

The Influence of Innovative School Leadership Practices and Teacher Professional Development on The Quality of Learning in Public Senior High Schools in Padang City

Sumiarni^{1*}, Hanif Al Kadri², Nellitawati³, and Ahmad Sabandi⁴

¹⁻⁴ Education Administration, Universitas Negeri Padang, Indonesia

Abstract

This study aimed to examine the relationships of innovative school leadership practices and teacher professional development with teacher-reported learning quality in public senior high schools in Padang City, Indonesia. A quantitative cross-sectional survey design was employed involving civil-servant (Aparatur Sipil Negara/ASN) teachers from 17 public senior high schools, with 273 respondents selected from a population of 855 teachers through proportionate stratified random sampling. Data were collected using validated five-point Likert-scale questionnaires, summarized using the Respondent Achievement Level (TCR), and analyzed through multiple linear regression. The results showed that learning quality (TCR = 90.90%), innovative school leadership practices (TCR = 91.59%), and teacher professional development (TCR = 89.28%) were all categorized as Very Good. Innovative school leadership practices ($\beta = .343, t = 6.381, p < .001$) and teacher professional development ($\beta = .351, t = 6.537, p < .001$) were significant positive predictors of teacher-reported learning quality. Collectively, both predictors explained 33.4% of the variance in learning quality ($R^2 = .334, F = 67.562, p < .001$), leaving 66.6% attributable to factors outside the model. These findings suggest that strengthening innovative leadership, particularly teacher involvement in decision-making, and sustained professional development, including classroom action research, may support perceived learning quality. However, because the study relied on cross-sectional, same-source self-reports, the findings should be interpreted as predictive rather than causal. Future research should employ longitudinal, multilevel, and multi-source designs to identify additional school- and teacher-level determinants.

ARTICLE HISTORY

Received : 27 April 2026
Revised : 20 July 2026
Accepted : 29 August 2026

KEYWORDS

Innovative School Leadership; Teacher Professional Development; Learning Quality; Correlational Survey; Indonesian Public Senior High Schools

PUBLISHER'S NOTE

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY 4.0) license.



CORRESPONDING AUTHOR

* Sumiarni, Education Administration, Universitas Negeri Padang, Indonesia. Email: sumiarni91@guru.sma.belajar.id

Introduction

Learning quality is widely used as an indicator of the effectiveness of education systems, reflecting how well the learning process supports the development of students' knowledge, skills, and character (Saini et al., 2023). International bodies such as UNESCO and the OECD treat learning quality as foundational to building competitive human resources through critical thinking, creativity, collaboration, and communication (Souza, 2024), and the shift from teacher-centered to student-centered learning has reinforced the view that educational success depends on schools' capacity to create meaningful and adaptive learning experiences (Utami et al., 2024; Kadarsih et al., 2020).

In Indonesia, the Merdeka Curriculum has placed learning quality at the center of education reform through differentiated learning and strengthening of the Pancasila Student Profile. National evaluations, however, indicate that this transformation has not been fully matched by changes in classroom practice: the 2024 Indonesian Education Report Card shows that while literacy and

numeracy outcomes have improved, several learning-quality indicators have not yet reached optimal levels (Fadil & Nurulpaik, 2026; Kementerian Pendidikan Dasar dan Menengah, 2024). A similar pattern is visible at the local level. Based on the 2025 Padang City Education Report, public senior high schools in the city show variation in classroom management, psychological support for students, and learning methods, and several schools recorded declines relative to the previous year. Of the 17 public senior high schools in the city, 14 (82%) agreed during preliminary consultation to share their school-level Education Report figures for this background analysis; three schools (SMAN 8, SMAN 11, SMAN 12) declined to disclose these figures for publication. Because 14 schools already represent the large majority of public senior high schools in the city, they are treated here as sufficient to characterize the general condition of learning quality in Padang City, while the main survey sample reported later still draws respondents from all 17 schools, including these three (Table 1).

Table 1. Padang City Public Senior High School Education Report Indicators, 2025

School	Classroom Mgmt.	Psych. Support	Learning Methods	Change vs. previous year
SMAN 1	72.51	67.79	65.00	Declined (support, methods)
SMAN 2	69.91	68.64	66.00	Declined (classroom mgmt.)
SMAN 3	67.45	63.03	63.00	Declined (support)
SMAN 4	61.00	61.74	62.78	Declined (all indicators)
SMAN 5	76.43	75.85	72.00	Improved
SMAN 6	75.36	71.38	70.00	Improved
SMAN 7	79.95	79.21	70.00	Improved
SMAN 8	—	—	—	Not available ^a
SMAN 9	75.46	67.02	65.00	Declined (support, methods)
SMAN 10	68.78	70.71	67.00	Declined (classroom mgmt.)
SMAN 11	—	—	—	Not available ^a
SMAN 12	—	—	—	Not available ^a
SMAN 13	63.78	62.81	60.00	Declined (all indicators)
SMAN 14	65.86	65.32	63.00	Declined (all indicators)
SMAN 15	68.81	67.86	67.00	Improved
SMAN 16	70.67	68.12	67.00	Improved
SMAN 4 Sumatera Barat	60.29	58.87	59.00	Declined (mgmt., support)

