



Teachers' Perceptions of Deep Learning-Based Instructional Transformation in the Context of Primary Education Reform

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Abstract

The global shift toward deep learning-oriented pedagogy has redefined instructional transformation in primary education; however, empirical evidence regarding teachers' perceptions as a mediating factor of reform remains limited, particularly in developing educational contexts. This study aims to examine primary school teachers' perceptions of deep learning-based instructional transformation and to identify their cognitive understanding, affective disposition, and behavioral readiness toward its implementation. Employing a quantitative survey design, the study involved 87 primary school teachers selected through purposive sampling. Data were collected using a validated perception instrument and analyzed using descriptive statistical techniques. The findings indicate that teachers demonstrate a high conceptual endorsement of deep learning principles, particularly in fostering critical thinking, meaningful engagement, and knowledge transfer. Nevertheless, a moderate level of behavioral readiness suggests a perception-practice gap, especially in authentic assessment design and instructional alignment. Theoretically, this study contributes by positioning teacher perception as a strategic lever in systemic pedagogical transformation and extends deep learning discourse within primary education reform frameworks. Practically, the findings highlight the urgency of structured professional development and policy alignment to sustain deep learning implementation at the foundational level of schooling.

INTRODUCTION

The accelerating transformation of education in the twenty-first century has reshaped instructional paradigms from content transmission toward deep learning-oriented pedagogy that emphasizes critical thinking, conceptual understanding, collaboration, and knowledge transfer. Deep learning in educational discourse extends beyond technological adoption; it represents a pedagogical shift that encourages learners to construct meaning, integrate knowledge across contexts, and apply understanding in authentic situations (Nafi'ah & Faruq, 2025). This transformation aligns with global education reform agendas that prioritize competencies over rote memorization and surface-level achievement (Learning et al., 2025).

Within primary education, the urgency of deep learning becomes even more pronounced. The elementary school stage constitutes the foundational period for cognitive structuring, socio-emotional development, and metacognitive growth. Evidence from the science of learning and development highlights that early engagement in meaningful, inquiry-based, and reflective learning environments significantly contributes to long-term academic resilience and adaptive expertise (Nofamataro Zebua, 2025). Consequently, curriculum reforms across various educational systems increasingly emphasize authentic assessment, interdisciplinary integration, and higher-order thinking skills.

In the Indonesian context, this global shift resonates strongly with the implementation of the Kurikulum Merdeka, which emphasizes student-centered learning, project-based exploration, differentiated instruction, and competency mastery. Central to this reform is the Profil Pelajar Pancasila, a national framework designed to cultivate critical reasoning, creativity, collaboration, independence, and global diversity awareness (Prihantoro, 2025). These dimensions conceptually mirror deep learning principles that prioritize meaningful engagement and transferable understanding. However, translating policy frameworks into classroom realities requires more than structural curriculum changes; it demands teachers' cognitive alignment, emotional acceptance, and professional readiness to enact pedagogical transformation.

Pedagogical transformation does not occur automatically through curriculum redesign alone. Teachers play a pivotal mediating role between reform discourse and classroom enactment. Their perceptions, beliefs, and professional confidence substantially influence how instructional innovations are interpreted and implemented (Adi Saputra et al., 2025). When teachers perceive innovation as meaningful and feasible within their contextual constraints, sustainable implementation becomes more attainable. Conversely, when reform is perceived as administratively imposed without adequate pedagogical clarity or institutional

support, a perception–practice gap may emerge, weakening long-term reform impact.

Although research on deep learning continues to expand globally, dominant scholarship primarily focuses on student achievement outcomes, digital platforms, or curriculum design models. Empirical investigations that situate teacher perception as a central variable in primary education transformation particularly within the Indonesian educational reform landscape remain limited. Considering the structural diversity of Indonesian primary schools and the ongoing transition toward Kurikulum Merdeka, examining teachers' perceptions becomes a strategic entry point to evaluate reform feasibility at the grassroots level. Without understanding how teachers cognitively interpret deep learning, emotionally respond to reform expectations, and behaviorally prepare instructional adaptation, policy aspirations risk becoming symbolic rather than transformative.

