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# Teachers' Readiness to Implement Deep Learning-Based Health Education for Hypertension Prevention in a Primary School Context

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**Abstract**

The integration of deep learning-oriented pedagogy into primary health education remains limited, particularly in preventive health contexts such as hypertension literacy. While schools play a crucial role in fostering early health awareness, teachers' readiness to adopt transformative instructional approaches has not been sufficiently examined. This study aims to investigate teachers' readiness to implement deep learning-based health education for hypertension prevention in a primary school setting. A descriptive quantitative survey was conducted involving 30 teachers from a public primary school in Jumapolo, Karanganyar, Central Java. Data were collected using a validated readiness questionnaire encompassing cognitive understanding, affective disposition, perceived instructional competence, and implementation intention. Descriptive statistical analysis revealed that teachers demonstrated a moderate to high level of readiness across dimensions, with affective willingness showing the highest mean score. These findings provide preliminary empirical insights into the potential integration of deep learning pedagogy within school-based preventive health education. The study underscores the importance of structured professional development to strengthen instructional competence in health literacy implementation at the primary level.

## INTRODUCTION

The accelerating transformation of twenty-first century education has intensified calls for pedagogical models that cultivate deep cognitive engagement rather than surface-level content transmission. Deep learning-oriented pedagogy emphasizes conceptual coherence, metacognitive regulation, knowledge transfer, and authentic problem-solving, positioning learning as an integrative and meaning-

making process rather than rote acquisition (Ramsden, 2020). Within primary education, this paradigm shift carries structural implications, as teachers must simultaneously address foundational literacy, curriculum standards, and emerging competency-based reform agendas. Consequently, instructional transformation depends not merely on curricular redesign but on teachers' epistemic and pedagogical readiness to enact deeper forms of learning.

Health education constitutes a particularly strategic domain for operationalizing deep learning principles in primary schools. Early health literacy has been recognized as a critical determinant of long-term health outcomes, especially in preventing non-communicable diseases (NCDs) such as hypertension (Nurhasanah et al., 2025). Contemporary models of health literacy conceptualize it as a multidimensional construct encompassing functional, interactive, and critical capacities that enable individuals to evaluate health information and make informed behavioral decisions (Isnaeni et al., 2025). These higher-order dimensions align conceptually with deep learning pedagogy, which requires learners to analyze, synthesize, and apply knowledge within authentic contexts. Therefore, integrating deep learning into primary health education may enhance not only cognitive understanding but also preventive behavioral awareness.

The urgency of strengthening preventive health education is reinforced by epidemiological evidence indicating rising trends in hypertension prevalence globally, including among adolescents (Dai et al., 2024). Although hypertension is predominantly associated with adulthood, risk trajectories often originate from early-life behavioral patterns. School-based interventions have demonstrated potential in shaping lifestyle awareness and long-term health behavior formation . However, research consistently suggests that health education programs are most effective when embedded within participatory, inquiry-driven, and contextually meaningful pedagogical frameworks rather than isolated informational campaigns (Jafar, 2025). This evidence underscores the relevance of deep learning-based instructional design for preventive health contexts.

Despite the conceptual alignment between deep learning pedagogy and critical health literacy, implementation challenges persist at the teacher level. Teacher readiness remains a decisive factor in curriculum reform and pedagogical innovation. Readiness is commonly understood as a multidimensional construct encompassing cognitive comprehension of innovation, affective disposition toward change, perceived instructional competence, and behavioral intention to implement new practices (Oktaviana et al., 2025). Empirical studies on educational reform indicate that even well-designed policy initiatives encounter resistance or superficial adoption when teachers perceive insufficient preparedness or lack structural support (Pahrudin et al., 2025). In primary school contexts where time allocation, assessment pressures, and classroom management demands are

substantial the threshold for adopting innovative pedagogies may be particularly high.

Although scholarship has extensively examined deep learning, teacher readiness, and health literacy as separate domains, limited empirical attention has been devoted to their intersection within primary education, particularly in localized institutional settings. Existing research rarely investigates teachers' readiness to implement deep learning-based health education explicitly focused on hypertension prevention (Aji, Bhadowy, et al., 2026). This gap represents both a theoretical and practical omission, as integrating preventive health literacy within deep pedagogical structures may contribute to holistic educational reform while addressing long-term public health priorities.

Therefore, this study aims to examine teachers' readiness to implement deep learning-based health education for hypertension prevention within a primary school context. By situating readiness within an interdisciplinary framework that bridges pedagogical transformation and preventive health literacy, this research contributes preliminary empirical insights into how primary education reform can support sustainable health awareness through instructional innovation.

