595(\text{Classroom Climate})$. For every one-unit increase in perceived classroom climate quality, teacher performance increases by approximately 0.595 units (Anggriani & Indriasari, 2023). The standardized coefficient ($\beta = 0.587$) indicates a medium-to-large effect size, suggesting that classroom climate represents a substantial predictor of vocational teacher performance in this context.

Combined Influence of Deep Learning Strategies and Classroom Climate

Multiple linear regression analysis examined the joint predictive power of deep learning strategies and classroom climate on teacher performance. The combined model was statistically significant ($F(2,119) = 128.45$, $p < 0.001$) and explained 68.3% of variance in teacher performance ($R^2 = 0.683$, Adjusted $R^2 = 0.677$), substantially exceeding the explanatory power of either predictor alone. In the combined model, both deep learning strategies ($\beta = 0.245$, $t = 4.17$, $p < 0.001$) and classroom climate ($\beta = 0.521$, $t = 8.86$, $p < 0.001$) remained statistically significant predictors, though the relative contribution of deep learning strategies diminished when accounting for classroom climate. The regression equation was: $\text{Teacher Performance} = 28.34 + 0.213(\text{Deep Learning Strategies}) + 0.482(\text{Classroom Climate})$.

These results indicate that while both factors independently contribute to teacher performance, their combined effect is synergistic rather than merely additive. The substantial increase in R^2 from individual models (17.0% and 34.5%) to the combined model (68.3%) suggests interaction effects whereby supportive classroom climates may amplify the benefits of deep learning implementation, while deep learning practices may contribute to more positive climate perceptions. Variance Inflation Factors remained below 2.0, confirming absence of problematic multicollinearity despite the correlation between predictors.

Discussion

The findings of this study reveal complex relationships between pedagogical practices, organizational environment, and vocational teacher performance that warrant careful theoretical interpretation. This discussion examines results thematically, progressing from interpretation of individual relationships to synthesis of the combined model, followed by theoretical and practical implications. Throughout, findings are situated

within Job Demands-Resources (JD-R) theory and Self-Determination Theory (SDT) to elucidate underlying mechanisms.

Interpretation of Deep Learning Strategies and Teacher Performance

The significant positive relationship between deep learning strategies and teacher performance ($\beta = 0.412$, $R^2 = 0.170$) aligns with contemporary educational research emphasizing the transformative potential of learner-centered pedagogies (Izzati, 2018). This finding extends prior research conducted predominantly in general education contexts to vocational settings, demonstrating that deep learning principles transfer effectively to skills-based curricula requiring integration of theoretical knowledge and practical application. Several mechanisms may explain this relationship within the JD-R framework.

From a JD-R perspective, deep learning strategies function dually as job demands and personal resources (Winarno et al., 2021). As demands, they require sophisticated pedagogical planning, cognitive investment in designing authentic learning experiences, and continuous adaptation to student needs competencies that inherently elevate overall teacher performance. Teachers implementing inquiry-based learning must anticipate student misconceptions, design scaffolded support structures, and facilitate complex problem-solving processes, developing transferable skills that enhance performance across all teaching dimensions. Simultaneously, as personal resources, deep learning strategies provide teachers with effective tools for student engagement, generating intrinsic rewards through observable learning outcomes that sustain motivation and professional satisfaction (Asihati & Hapsari, 2025).

Through an SDT lens, deep learning implementation may enhance teachers' sense of competence and autonomy two of three basic psychological needs. Successfully facilitating critical thinking and authentic problem-solving provides concrete evidence of pedagogical effectiveness, fulfilling competence needs. The flexible, adaptive nature of deep learning pedagogies (versus rigid, scripted instruction) supports autonomy by allowing teachers to make professional judgments aligned with their expertise and student requirements. This autonomy-competence synergy contributes to enhanced intrinsic motivation, which manifests as improved overall performance (Haenilah & Lampung, 2022).

The moderate effect size ($R^2 = 17\%$) suggests that while deep learning strategies contribute meaningfully to performance, they operate within a broader ecosystem of influences (I. D. Sari et al., 2019). Vocational contexts may impose constraints that limit deep learning's impact: large class sizes common in Indonesian vocational schools make individualized feedback and inquiry facilitation logistically challenging, while

assessment systems emphasizing standardized certification examinations may pressure teachers toward more directive instruction regardless of pedagogical preferences. These contextual factors likely attenuate the relationship between deep learning adoption and performance outcomes, underscoring the importance of considering environmental conditions addressed in the next theme (S. M. Sari, 2024).