By positioning teacher perception within the intersection of deep learning discourse and Indonesian curriculum reform, this study offers a contextualized contribution to primary education research. Rather than treating deep learning as a purely global pedagogical construct, this research embeds it within the national transformation agenda represented by Kurikulum Merdeka and Profil Pelajar Pancasila. This integrative perspective strengthens the theoretical linkage between global educational innovation and local reform implementation, thereby advancing the discourse on sustainable instructional transformation in Indonesian primary education. Methodologically, this study contributes by operationalizing teacher perception into multidimensional constructs cognitive, affective, and behavioral within a unified empirical framework, enabling a more systematic assessment of reform readiness at the primary education level.

METHODS

This study employed a quantitative explanatory design using Structural Equation Modeling-Partial Least Squares (SEM-PLS) to examine the structural relationships among teachers' cognitive perception, affective disposition, and behavioral readiness toward deep learning-based instructional transformation. SEM-PLS was selected because it is suitable for predictive modeling, complex construct relationships, and relatively small sample sizes, while not requiring strict multivariate normality assumptions (Hair & Sabol, 2025).

The participants consisted of 87 primary school teachers from 12 public and private elementary schools implementing Kurikulum Merdeka. Purposive sampling was applied to ensure respondents had a minimum of three years of teaching experience and direct exposure to instructional reform initiatives. This criterion ensured contextual familiarity with deep learning discourse within Indonesian primary education.

Data were collected using a structured questionnaire developed based on the Theory of Planned Behavior (Ajzen, 2020) and deep learning pedagogical principles (Fullan et al., 2018; Hattie & Donoghue, 2016). The instrument comprised 30 reflective indicators measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), representing three latent constructs: Cognitive Perception (CP), Affective Disposition (AD), and Behavioral Readiness (BR). Content validity was established through expert review involving curriculum specialists and educational measurement experts.

Data analysis was conducted using SmartPLS version XX. The evaluation followed a two-stage approach: measurement model assessment and structural model assessment (Hair et al., 2021). In the measurement model, convergent validity was assessed using outer loadings (> 0.70), Average Variance Extracted (AVE > 0.50), and Composite Reliability (CR > 0.70). Discriminant validity was examined using the Fornell-Larcker criterion and Heterotrait-Monotrait ratio (HTMT < 0.90).

In the structural model evaluation, collinearity was assessed using Variance Inflation Factor (VIF < 5). Path coefficients were tested using bootstrapping procedures with 5,000 resamples to determine statistical significance ($p < .05$). The coefficient of determination (R^2) was used to evaluate predictive accuracy, while effect size (f^2) and predictive relevance (Q^2) were calculated to assess model robustness.

This SEM-PLS framework enables the study to simultaneously examine direct and indirect relationships among perception constructs, thereby modeling reform readiness as a structural predictive system within the context of primary education transformation.

RESULT AND DISCUSSION

Results should be clear and concise. Discussion should explore the significance of the results of the work, not repeat them. Avoid extensive citations and discussion of published literature. Numbering:

Measurement Model Evaluation

The measurement model was assessed to ensure construct reliability and validity before examining structural relationships. Convergent validity was evaluated through outer loadings, Average Variance Extracted (AVE), and Composite Reliability (CR). All indicators demonstrated outer loadings above the recommended threshold of 0.70, indicating adequate item reliability. The AVE values for Cognitive Perception (CP), Affective Disposition (AD), and Behavioral Readiness (BR) exceeded 0.50, confirming sufficient convergent validity. Composite Reliability values ranged between 0.86 and 0.91, indicating strong internal consistency (Hair et al., 2021).

Table 1 presents the summary of measurement model results.

Construct	AVE	Composite Reliability	Cronbach's Alpha
Cognitive Perception (CP)	0.61	0.89	0.87
Affective Disposition (AD)	0.58	0.88	0.85
Behavioral Readiness (BR)	0.63	0.91	0.89

Discriminant validity was examined using the Fornell-Larcker criterion and HTMT ratio. The square root of AVE for each construct was higher than its inter-construct correlations, and HTMT values were below 0.90, confirming discriminant validity. These results indicate that the constructs are empirically distinct and suitable for structural analysis.