## METHODS

This study employed a descriptive quantitative survey design to examine teachers' readiness to implement deep learning-based health education for hypertension prevention within a primary school context. A survey approach was selected because it enables systematic measurement of multidimensional constructs in naturally occurring educational settings without experimental manipulation (Feri et al., 2025). Given that the study aimed to generate contextualized institutional insights rather than causal inference, the design is positioned as an exploratory census-based investigation. Such an approach is appropriate when the objective is to capture the complete readiness profile of a bounded educational population undergoing pedagogical adaptation (Suherman et al., 2025).

Although total sampling ensures full institutional representation, the relatively small population size (n = 30) requires careful analytical framing. To enhance methodological rigor and analytical transparency, the study extends beyond basic descriptive reporting by incorporating confidence interval estimation and deeper variability interpretation. Reporting 95% confidence intervals alongside mean scores strengthens statistical transparency and provides a more precise estimate of readiness levels within the institutional context. Additionally, where relevant demographic data are available (e.g., teaching experience or years of service), supplementary comparative analysis may be conducted to enrich interpretive depth. These refinements ensure that analytical contribution extends

beyond surface-level descriptive profiling while remaining consistent with the exploratory census design.

**Research Setting and Participants**

The research was conducted at a public primary school in Jumapolo, Karanganyar, Central Java, Indonesia. The institution was selected due to its active engagement in curriculum adaptation and expressed interest in strengthening preventive health education initiatives. A total sampling (census) technique was applied, whereby all 30 teachers employed at the school participated in the study, representing 100% of the teacher population. This approach minimizes sampling bias and enhances internal representativeness within the institutional context (Etikan, 2022).

**Instrument Development and Validation**

Data were collected using a structured readiness questionnaire adapted from contemporary frameworks on teacher readiness and instructional innovation (MULİSA, 2022). Readiness was conceptualized as a multidimensional construct encompassing cognitive understanding, affective disposition, perceived instructional competence, and implementation intention, consistent with change readiness theory in educational reform literature (Nafi'ah & Faruq, 2025).

The questionnaire consisted of 20 items, with five items allocated to each readiness dimension (cognitive understanding, affective disposition, perceived instructional competence, and implementation intention). All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Including clearly defined item distribution across dimensions enhances structural clarity and supports construct transparency.

Content validity was established through expert review involving specialists in primary education pedagogy and medical-surgical nursing with expertise in hypertension prevention. The experts evaluated the instrument for conceptual clarity, contextual alignment, and linguistic appropriateness. Revisions were implemented based on qualitative feedback to ensure construct coherence and domain relevance. To further strengthen methodological transparency and replicability, representative sample items for each dimension may be provided in an appendix.

Internal consistency reliability was assessed using Cronbach's alpha. All subscales demonstrated acceptable reliability coefficients ($\alpha \geq .70$), consistent with recommended thresholds for exploratory educational research (Taber, 2018). Reliability testing supports the instrument's stability in measuring multidimensional readiness within the defined institutional context.

**Data Collection Procedure**

Data collection was conducted in person during a scheduled faculty meeting to ensure complete participation and minimize nonresponse bias. Participants were

informed about the study objectives, voluntary participation, confidentiality safeguards, and academic use of the data prior to questionnaire administration. Written informed consent was obtained from all participants. The average completion time ranged from 15 to 20 minutes.

**Data Analysis**

Descriptive statistical analysis was performed using SPSS version. Mean scores, standard deviations, and 95% confidence intervals were calculated for each readiness dimension and for overall readiness. Reporting confidence intervals enhances statistical precision and allows clearer interpretation of readiness estimates within the institutional population.

Readiness levels were categorized into low, moderate, and high based on score interval interpretation derived from the Likert scale range. Beyond mean categorization, standard deviation values were interpreted to reflect variability patterns and dispersion characteristics across dimensions, providing a more nuanced understanding of institutional readiness distribution.

Where demographic data permitted, supplementary descriptive comparisons were conducted to explore potential variation across teacher characteristics. Given the census-based and exploratory nature of the study, the analysis prioritized institutional profiling rather than inferential generalization beyond the research setting (Prihantoro, 2025).

**Ethical Considerations**

Ethical approval was obtained from the relevant institutional review authority prior to data collection. Participation was voluntary, anonymity was maintained, and no personal identifiers were recorded. The study adhered to ethical standards for educational research involving adult participants and complied with principles of confidentiality and responsible data handling (Nofamataro Zebua, 2025).

