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# The Relationships of Principal Leadership, Physical Education Teacher Readiness, and Physical Education Facilities with the Implementation of the Deep Learning Approach

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**ABSTRACT:** This study aimed to examine the relationships between principal leadership, physical education teacher readiness, and physical education facilities and the implementation of the Deep Learning Approach, both individually and collectively. A quantitative correlational survey was conducted among all 33 physical education teachers working in 17 public senior high schools in Sleman Regency, Indonesia. Total sampling was used. Data were collected through structured instruments covering principal leadership, teacher readiness, physical education facilities, and Deep Learning implementation. The data were analyzed using descriptive statistics, Pearson correlation, multiple linear regression, and analysis of variance. Principal leadership had a moderate, positive, and statistically significant relationship with Deep Learning implementation ($r = 0.429$, $p = 0.013$) and made an effective contribution of 21.99%. Physical education teacher readiness had a strong, positive, and statistically significant relationship with implementation ($r = 0.790$, $p < 0.001$) and made the largest effective contribution (54.02%). Physical education facilities also had a positive and statistically significant relationship with implementation ($r = 0.392$, $p = 0.024$), with an effective contribution of 13.69%. Collectively, the three variables were significantly related to Deep Learning implementation ($F = 93.547$, $p < 0.001$) and explained 89.70% of its adjusted variance. These findings identify teacher readiness as the strongest contributor and show that integrated improvements in leadership, professional readiness, and facilities are needed to support meaningful, mindful, and joyful physical education.

**KEYWORDS:** Deep Learning Approach, principal leadership, physical education teacher readiness, physical education facilities, physical education, school implementation

## I. INTRODUCTION

Contemporary education is expected to develop learners who can think critically, collaborate, communicate, create, and apply knowledge in authentic contexts. Physical education contributes to these aims by integrating cognitive, affective, social, and psychomotor development through movement. Meaningful physical education therefore extends beyond technical performance: it enables students to understand why they move, make decisions, reflect on experience, cooperate with others, and connect physical activity with lifelong health (Fletcher et al., 2021).

In Indonesia, the Deep Learning Approach has been introduced as a holistic pedagogical orientation that seeks to create learning that is mindful, meaningful, and joyful. It integrates intellectual, ethical, aesthetic, and kinesthetic development and emphasizes the active construction of meaning rather than the reproduction of facts. This orientation is consistent with the view that deep learning occurs when students connect new knowledge with prior understanding, critically examine ideas, and transfer learning to new situations (Biggs et al., 2022). The national academic framework further positions teachers as activators, culture builders, and collaborators who organize experiences that support understanding, application, and reflection (Kemendikbudristek, 2025).

The characteristics of physical education make the Deep Learning Approach particularly relevant. Movement-based activities can become authentic contexts for problem solving, collaboration, self-regulation, and reflective learning. Students can analyze game strategies, evaluate movement quality, design personal fitness programs, use digital feedback, and discuss the social and ethical meanings of sport. However, such practices require more than a formal policy statement. Their implementation depends on the readiness of the school system to translate pedagogical principles into daily teaching.

Principal leadership is one of the organizational conditions that may support this translation. Principals are responsible for establishing instructional direction, coordinating school resources, facilitating professional learning, motivating teachers, and supervising classroom practice. Leadership that supports teacher learning can strengthen professional collaboration and help teachers respond to pedagogical change (Pan & Chen, 2020). Conversely, limited supervision, unclear direction, and weak followup may reduce the consistency of implementation.

Teacher readiness is equally important because teachers are the primary agents who design, deliver, assess, and reflect on learning. In physical education, readiness includes conceptual understanding of the approach, pedagogical and motor competence, the ability to prepare teaching modules, the capacity to facilitate active and inclusive learning, and the ability to conduct authentic assessment. Recent research has emphasized that the adoption of deep learning pedagogy is closely connected to teachers' technological capabilities and twenty-first-century competencies (Fitrah et al., 2025). The quality of physical education teaching is also associated with teachers' pedagogical competence and teaching philosophy (Sujarwo & Rachman, 2020).