Structural Model Evaluation

After confirming the adequacy of the measurement model, the structural model was evaluated. Collinearity diagnostics indicated acceptable Variance Inflation Factor (VIF) values below 3.0, suggesting no multicollinearity issues.

Bootstrapping analysis with 5,000 resamples was conducted to test path significance. The structural model results are summarized in Table 2.

Table 2. Structural Model Results

Path	β	t-value	p-value
CP → AD	0.62	8.45	< .001
AD → BR	0.48	5.92	< .001
CP → BR	0.29	3.11	.002

The results indicate that Cognitive Perception significantly predicts Affective Disposition ($\beta = 0.62$, $p < .001$). Affective Disposition significantly influences Behavioral Readiness ($\beta = 0.48$, $p < .001$). Cognitive Perception also has a direct effect on Behavioral Readiness ($\beta = 0.29$, $p = .002$).

The coefficient of determination (R^2) for Affective Disposition was 0.38, while Behavioral Readiness showed an R^2 of 0.56, indicating moderate to substantial predictive accuracy. Effect size analysis (f^2) revealed that Cognitive Perception exerts a strong effect on Affective Disposition and a moderate effect on Behavioral Readiness.

Mediation Analysis

To examine indirect effects, bootstrapping mediation analysis was performed. Results revealed that Affective Disposition partially mediates the relationship between Cognitive Perception and Behavioral Readiness (indirect effect $\beta = 0.30$, $p < .001$). Since both direct and indirect effects were significant, partial mediation was confirmed.

This finding suggests that teachers' conceptual understanding of deep learning enhances behavioral readiness not only directly but also indirectly through positive attitudinal orientation toward instructional transformation.

The structural model provides strong empirical support for a sequential mechanism in which teachers' Cognitive Perception (CP) shapes their Affective Disposition (AD), and both dimensions directly and indirectly determine Behavioral Readiness (BR) to enact deep learning-based instructional transformation. Substantively, this pattern clarifies a common paradox in school reform: teachers may verbally endorse innovation, attend trainings, and even adopt reform language in lesson plans, yet classroom practice remains largely unchanged. The current model suggests that reform success is not driven by "understanding" alone, but by how understanding is translated into a stable attitudinal orientation that reduces perceived risk and increases the willingness to shift practice.

From a theoretical standpoint, the pathway is consistent with the Theory of Planned Behavior (TPB), which posits that beliefs and evaluations (cognition) influence behavior through motivational and attitudinal processes (Ajzen, 2020). In the context of deep learning, CP can be interpreted as a teacher's internal knowledge architecture about what deep learning entails meaningful learning, transfer, metacognitive reflection, and higher-order thinking rather than surface activity or technology usage. When CP is high, teachers can cognitively distinguish deep learning from routine "busy work" or procedural coverage. This distinction matters because it changes the teacher's appraisal of the reform: deep learning becomes a legitimate pedagogical orientation rather than an administrative trend. Consequently, teachers with stronger CP are more likely to develop positive AD seeing deep learning as valuable, aligned with professional identity, and worth the effort thereby increasing readiness to implement (P. T. Aji et al., 2026).

The significance of the partial mediation effect further sharpens the interpretation by evidencing a perception practice pathway: cognitive endorsement becomes instructionally actionable when it is psychologically supported by positive affective disposition. This offers a critical insight for reform implementation in primary schools. Teachers may "agree" with deep learning principles, yet still hesitate to redesign learning tasks, shift authority toward student inquiry, or adopt authentic assessment practices. Such hesitations are often driven by affective-professional variables: fear of classroom unpredictability, concern about time efficiency and syllabus coverage, anxiety about evaluation by supervisors, or uncertainty about assessment standards. In line with teacher-change literature, deep pedagogical transformation requires both epistemic change (what teachers believe counts as learning and evidence of learning) and affective-professional change (teachers' sense of efficacy, safety, and support during experimentation) (Yakavets et al., 2023). Therefore, the mediation finding should be read as more than

a statistical detail; it indicates that reform efforts that target cognition without strengthening affective alignment may stall at the level of discourse rather than practice.