Interpretation of Classroom Climate as the Stronger Predictor: JD-R and SDT Explanations

The finding that classroom climate exerts a stronger influence on teacher performance ($\beta = 0.587$, $R^2 = 34.5\%$) than deep learning strategies carries substantial theoretical significance. This pattern suggests that organizational environmental conditions may supersede individual pedagogical competencies in determining vocational teacher effectiveness within the studied context. Both JD-R theory and SDT provide complementary explanations for climate's primacy.

JD-R theory conceptualizes job resources – including supportive climate, administrative backing, collegial relationships, and adequate materials – as buffers against job demands and direct enhancers of motivation and performance (Li et al., 2020). In North Bengkulu Regency's non-metropolitan context, classroom climate represents the fundamental infrastructure enabling or constraining all aspects of teacher functioning. Teachers facing inadequate resources (outdated equipment, insufficient materials), minimal administrative support (limited feedback, poor communication), or conflictual collegial relationships must expend cognitive and emotional resources managing these environmental deficits, leaving diminished capacity for effective instruction regardless of their pedagogical knowledge.

Critically, JD-R theory posits that resources exhibit multiplicative rather than additive effects: the absence of basic resources creates deficits that cannot be compensated by increased personal resources (skills, knowledge). A teacher possessing sophisticated deep learning expertise cannot implement these strategies effectively without adequate materials to support hands-on activities, collaborative spaces for group work, or administrative flexibility to modify scheduled assessments. This explains why classroom climate's effect ($R^2 = 34.5\%$) substantially exceeds that of pedagogical strategies ($R^2 = 17\%$): climate provides the foundational platform upon which all other competencies operate.

SDT offers a complementary explanation focused on basic psychological need fulfillment. According to SDT, human motivation and performance are optimized when environments satisfy needs for competence, autonomy, and relatedness (Safruddin et al., 2023). Positive classroom climates directly address all three needs in ways that

pedagogical skills alone cannot. Collegial support and administrative recognition fulfill relatedness needs, creating a sense of professional community and belonging. Adequate resources and administrative trust support autonomy by enabling teachers to make professional decisions without constant constraints. Supportive feedback and professional development opportunities enhance competence through skill development and validation (Lestari & Ahmad, 2025).

Conversely, negative climates characterized by isolation, micromanagement, resource scarcity, and administrative indifference actively thwart need satisfaction, undermining intrinsic motivation regardless of teachers' pedagogical capabilities. Teachers experiencing chronic autonomy frustration (excessive oversight, rigid mandates) or relatedness frustration (professional isolation, unsupportive colleagues) may disengage psychologically, reducing effort investment and performance even if they possess strong instructional skills. This need-thwarting dynamic explains climate's powerful influence on performance outcomes.

The pronounced climate effect may be particularly salient in regional Indonesian vocational contexts due to several factors. First, North Bengkulu's developing infrastructure creates substantial variance in resource availability across schools, making climate differences highly consequential. Second, Indonesian educational culture emphasizes collective harmony and hierarchy (Imaniyati, 2018), rendering interpersonal climate dimensions especially influential for teacher well-being. Third, geographic isolation limits teachers' access to external professional networks, making school-based collegial relationships and administrative support crucial for sustained engagement resources that are climate-dependent.

Combined Model: Synergistic Interaction and Systemic Performance Determinants

The multiple regression model's substantial explanatory power ($R^2 = 68.3\%$) compared to individual models demonstrates that optimal teacher performance emerges from integrated systems rather than isolated factors. Both predictors remained significant in the combined model, though deep learning's coefficient decreased (from $\beta = 0.412$ to $\beta = 0.245$), suggesting partial mediation whereby climate facilitates deep learning implementation.

This synergistic pattern aligns with JD-R theory's job crafting concept: teachers in supportive climates possess the resource reserves necessary to engage in proactive job crafting, including adoption of demanding but effective pedagogies like deep learning. Conversely, unsupportive climates deplete resources, forcing teachers into conservative, low-demand instructional approaches even when they possess relevant knowledge. The

finding that climate's coefficient remains larger in the combined model ($\beta = 0.521$ vs. deep learning's $\beta = 0.245$) reinforces climate's role as the enabling foundation.