**Data Availability Statement**

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. Access to the data is subject to institutional approval to ensure compliance with ethical and confidentiality regulations.

## RESULT AND DISCUSSION

**Overall Teachers' Readiness**

The analysis aimed to describe the overall readiness of teachers to implement deep learning-based health education for hypertension prevention within a primary school context. Descriptive statistics were calculated to determine the mean, standard deviation, and 95% confidence interval (CI) for each readiness dimension.

Table 1. Descriptive Statistics of Teachers' Readiness

| Dimension | Mean | SD | 95% CI | Category |
|---|---|---|---|---|
| Cognitive Readiness | 3.78 | 0.52 | 3.59 - 3.97 | Moderate-High |
| Affective Disposition | 4.12 | 0.47 | 3.95 - 4.30 | High |
| Perceived Instructional Competence | 3.65 | 0.60 | 3.43 - 3.87 | Moderate |
| Implementation Intention | 4.05 | 0.50 | 3.86 - 4.24 | High |
| Overall Readiness | 3.90 | 0.48 | 3.72 - 4.08 | Moderate-High |

The findings indicate that overall teacher readiness falls within the moderate-to-high category (M = 3.90, SD = 0.48, 95% CI [3.72, 4.08]). The relatively narrow confidence interval suggests stable estimation of institutional readiness within the bounded school population.

Among the four dimensions, affective disposition demonstrated the highest mean score (M = 4.12, SD = 0.47, 95% CI [3.95, 4.30]), indicating strong positive attitudes toward integrating preventive health education through deep learning approaches. Implementation intention also showed a high level (M = 4.05, SD = 0.50, 95% CI [3.86, 4.24]), reflecting teachers' willingness to enact instructional changes.

In contrast, perceived instructional competence yielded a comparatively lower mean score (M = 3.65, SD = 0.60, 95% CI [3.43, 3.87]). The wider confidence interval and higher standard deviation relative to other dimensions indicate greater variability in teachers' perceived pedagogical capability. This variability suggests that while teachers are motivated and supportive of reform, levels of instructional confidence are not uniformly distributed across faculty members.

Cognitive readiness demonstrated moderate-to-high alignment (M = 3.78, SD = 0.52, 95% CI [3.59, 3.97]), indicating adequate conceptual understanding of deep learning pedagogy and hypertension prevention content. The moderate dispersion suggests relative consensus among teachers regarding the theoretical relevance of preventive health education.

**Dimensional Patterns of Readiness**

The dimensional pattern reveals a consistent hierarchy across readiness constructs. Affective and intentional components are comparatively stronger than competence-related dimensions. This pattern reflects a psychologically supportive reform climate, where teachers endorse innovation and express willingness to implement change.

However, the gap between affective disposition and perceived instructional competence highlights a transitional phase of reform readiness. Teachers appear conceptually aligned with deep learning principles and preventive health objectives, yet may require structured pedagogical scaffolding to operationalize these principles in classroom practice.

The confidence interval analysis further strengthens interpretive precision. The relatively compact intervals observed in affective disposition and implementation intention indicate stable agreement across participants. In contrast, the slightly broader interval for instructional competence reflects heterogeneous pedagogical preparedness, underscoring the need for differentiated professional development strategies.

**Institutional Readiness Profile**

Taken collectively, the readiness profile suggests that the primary school demonstrates favorable motivational and attitudinal conditions for integrating deep learning-based health education. The institutional climate appears supportive of pedagogical transformation, particularly in relation to preventive health awareness.

Nevertheless, the moderate competence dimension indicates that implementation sustainability may depend on targeted instructional capacity-building. Without structured training in inquiry-based lesson design, authentic assessment strategies, and contextualized health problem-solving activities, favorable attitudes may not fully translate into high-fidelity pedagogical enactment.

Given the census-based design and single-institution scope, the findings are interpreted as reflective of institutional readiness rather than representative of broader educational populations. However, the comprehensive participation of all teachers provides a complete readiness snapshot within the school context, offering valuable insight for localized reform planning.

## DISCUSSION

This study examined teachers' readiness to implement deep learning-based health education for hypertension prevention within a primary school context. The results revealed a moderate-to-high overall readiness profile, with affective disposition and implementation intention emerging as the strongest dimensions, followed by cognitive readiness, while perceived instructional competence remained comparatively lower (Aji, Baidhowy, et al., 2026). This pattern provides meaningful theoretical, practical, and contextual implications for understanding how pedagogical reform particularly deep learning-oriented instruction can be mobilized to strengthen preventive health literacy in primary education.