This interpretation is also pedagogically plausible within the instructional logic of deep learning. Deep learning tasks typically involve open-ended inquiry, discussion, collaboration, and performance-based assessment features that increase variability in classroom trajectories and demand higher teacher orchestration. In primary education, where classrooms are heterogeneous and time is tightly structured, teachers may perceive such variability as risky. As a result, even teachers with adequate conceptual understanding can fall back on more controllable routines (e.g., worksheets, short-answer tasks, teacher-centered explanation) if their attitudes toward reform are not sufficiently positive and their perceived competence is not strong. This helps explain why some schools report “implementation” of deep learning in documentation while the enacted pedagogy remains largely superficial an issue frequently discussed in reform research as the difference between adoption of form and transformation of function (Vaino et al., 2023).

In the Indonesian policy context, the findings are particularly consequential because Kurikulum Merdeka and the Profil Pelajar Pancasila provide a clear mandate for student-centered and competency-driven learning. Deep learning principles conceptually align with key dimensions of the Profil Pelajar Pancasila especially critical reasoning, creativity, collaboration, independence, and global diversity orientation yet this alignment does not automatically translate into classroom enactment. The model’s results imply that implementation strength depends on teachers’ internalization of reform meaning (CP), their willingness and affective commitment (AD), and their practical readiness to redesign instruction (BR). This means that policy alignment is necessary but insufficient: if reform is carried mainly through administrative compliance (documents, reporting, “format checking”) without strengthening teachers’ conceptual clarity and attitudinal ownership, deep learning may remain a symbolic label rather than an enacted pedagogy (P. T. Aji & Rizkasari, 2021).

Moreover, the model suggests that affective disposition is a strategic leverage point for accelerating transformation. When AD is high, teachers are more willing to engage in iterative lesson design, adopt inquiry cycles, implement project-based learning, and embed reflection routines practices associated with deep learning’s emphasis on meaning-making and transfer (Pathan et al., 2025). Conversely, when AD is fragile, teachers may enter “compliance mode,” adopting visible features (terminology, lesson format, activity labels) while keeping the underlying pedagogy unchanged. This distinction is crucial for evaluating Kurikulum Merdeka implementation: evidence of deep learning should be sought not only in lesson plan

wording but also in learning artifacts and processes student reasoning products, reflection traces, collaborative knowledge building, and authentic assessment outputs.

Importantly, the direct effect of CP on BR (alongside the mediated path through AD) indicates that conceptual understanding also has an independent contribution to readiness. This implies that strengthening teacher cognition is still essential: teachers cannot enact deep learning effectively if they lack clarity about what constitutes deep learning evidence in primary classrooms (e.g., what “transfer” looks like for Grade 4, how to scaffold inquiry for mixed-ability students, how to operationalize Profil Pelajar Pancasila into observable indicators). However, the mediation finding emphasizes sequencing: conceptual training should be paired with experiences that build positive attitudes successful demonstrations, peer modeling, coaching, and supportive feedback so cognition is not left “floating” as abstract agreement (Fohlin, 2025).

Taken together, the results contribute to a more realistic model of reform readiness in primary education. They indicate that deep learning transformation is best understood as a system of interacting teacher states, not as a single variable. Teachers first need to understand deep learning as a pedagogical framework (CP), then accept and value it as professionally meaningful and feasible (AD), and finally translate this into consistent instructional adaptation (BR). This layered mechanism helps explain differential reform outcomes across schools and supports the argument that reform policy should target teacher cognition and teacher affect simultaneously if the goal is genuine classroom transformation rather than surface compliance (E. R. I. H. R. P. T. Aji, 2022).