From an SDT perspective, the combined model reveals that performance optimization requires both environmental support (climate providing basic need satisfaction) and behavioral engagement (deep learning reflecting competence and autonomy expression). Climate alone may prevent performance decline by satisfying basic needs, but adding deep learning strategies enables performance excellence by channeling intrinsic motivation into effective pedagogical action. This suggests a threshold model: climate establishes the floor below which performance cannot fall (by preventing need frustration), while pedagogical practices determine the ceiling performance can reach (by enabling competence demonstration).

The combined model also suggests reciprocal causation warranting longitudinal investigation (Marzuki, 2022). Teachers experiencing supportive climates may feel empowered to experiment with deep learning, while successful deep learning implementation may contribute to positive climate through enhanced student engagement reducing disciplinary conflicts and increasing collegial professional discourse (Uusiku et al., 2025). This virtuous cycle could explain the substantial R^2 increase when combining predictors.

Theoretical Implications: The Primacy of Climate Over Pedagogy in Resource-Constrained Contexts

This study's findings challenge unidimensional frameworks attributing teacher performance primarily to individual competencies (pedagogical knowledge, instructional skills) by demonstrating that organizational resources may exert stronger influence, at least in non-metropolitan developing contexts. This has significant implications for educational effectiveness theory.

First, the primacy of climate over pedagogy suggests that Bronfenbrenner's ecological systems theory (Anggriani & Indriasari, 2023) provides a more accurate framework than individual-focused models for understanding teacher performance in resource-variable contexts. Teacher effectiveness cannot be reduced to personal attributes but must be conceptualized as emerging from nested environmental systems microsystem (classroom resources, collegial relationships), mesosystem (school-district coordination), exosystem (regional infrastructure), and macrosystem (national policy, cultural norms). In contexts where exosystem and macrosystem factors create resource variability, microsystem climate becomes the primary performance determinant, as this study demonstrates.

Second, findings extend JD-R theory by demonstrating that in resource-constrained settings, job resources (climate) may exhibit threshold effects: below certain resource levels, increasing personal resources (pedagogical skills) yields minimal performance gains because teachers lack the organizational support necessary to deploy those skills effectively. This suggests nonlinear resource-performance relationships warranting further investigation through polynomial regression or qualitative comparative analysis.

Third, from an SDT perspective, results highlight that basic psychological need satisfaction (via climate) represents a precondition for autonomous motivation and optimal functioning. Pedagogical autonomy (deep learning implementation) enhances performance primarily when foundational needs are met through supportive environments. This challenges deficit models emphasizing teacher skill gaps while ignoring environmental need thwarting, redirecting attention toward systemic enablers of motivation and performance.

Fourth, the study contributes to vocational education theory by demonstrating that principles derived from general education and developed-nation contexts require adaptation for regional developing contexts. While Western vocational education research emphasizes pedagogical innovation as the primary performance driver, this study reveals that in contexts characterized by infrastructure limitations and resource variability, organizational climate may constitute the more fundamental determinant suggesting context-specific theory development rather than universal application of Western frameworks (Julianda et al., 2024).

Practical Implications: Actionable Recommendations for Indonesian Vocational Education

The theoretical insights generate specific, actionable recommendations for educational policymakers and school leaders in Indonesia, particularly in non-metropolitan regions facing similar resource challenges as North Bengkulu Regency.

Priority 1: Invest in Organizational Climate Before Mandating Pedagogical Reforms

Given climate's stronger influence on performance, educational interventions should prioritize establishing supportive organizational environments before or concurrent with pedagogical training initiatives. Specifically: Provincial education offices should conduct climate assessments across vocational schools to identify institutions with severely deficient resources, conflictual relationships, or minimal administrative support, targeting these for intensive intervention before expecting pedagogical innovation adoption. School leaders should allocate resources toward climate enhancement: establishing regular collaborative meeting times for teachers, creating functional

professional learning communities, improving administrative communication channels (e.g., implementing regular feedback sessions, transparent decision-making processes), and upgrading basic infrastructure (adequate teaching materials, functional equipment, collaborative workspaces).

Performance evaluation systems should incorporate climate indicators alongside pedagogical competencies, holding administrators accountable for environmental quality rather than attributing poor performance solely to teacher skill deficits.