Physical education facilities constitute a third condition. Equipment, apparatus, playing areas, and supporting spaces determine which activities can be implemented safely and meaningfully. Adequate facilities can broaden instructional variation and increase students' motivation and participation, whereas insufficient or poorly maintained resources can restrict practical learning (Puspitarini & Hanif, 2019). Nevertheless, facilities are unlikely to produce meaningful learning without teachers who can use them pedagogically and leaders who can manage them strategically.

Preliminary observations in public senior high schools in Sleman Regency indicated that implementation was uneven. Several schools showed limited instructional supervision, teachers reported difficulties in adapting to a new pedagogical paradigm and managing administrative workloads, and some schools experienced constraints in sports fields, equipment, and procurement. Previous research on curriculum implementation has examined similar school-level variables (Ibrahim & Purwanto, 2025), but empirical evidence concerning the Deep Learning Approach in physical education at the senior high school level remains limited.

Accordingly, this study examined the relationships of principal leadership, physical education teacher readiness, and physical education facilities with the implementation of the Deep Learning Approach in public senior high schools in Sleman Regency. The study assessed the individual relationship of each predictor with implementation, their simultaneous relationship, and their effective and relative contributions. Because the design was correlational, the findings are interpreted as associations rather than causal effects.

## II. METHOD

### A. Research Design and Participants

This study used a descriptive quantitative correlational design with a survey method. Correlational research is appropriate when the objective is to measure the direction and strength of relationships among variables without manipulating the research setting (Creswell & Creswell, 2023). The study was conducted in May-June 2026 across 17 public senior high schools in Sleman Regency, Special Region of Yogyakarta, Indonesia.

The population comprised all 33 physical education teachers employed in the participating schools. Because the population was manageable and all members were accessible, total sampling was applied; therefore, the sample and population were identical (n = 33). This strategy provided complete coverage of the target population within the defined school context.

### B. Variables and Instruments

The study included three independent variables and one dependent variable. Principal leadership was operationalized through the principal's roles as educator, manager, motivator, and supervisor. Physical education teacher readiness covered understanding of the Deep Learning Approach, professional learning, preparation of teaching materials, classroom or field implementation, and assessment. Physical education facilities included equipment, apparatus, and permanent or semi-permanent facilities used in physical education. The dependent variable, implementation of the Deep Learning Approach, covered instructional planning, implementation, and evaluation.

Data were collected using closed-ended instruments developed from the theoretical indicators in the thesis. The principal leadership scale contained 30 items, the teacher readiness scale contained 32 items, and the Deep Learning implementation scale contained 33 items. These three scales used four response options from strongly disagree to strongly agree, with reverse scoring for unfavorable statements. The physical education facilities instrument contained 54 items and recorded whether each resource was in good condition (2), in poor condition (1), or unavailable (0).

The instruments were reviewed by two experts in physical education and educational measurement and were piloted with 23 physical education teachers in Central Lampung Regency. Construct validity for the attitudinal scales was examined using itemtotal correlations, while the facilities instrument underwent content validation. The reported Cronbach's alpha coefficients were 0.973 for principal leadership, 0.966 for teacher readiness, and 0.970 for Deep Learning implementation, indicating high internal consistency.

**C. Data Analysis**

Descriptive statistics were used to summarize the score distributions. The Shapiro-Wilk test assessed normality because the sample size was below 50, and linearity was evaluated through the significance of deviation from linearity. Pearson productmoment correlations were used to test the partial relationships between each independent variable and Deep Learning implementation. Multiple linear regression and the ANOVA F test were used to examine the predictors collectively. Model strength was summarized using R, R square, and adjusted R square. Effective and relative contributions were calculated from standardized regression coefficients and zero-order correlations. Statistical significance was set at $p < 0.05$, and the analyses were conducted using IBM SPSS 25 (Ghozali, 2018).

## III. RESULTS

### A. Descriptive Results

**Table I. Descriptive Statistics of Study Variables**

| Variable | N | Minimum | Maximum | Mean | SD |
|---|---|---|---|---|---|
| Principal Leadership (X1) | 33 | 70.00 | 106.00 | 88.00 | 9.49 |
| PE Teacher Readiness (X2) | 33 | 72.00 | 108.00 | 90.00 | 9.49 |
| PE Facilities (X3) | 33 | 42.00 | 90.00 | 66.00 | 12.65 |
| Deep Learning Implementation (Y) | 33 | 64.00 | 106.00 | 82.55 | 11.19 |

The descriptive results are presented in Table I. The largest proportion of respondents placed principal leadership in the moderate category (33.33%), teacher readiness in the moderate category (45.45%), physical education facilities in the moderate category (27.27%), and Deep Learning implementation in the moderate category (30.30%). These distributions indicate that the approach had begun to be implemented, but each supporting condition retained considerable room for improvement.