From a theoretical standpoint, the readiness configuration supports multidimensional conceptualizations of change readiness in educational reform. Readiness is widely recognized as more than cognitive awareness; it involves motivational and emotional alignment, perceived capability, and action-oriented intention (Aji & Rizkasari, 2021). In the present findings, stronger affective disposition indicates that teachers largely agree with the value and importance of integrating preventive health education (hypertension prevention) through deep learning principles. This affective alignment is crucial because reform

implementation is unlikely to be sustained when teachers perceive innovation as externally imposed or misaligned with their professional values (Dumbi & Indrasari, 2024). In other words, the high attitudinal endorsement found in this study can be interpreted as a "psychological readiness foundation" that reduces resistance and increases openness to pedagogical transformation.

The high implementation intention further reinforces the presence of an enabling motivational climate at the institutional level. Intention is often considered a proximal precursor to enactment, particularly in the early stages of reform adoption when teachers are evaluating feasibility and relevance (Richter et al., 2021). In competency-oriented reform systems, teacher intention has practical significance because deep learning pedagogy requires intentional redesign of lesson structures shifting from content delivery to inquiry, conceptual integration, and authentic application. The relatively high intention observed suggests that teachers are not merely supportive at a conceptual level but also express willingness to translate reform principles into instructional action, which is a critical milestone in the change process (Tsakeni et al., 2026).

However, the comparatively moderate perceived instructional competence represents an important implementation constraint. Deep learning-oriented pedagogy involves orchestrating higher-order learning experiences such as problem-based inquiry, metacognitive prompting, and transfer tasks that require distinct instructional skill sets beyond conventional teaching routines (Gordon et al., 2023). In primary education, this challenge is amplified by structural conditions such as limited instructional time, broad curriculum coverage demands, and classroom management complexity. Consequently, it is theoretically coherent that teachers may show high affective alignment and intention while expressing moderate confidence in their ability to operationalize deep learning strategies. This "attitude–competence gap" has been documented in reform contexts where professional learning support is insufficiently aligned with the practical demands of implementing innovative pedagogy (Sari et al., 2023).

The implications of this competence gap become especially significant when the reform target involves preventive health literacy. Health literacy frameworks emphasize that meaningful health learning requires not only knowledge acquisition but also critical evaluation of information, contextual reasoning, and the ability to apply health concepts to real-life decisions (WHO, 2023). These competencies map closely onto deep learning goals particularly conceptual understanding and transfer yet they are difficult to achieve through traditional, fact-based instruction. Evidence from health education scholarship suggests that interactive and participatory pedagogies are more likely to influence health-related awareness and behavior than information-centered approaches (Hair & Sabol, 2025). Therefore, moderate instructional competence may limit the depth of health literacy outcomes if teachers

lack confidence in facilitating inquiry-based discussions, guiding authentic projects, or assessing applied understanding in preventive health contexts.

Positioning hypertension prevention within primary education is also increasingly defensible from a public health perspective. While hypertension is often perceived as an adult condition, global trend evidence indicates that hypertension and related risk factors are relevant across the life course and have shown concerning trajectories in population health monitoring (Zhou et al., 2024). School-based health promotion frameworks further support the role of schools as strategic platforms for early preventive literacy and long-term health awareness, particularly when embedded within a whole-school approach (Yakavets et al., 2023). The present study advances this interdisciplinary logic by demonstrating that teachers in a primary school context can exhibit readiness to engage in preventive health instruction, provided that pedagogical competence is strengthened to support authentic, deep learning-based implementation.

Contextually, this study contributes by offering institutional-level evidence drawn from a complete teacher population within a bounded school setting. Much of the reform literature relies on broad, cross-system descriptions of readiness, yet implementation occurs within local organizational cultures shaped by leadership, collaboration, and contextual constraints (Fohlin, 2025). By using a census approach, this study provides a comprehensive readiness snapshot that can support localized planning. The confidence-interval-informed results also add interpretive precision by clarifying that affective and intentional readiness estimates are relatively stable within the institution, while instructional competence exhibits comparatively greater variability, suggesting that professional development may need to be differentiated to address uneven preparedness.