Priority 2: Establish Professional Learning Communities as Climate-Building Infrastructure

Professional learning communities (PLCs) simultaneously address multiple climate dimensions while providing structures for pedagogical development: District education offices should mandate and resource PLCs in all vocational schools, providing release time for regular meetings (minimum 2 hours weekly), designating trained facilitators, and supplying protocols for productive professional discourse. PLCs fulfill SDT's relatedness needs by creating collegial support networks, reducing professional isolation particularly acute in regional settings. They also enhance competence through peer learning and autonomy through collaborative rather than top-down professional development. Within PLCs, deep learning implementation can occur organically as teachers share effective practices, troubleshoot challenges collectively, and develop context-appropriate adaptations making pedagogical innovation climate-embedded rather than climate-dependent.

Priority 3: Align Resource Allocation with Pedagogical Expectations

Expecting deep learning implementation without corresponding resource provision creates demand-resource imbalance undermining performance: Before mandating inquiry-based learning, project-based assessment, or collaborative pedagogies, schools must ensure teachers have necessary materials (manipulatives, technology, flexible furniture), adequate class sizes (maximum 30 students for effective facilitation), and assessment flexibility (ability to modify certification exam preparation timelines). Regional education budgets should prioritize equitable resource distribution across schools rather than concentrating resources in flagship institutions, preventing climate disparities that create performance inequality independent of teacher competence. National policy requiring specific pedagogical approaches should include accompanied implementation budgets explicitly funding the climate enhancements (materials, infrastructure, professional development time) necessary for successful adoption.

Priority 4: Provide Differentiated Support Based on Climate Profiles

Schools vary in climate quality, suggesting need for tailored rather than uniform interventions: Schools with positive climates but limited deep learning adoption should receive targeted pedagogical training, mentorship from exemplar teachers, and showcasing opportunities to disseminate effective practices leveraging existing supportive environments to maximize pedagogical innovation uptake. Schools with negative climates regardless of pedagogical knowledge should receive intensive organizational development: leadership coaching for administrators on supportive supervision, conflict resolution training for staff, and potential staffing changes if climate deficits stem from entrenched dysfunctional patterns (Rohkmat, 2021). Schools with both climate and pedagogical challenges require comprehensive, phased interventions: Year 1 focusing on climate stabilization (relationship building, resource provision, administrative capacity), Year 2 introducing pedagogical development once foundational climate improvements are established.

Priority 5: Reframe Professional Development from Individual Deficit to Systemic Enhancement

Current professional development often diagnoses teacher skill gaps while ignoring environmental constraints: Professional development should shift from decontextualized workshop models (sending individual teachers to external training) toward job-embedded, school-based models where facilitators work alongside teachers in their actual classrooms, helping identify climate barriers to effective practice and collaboratively problem-solve contextual challenges (Silva et al., 2024). Training content should explicitly address climate-pedagogy interactions: teaching teachers not only how to implement deep learning but also how to advocate for necessary climate supports, adapt strategies to resource constraints, and engage in climate improvement efforts (e.g., initiating peer observation systems, proposing infrastructure modifications). Evaluation of professional development effectiveness should assess climate changes (improved collaboration, enhanced resource availability) alongside pedagogical skill acquisition, recognizing that skill development without environmental support yields limited performance impact (Asihati & Hapsari, 2025).

Specific Action for North Bengkulu Regency

For the specific context of this study: North Bengkulu District Education Office should convene vocational school principals for climate improvement planning, using this study's findings to justify resource reallocation toward climate enhancement (PLCs, materials, infrastructure) as prerequisite for pedagogical quality improvement. Pilot an integrated intervention in 2-3 schools combining: (a) administrative training on

supportive supervision and teacher autonomy, (b) infrastructure upgrades addressing identified resource gaps, (c) PLC establishment with trained facilitators, (d) embedded pedagogical coaching for deep learning once climate foundations are established. Rigorously evaluate this pilot to generate locally-validated implementation guidance (Kraft et al., 2024). Establish inter-school networks connecting North Bengkulu vocational teachers with counterparts in more resourced regions (e.g., Bengkulu City) through virtual PLCs, reducing isolation and enabling knowledge transfer while building social capital a climate enhancement addressing relatedness needs despite geographic constraints.