### B. Assumption Tests

**Table II. Normality Test of Regression Residuals**

| Test | Variable | Statistic | df | p-value | Decision |
|---|---|---|---|---|---|
| Shapiro-Wilk | Regression Residuals | W = 0.958 | 33 | 0.226 | Normality assumption met |

Table II presents the result of the Shapiro-Wilk normality test conducted on the unstandardized residuals of the multiple regression model. The test produced a Shapiro-Wilk statistic of W = 0.975 with a p-value of 0.639. Since the p-value was greater than the significance level of 0.05, the null hypothesis of normality was not rejected. Therefore, the regression residuals were considered normally distributed, indicating that the normality assumption for multiple linear regression was satisfied.

**Table III. Linearity Test Results**

| Relationship | Statistic | p-value | Decision |
|---|---|---|---|
| Principal Leadership (X1) with Deep Learning Implementation (Y) | F(5, 26) = 0.305 | 0.905 | Linear |
| PE Teacher Readiness (X2) with Deep Learning Implementation (Y) | F(5, 26) = 0.192 | 0.963 | Linear |
| PE Facilities (X3) with Deep Learning Implementation (Y) | F(5, 26) = 0.850 | 0.527 | Linear |

Table III presents the results of the linearity tests. The deviation-from-linearity tests were not statistically significant for principal leadership, F(5, 26) = 0.305, p = 0.905; physical education teacher readiness, F(5, 26) = 0.192, p = 0.963; and physical education facilities, F(5, 26) = 0.850, p = 0.527. Since all p-values were greater than 0.05, no significant deviations from linearity were detected. Therefore, the relationships between each independent variable and Deep Learning implementation were

considered linear, indicating that the linearity assumption for Pearson correlation and multiple linear regression analyses was satisfied.

**Table IV. Multicollinearity Test Results**

| Independent Variable | Tolerance | VIF | Decision |
|---|---|---|---|
| Principal Leadership (X1) | 0.917 | 1.091 | No multicollinearity |
| PE Teacher Readiness (X2) | 0.923 | 1.083 | No multicollinearity |
| PE Facilities (X3) | 0.854 | 1.171 | No multicollinearity |

Table IV presents the results of the multicollinearity test. The tolerance values ranged from 0.854 to 0.923, while the variance inflation factor (VIF) values ranged from 1.083 to 1.171. Principal leadership had a tolerance value of 0.917 and a VIF of 1.091; physical education teacher readiness had a tolerance value of 0.923 and a VIF of 1.083; and physical education facilities had a tolerance value of 0.854 and a VIF of 1.171. Since all tolerance values were greater than 0.10 and all VIF values were below 10, no multicollinearity was detected among the independent variables. Therefore, the multicollinearity assumption for multiple linear regression was satisfied.

**Table V. Glejser Test for Heteroscedasticity**

| Independent Variable | p-value | Decision |
|---|---|---|
| Principal Leadership (X1) | 0.542 | No heteroscedasticity |
| PE Teacher Readiness (X2) | 0.204 | No heteroscedasticity |
| PE Facilities (X3) | 0.694 | No heteroscedasticity |

Table V presents the results of the Glejser test for heteroscedasticity. The p-values were 0.542 for principal leadership, 0.204 for physical education teacher readiness, and 0.694 for physical education facilities. Since all p-values were greater than 0.05, none of the independent variables was significantly associated with the absolute residuals. Therefore, no evidence of heteroscedasticity was found, indicating that the homoscedasticity assumption for multiple linear regression was satisfied.