Beyond its internal coherence, the present model also resonates with and extends the broader literature on teacher readiness and educational reform. Prior studies on reform implementation consistently demonstrate that teachers’ beliefs and professional identity significantly influence the depth of instructional change (Feser et al., 2023). Research on curriculum reform indicates that teachers do not simply “apply” policy directives; rather, they actively interpret, negotiate, and reconstruct reform messages within their existing belief systems and classroom realities (Dumbi & Indrasari, 2024). In this regard, the strong path from Cognitive Perception to Affective Disposition in the current model reinforces the notion that reform uptake begins with interpretive framing how teachers cognitively make sense of innovation. Furthermore, studies on teacher self-efficacy and change readiness suggest that positive attitudes toward reform are more predictive of instructional adaptation than formal training exposure alone (Tschannen-Moran & Hoy, 2001). The mediation structure found in this study empirically supports these insights by demonstrating that attitudinal alignment functions as a psychological conduit through which conceptual clarity becomes practice-oriented behavior.

Therefore, this research contributes to reform scholarship by modeling teacher readiness not as a static attribute, but as a dynamic interplay between cognition, affect, and behavioral enactment within a structural predictive framework (Sytziouki et al., 2025).

In addition, the findings should be interpreted in light of the structural characteristics that make primary education uniquely constrained compared to secondary or higher education contexts. Primary classrooms are typically characterized by high instructional intensity, heterogeneous learner profiles, strong curriculum pacing expectations, and limited subject specialization by teachers. Unlike secondary teachers who may focus on a single discipline, primary teachers manage multiple subject domains within the same instructional block, increasing cognitive load and reducing flexibility for extended inquiry-based exploration. Moreover, assessment pressures particularly summative testing cultures and reporting requirements may implicitly incentivize efficiency and coverage rather than deep conceptual engagement (Talib et al., 2025). Classroom management demands are also more immediate in primary settings, where student developmental variability requires structured routines to maintain engagement and order. These contextual constraints can moderate how deep learning principles are enacted, even when teachers demonstrate strong cognitive understanding. Thus, the perception–practice gap identified in this study may be partly explained by systemic time-on-task pressures, accountability structures, and classroom ecology specific to primary schooling. Recognizing these constraints is essential for interpreting reform readiness realistically: strengthening Behavioral Readiness requires not only attitudinal alignment but also structural adjustments that protect instructional time for inquiry, collaborative learning, and reflective processes consistent with deep learning pedagogy (Sari et al., 2023).

CONCLUSIONS AND RECOMMENDATIONS

This study concludes that teachers' readiness to implement deep learning-based instructional transformation in primary education operates through a structured perceptual mechanism. Cognitive Perception significantly influences Behavioral Readiness both directly and indirectly through Affective Disposition, confirming that reform implementation is not merely a matter of conceptual agreement but also of attitudinal internalization and professional confidence. The SEM-PLS analysis demonstrates that teacher perception functions as a predictive structural system, with moderate-to-substantial explanatory power for reform readiness within the context of Kurikulum Merdeka.

The findings contribute theoretically by integrating deep learning discourse with teacher perception theory in a unified structural model, thereby advancing reform scholarship beyond student-centered or technology-focused analyses.

Methodologically, this study strengthens empirical rigor by operationalizing perception into multidimensional constructs and validating their relationships through SEM-PLS modeling. Substantively, the results highlight the importance of affective alignment as a mediating mechanism in bridging conceptual understanding and classroom enactment.

From a practical perspective, sustainable deep learning transformation in primary education requires systemic strategies that simultaneously enhance conceptual clarity, strengthen professional ownership, and support instructional redesign. Professional development programs should move beyond technical training toward reflective, practice-based, and coaching-oriented models. School leadership should create enabling conditions that reduce administrative overload and protect instructional time for inquiry-based and authentic learning practices. At the policy level, reform monitoring frameworks should assess not only compliance indicators but also teacher readiness dimensions to ensure meaningful implementation of Profil Pelajar Pancasila values.

Future research is recommended to expand the structural model by incorporating additional variables such as teacher self-efficacy, institutional support, and assessment literacy, as well as employing longitudinal designs to examine reform sustainability over time. Triangulation with classroom observation data and student learning artifacts would further strengthen the evidence base for deep learning implementation in Indonesian primary education.

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