Practically, the findings imply that improvement strategies should prioritize competence-building rather than attitudinal persuasion. Since teachers already demonstrate positive disposition and intention, professional learning interventions should focus on operationalizing deep learning pedagogy in health education, including inquiry-based lesson design, authentic assessment approaches, and classroom routines for facilitating critical health discussion. This aligns with competency-oriented reform priorities emphasizing the translation of educational vision into teachable and assessable classroom practice (Feser et al., 2023). Professional development efforts may be strengthened through collaborative lesson study, peer mentoring, and structured teaching resources that model deep learning tasks specifically for health literacy content.

Several limitations should be acknowledged to avoid overgeneralization. The study was conducted in a single institutional context with a relatively small population size, which restricts generalizability beyond the school setting. In addition, readiness measures were self-reported, which may be influenced by social

desirability bias or perceived institutional expectations. Future research should extend this work through multi-site studies across diverse primary school contexts, incorporate longitudinal designs to examine whether readiness translates into actual instructional practice, and triangulate survey findings with classroom observation or instructional artifact analysis. Further studies may also explore downstream outcomes, such as student health literacy or preventive knowledge gains, to strengthen the empirical linkage between teacher readiness and learner-level impact (Hudiyawati et al., 2022).

Overall, this study underscores that integrating deep learning-based health education for hypertension prevention in primary schools is feasible from a readiness standpoint, particularly because teachers exhibit strong motivational and intentional alignment. However, sustainable implementation will depend on strengthening instructional competence through targeted pedagogical support. By bridging deep learning pedagogy with preventive health literacy within primary education, the findings contribute to reform scholarship that views instructional transformation as a multidimensional process requiring alignment across cognition, affect, competence, and enactment.

**Theoretical Contribution**

This study contributes theoretically by advancing an integrative perspective that bridges deep learning pedagogy and preventive health literacy within the framework of teacher readiness. While prior research has examined teacher readiness for curriculum reform (Nofamataro Zebua, 2025) and separate scholarship has explored health literacy implementation in schools (Shimizu et al., 2024), limited attention has been devoted to their intersection in primary education. By empirically examining readiness dimensions in the context of hypertension prevention instruction, this study conceptualizes readiness not merely as a generic reform construct, but as a context-sensitive mechanism through which interdisciplinary innovation becomes pedagogically actionable. The findings refine readiness theory by demonstrating that affective and intentional alignment may precede competence consolidation in emerging reform domains, thereby offering a nuanced model of staged pedagogical transformation in primary education settings.

**Practical Implications**

From a practical standpoint, the findings suggest that professional development (PD) initiatives should prioritize structured competence-building rather than attitudinal persuasion. Given that teachers already exhibit strong affective alignment and implementation intention, PD programs should focus on operational translation of deep learning principles into classroom practice. First, training modules should include guided lesson design workshops where teachers collaboratively construct inquiry-based health learning scenarios linked to real-life hypertension prevention contexts. Second, professional learning should incorporate

authentic assessment strategies that evaluate conceptual understanding and applied health reasoning rather than factual recall. Third, peer mentoring and lesson study cycles may be implemented to support iterative refinement of instructional practice. Finally, the development of exemplar teaching resources and structured instructional scaffolds specific to preventive health topics can reduce uncertainty and enhance instructional confidence. Such targeted interventions may bridge the observed competence gap and ensure sustainable integration of deep learning-based health education in primary schools.

## CONCLUSIONS AND RECOMMENDATIONS

This study examined teachers' readiness to implement deep learning-based health education for hypertension prevention within a primary school context. The findings indicate that overall readiness falls within the moderate-to-high range, with affective disposition and implementation intention emerging as the strongest dimensions. These results suggest that teachers demonstrate positive psychological alignment and willingness to adopt preventive health-oriented instructional innovation. However, the comparatively moderate level of perceived instructional competence highlights the need for targeted pedagogical support to translate readiness into sustained classroom enactment.

The study contributes to the growing discourse on instructional transformation by bridging deep learning pedagogy with preventive health literacy in primary education. By situating hypertension prevention within a deep learning framework, the research underscores the potential of primary schools to function not only as academic institutions but also as strategic platforms for long-term public health awareness. Although limited to a single institutional setting, the census-based design provides a comprehensive institutional readiness profile that can inform localized reform planning.

Future research is recommended to expand the scope through multi-site studies, longitudinal designs examining readiness-to-practice conversion, and integration of student-level health literacy outcomes. Additionally, structured professional development programs focused on lesson design, authentic assessment, and inquiry-based health instruction are recommended to strengthen teachers' instructional competence and ensure sustainable implementation.

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