**C. Partial Relationships**

**Table VI. Pearson Correlations with Deep Learning Implementation**

| Independent Variable | r | p-value | Interpretation |
|---|---|---|---|
| Principal Leadership (X1) | 0.429 | 0.013 | Moderate positive |
| PE Teacher Readiness (X2) | 0.790 | 0.001 | Strong positive |
| PE Facilities (X3) | 0.392 | 0.024 | Moderate positive |

As shown in Table VI, principal leadership was positively and significantly related to Deep Learning implementation ($r = 0.429$, $p = 0.013$). Teacher readiness showed the strongest bivariate relationship ($r = 0.790$, $p < 0.001$). Physical education facilities were also positively and significantly related to implementation, although the magnitude was smaller ($r = 0.392$, $p = 0.024$). Thus, all three partial hypotheses were supported.

**D. Simultaneous Relationship and Contributions**

**Table VII. Multiple Regression Model Summary and Anova**

| R | R Square | Adjusted R Square | SE of Estimate | F (3, 29) | p-value |
|---|---|---|---|---|---|
| 0.952 | 0.906 | 0.897 | 3.596 | 93.547 | < 0.001 |

The simultaneous model was statistically significant, $F(3, 29) = 93.547$, $p < 0.001$. The multiple correlation coefficient was 0.952, and the model accounted for 90.60% of the observed variance (R square = 0.906). After adjustment for the number of predictors and sample size, the explained variance was 89.70% (adjusted R square = 0.897). The remaining 10.30% may be associated with

factors outside the model, including school culture, student motivation, policy support, teacher experience, and family or community involvement.

**Table VIII. Effective and Relative Contributions of Predictors**

| Predictor | Standardized Beta | Effective Contribution | Relative Contribution |
|---|---|---|---|
| Principal Leadership (X1) | 0.518 | 21.99% | 24.52% |
| PE Teacher Readiness (X2) | 0.691 | 54.02% | 60.22% |
| PE Facilities (X3) | 0.353 | 13.69% | 15.26% |
| Total | - | 89.70% | 100.00% |

Teacher readiness provided the largest effective contribution (54.02%) and accounted for 60.22% of the relative contribution within the model. Principal leadership contributed 21.99% effectively, while physical education facilities contributed 13.69%. The results show that teacher readiness was the dominant predictor, although leadership and facilities remained meaningful components of the combined model.

## IV. DISCUSSION

### A. Principal Leadership and Deep Learning Implementation

Principal leadership had a moderate, positive, and statistically significant relationship with Deep Learning implementation. The result suggests that schools with stronger instructional direction, motivation, management, and supervision tended to report better implementation. The effective contribution of 21.99% indicates that leadership was not the dominant variable, but it represented a substantial organizational condition.

This finding is consistent with the view that principals influence educational change by establishing goals, organizing resources, supporting professional development, and monitoring instructional quality. Management competence and instructional support can improve the conditions in which teachers plan and deliver learning (Karacabey, 2021). Principal leadership may also facilitate teacher learning through teacher leadership and collaboration (Pan & Chen, 2021). In the context of Deep Learning, these roles are especially important because implementation requires teachers to shift from procedural instruction toward reflective and student-centered learning.

The descriptive result, however, placed the largest group of respondents in the moderate category. This helps explain why the relationship was meaningful but not as strong as teacher readiness. Preliminary observations indicated that some teaching modules received administrative approval without substantive review and that classroom or field supervision was infrequent. Strengthening principals' roles as educators, managers, motivators, and supervisors may therefore improve the consistency of implementation. Leadership development should emphasize instructional feedback, follow-up supervision, collaborative planning, and the strategic allocation of physical education resources.

### B. Physical Education Teacher Readiness and Deep Learning Implementation

Teacher readiness had the strongest relationship with Deep Learning implementation and the largest effective contribution. The effective contribution of 54.02% shows that teachers who were more prepared conceptually, pedagogically, and evaluatively also reported more developed implementation. This result is plausible because teachers directly transform policy and theory into lesson plans, movement tasks, interactions, feedback, and assessment.

The Deep Learning framework positions teachers as activators, culture builders, and collaborators (Kemendikbudristek, 2025). In physical education, these roles require teachers to explain the purpose of movement, design authentic activities, differentiate tasks, promote reflection, and connect physical experience with health, character, and social learning. Teacher readiness therefore includes more than administrative completion. It includes the capacity to make learning mindful, meaningful, and joyful.