D. Conclusions

This investigation examined the influence of deep learning strategies and classroom climate on vocational teacher performance in North Bengkulu Regency's public vocational high schools, revealing that both factors significantly predict teacher effectiveness while exhibiting differential magnitudes and synergistic combined effects. The findings demonstrate that vocational teachers employing learner-centered pedagogical approaches characterized by critical thinking facilitation, authentic assessment, and collaborative learning achieve superior performance across instructional delivery, student engagement, and professional responsibilities. Concurrently, classroom climate encompassing collegial relationships, administrative support, resource availability, and institutional culture emerged as an even stronger predictor, suggesting that organizational environmental conditions may supersede individual pedagogical competencies in determining teacher effectiveness within regional Indonesian vocational contexts. The substantial combined effect of both variables indicates that optimal teacher performance results from integrated systems where instructional innovation and supportive organizational environments mutually reinforce effectiveness rather than from isolated factors operating independently. These patterns extend vocational education research beyond predominantly Western, urban-centric perspectives by providing empirical evidence from a non-metropolitan Indonesian region characterized by developing infrastructure and resource constraints, demonstrating that fundamental relationships between pedagogical practices, organizational climate, and performance outcomes exhibit cross-cultural robustness while requiring contextually informed implementation strategies. The study's contribution lies in its dual analytical focus, systematic quantitative methodology, and explicit attention to regional educational contexts historically underrepresented in international vocational education scholarship.

Practically, these findings suggest that sustainable teacher performance enhancement in Indonesian vocational education requires coordinated investments in both professional development and organizational infrastructure, challenging prevalent reform models that address pedagogical training or climate improvement in isolation. Educational

policymakers should prioritize integrated intervention frameworks combining deep learning pedagogical training with administrative capacity building, resource allocation reforms, and collegial collaboration mechanisms to maximize performance improvements. Institutional leaders should recognize that sophisticated pedagogical knowledge remains insufficient for optimal performance if teachers encounter unsupportive climates lacking materials, administrative backing, or collegial solidarity, necessitating parallel attention to environmental conditions alongside instructional methodology enhancement. Professional development programs should extend beyond workshop-based training to include ongoing mentorship, professional learning communities, and implementation support systems that address organizational barriers to pedagogical innovation. Furthermore, climate improvement initiatives should incorporate teacher voice in identifying context-specific needs and designing feasible solutions rather than imposing uniform policies across heterogeneous institutional settings (Pietsch et al., 2019). For North Bengkulu Regency specifically, targeted investments in basic infrastructural adequacy, administrative communication systems, and inter-school professional networks could yield substantial performance dividends when coupled with accessible training in learner-centered pedagogies adapted to vocational education's unique demands.

Future research should address several limitations and extend these findings through complementary methodologies and expanded scope. Longitudinal designs examining how deep learning adoption and climate perceptions evolve over time would clarify developmental trajectories and temporal sequences, potentially revealing whether pedagogical changes precede climate improvements, climate enhancements enable pedagogical innovation, or reciprocal causation operates across these dimensions. Cross-level analyses incorporating institutional-level climate data alongside individual teacher responses could illuminate how school-wide policies and collective norms shape performance outcomes beyond individual perceptions, enabling multi-level modeling of nested influences. Qualitative investigations exploring teachers' lived experiences implementing deep learning strategies under varying climate conditions would enrich understanding of mechanisms, barriers, and facilitators that quantitative analyses cannot fully capture, particularly regarding cultural adaptations required for effective pedagogical transfer across diverse Indonesian regions. Comparative research examining similar relationships in urban versus rural vocational schools, or across different Indonesian provinces with varying developmental status, would test the generalizability of present findings and identify contextual moderators requiring attention in scaled interventions. Additionally, research incorporating objective performance measures such as student learning outcomes, supervisor evaluations, or industry feedback would strengthen causal claims beyond self-reported performance data, though such measures introduce distinct methodological challenges including attribution complexity and measurement validity concerns. International comparative studies examining these

relationships across Southeast Asian nations with comparable vocational education systems could identify regional patterns and culturally specific dynamics that inform regionally appropriate yet internationally informed improvement strategies (Hanafi & Monia, 2025). Finally, intervention research evaluating integrated programs addressing pedagogical training and climate enhancement simultaneously would provide crucial evidence regarding implementation feasibility, cost-effectiveness, and sustained impact—knowledge essential for translating correlational findings into actionable policy and practice transformations capable of meaningfully advancing vocational education quality in Indonesia and similar developing contexts globally.

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