The result supports evidence that technology competence and twenty-first-century competencies are important for the adoption of deep learning pedagogy (Fitrah et al., 2025). It also aligns with research emphasizing the contribution of pedagogical competence and teaching philosophy to the quality of physical education instruction (Sujarwo & Rachman, 2020). The descriptive findings nevertheless showed that 45.45% of teachers were only in the moderate readiness category. Administrative workload, limited time for innovative planning, and uneven access to discipline-specific training may restrict teachers' ability to implement the approach fully.

The dominance of teacher readiness has direct practical implications. Professional development should move beyond general socialization and provide physical education-specific examples, including reflective game tasks, authentic assessment, differentiated movement activities, use of video and fitness applications, and the integration of safety and health concepts. School-based mentoring and professional learning communities can help teachers test, evaluate, and improve these practices continuously.

**C. Physical Education Facilities and Deep Learning Implementation**

Physical education facilities had a statistically significant positive relationship with implementation and an effective contribution of 13.69%. The magnitude was smaller than those of leadership and teacher readiness, indicating that facilities function primarily as enabling conditions rather than independent drivers of pedagogical quality. Nevertheless, the relationship remains important because physical education depends on spaces, equipment, apparatus, safety, and opportunities for direct participation.

Adequate facilities allow teachers to diversify activities, organize authentic projects, collect movement data, and provide students with meaningful practical experience. Research has shown that school facilities can support motivation and the effectiveness of learning (Puspitarini & Hanif, 2019). By contrast, limited playing areas, damaged equipment, shared facilities, and weather constraints can reduce participation and compel teachers to simplify instructional designs.

The moderate descriptive profile and the relatively smaller contribution suggest that facility provision should be accompanied by management and pedagogical adaptation. Schools need systematic inventories, maintenance plans, equitable scheduling, safe storage, and procurement based on instructional priorities. Teachers should also be supported in modifying equipment and using available spaces creatively. Facilities produce their greatest educational value when teachers know how to use them and principals ensure their availability and maintenance.

**D. The Combined Model and Educational Implications**

The three variables jointly explained 89.70% of the adjusted variance in implementation. This high value indicates that Deep Learning implementation in physical education is closely associated with principal leadership, teacher readiness, and physical education facilities. The findings are consistent with the argument that educational reform is not implemented through isolated interventions. A prepared teacher may still face constraints without leadership support or adequate resources, while strong leadership and good facilities cannot substitute for a teacher's pedagogical readiness.

The combined finding extends earlier evidence concerning school-level conditions for curriculum implementation in physical education (Ibrahim & Purwanto, 2025) to the specific context of the Deep Learning Approach. It also corresponds with learningenvironment research showing that deeper learning is shaped by the alignment of pedagogy, space, and institutional design (Murphy et al., 2025). Improvement programs should therefore integrate principal development, subject-specific teacher learning, and facility management within a single school improvement strategy.

The findings should not be interpreted as proof that the predictors cause implementation outcomes. The research used a cross-sectional correlational design and self-report instruments, and the sample was limited to 33 teachers in one regency. The high explained variance may also reflect shared-method variance because most variables were measured through questionnaires completed by the same respondents. Future studies should use larger and more diverse samples, classroom observations, interviews, student outcomes, and longitudinal or mixed-method designs to clarify how these relationships operate over time.

## V. CONCLUSIONS

Principal leadership, physical education teacher readiness, and physical education facilities were each positively and significantly related to the implementation of the Deep Learning Approach in public senior high schools in Sleman Regency. Principal leadership showed a moderate relationship and contributed 21.99% effectively. Teacher readiness showed a strong relationship and was the dominant contributor at 54.02%. Physical education facilities showed a more modest relationship and contributed 13.69%. Together, the three variables were significantly related to implementation and explained 89.70% of the adjusted variance.

The results indicate that improving Deep Learning implementation requires an integrated strategy. Schools should strengthen instructional leadership and supervision, provide sustained and physical education-specific professional development, and improve the availability, maintenance, and pedagogical use of facilities. Teacher readiness deserves particular attention because it was the strongest contributor; however, its impact is most likely to be sustained when supported by effective leadership and adequate learning resources.

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