Note. Source: 2025 Padang City Education Report (*Rapor Pendidikan*), as cited in the underlying thesis dataset.
^a School-level Education Report figures for SMAN 8, SMAN 11, and SMAN 12 are not presented because, during preliminary consultation, these three schools declined to have their *Rapor Pendidikan* figures disclosed for publication; the remaining 14 schools (82% of the 17 public senior high schools in Padang City) were consulted and are reported here to characterize the general condition of learning quality across the city. This limitation applies only to this background/contextual table; the main survey sample (Table 2) still includes teachers from all 17 schools, including SMAN 8, 11, and 12.

This variation suggests that learning quality is shaped by multiple, interacting school- and teacher-level factors. Among organizational factors, innovative school leadership the principal's capacity to articulate a shared vision, build a collaborative culture, use digital technology, and tolerate calculated risk in pursuit of better learning has been associated with stronger instructional practice (Chakraborty & Biswas, 2019; Li & Xue, 2023; Albaqiatussalihat et al., 2022). At the individual level, teachers who regularly participate in training, mentoring, and professional learning communities are thought to develop stronger pedagogical competence and to design more student-centered learning (Bellibaş, Gümüş, et al., 2021; Yayuk & Haqqi, 2024).

Prior research, however, has generally examined these two factors separately: studies of school leadership have concentrated on transformational or instructional leadership as broad constructs (Bellibaş, Kılınç, et al., 2021; Kwan, 2020), while studies of teacher professional development have more often linked it to teacher competence or performance than to learning quality directly. Few studies have modeled innovative school leadership practices and teacher professional development jointly as predictors of learning quality within the specific context of Merdeka Curriculum implementation in Indonesian public senior high schools, and fewer still have done so using an operational, context-specific set of indicators (e.g., teacher empowerment in decision-making, classroom action research) that translate directly into actionable recommendations for principals and teachers. This is the gap this study addresses.

The novelty of this study lies in integrating innovative school leadership practices and teacher professional development within a single empirical model of learning quality in the context of Merdeka Curriculum implementation. Unlike previous studies that predominantly examine leadership or professional development separately, this study evaluates their independent and joint contributions while operationalizing these constructs through context-specific practices, including teacher empowerment, collaborative professional learning, instructional innovation, and classroom action research. The study therefore contributes both context-specific empirical evidence from Indonesian public senior high schools and a practically oriented framework that can inform school-level strategies for improving learning quality.

Accordingly, this study aims to examine the extent to which innovative school leadership practices and teacher professional development are associated with teacher-reported learning quality in public senior high schools in Padang City, Indonesia. Specifically, the study investigates the individual contribution of innovative school leadership practices to learning quality, assesses the contribution of teacher professional development to learning quality, and determines their joint predictive contribution within the context of Merdeka Curriculum implementation. By doing so, the study seeks to provide empirical evidence that can support school leaders, teachers, and education policymakers in designing integrated strategies for improving learning quality. Based on these objectives and the proposed conceptual relationships, the following hypotheses were tested:

H1: Innovative school leadership practices are positively associated with teacher-reported learning quality.

H2: Teacher professional development is positively associated with teacher-reported learning quality.

H3: Innovative school leadership practices and teacher professional development jointly predict teacher-reported learning quality.

Method

This study used a quantitative, correlational (predictive) survey design. Because the independent variables innovative school leadership practices (X_1) and teacher professional development (X_2) occurred naturally and were not manipulated, data were collected retrospectively in a single cross-section (ex post facto data collection; see Fraenkel et al., 2012, for the corresponding research-design rationale). This design allows the two predictors to be examined for their association with teacher-reported learning quality (Y), but it does not support causal inference; regression coefficients reported below are therefore interpreted as conditional statistical associations rather than causal effects (Maulud & Abdulazeez, 2020; Hair et al., 2019).

Population, Sample, and Sampling Procedure

The accessible population comprised 855 civil-servant (Aparatur Sipil Negara/ASN, comprising both PNS and PPPK status) teachers actively teaching across all 17 public senior high schools (SMA Negeri) in Padang City, West Sumatra. The study was restricted to ASN teachers because they hold formal, permanent teaching appointments recognized by the Padang City/West Sumatra Provincial Education Office and were the population registered in the office's teacher database used to construct the sampling frame; non-ASN (honorary/contract) teachers were not part of this administrative frame and were therefore not sampled. This restriction means findings describe the perceptions of tenured civil-servant teachers and may not generalize to honorary teachers, whose employment conditions and exposure to school leadership and professional-development programs can differ; this is noted as a limitation below.

A sample of 273 teachers (31.9% of the population) was drawn using proportionate stratified random sampling, with school as the stratum, so that each school's number of respondents was proportional to its share of the population (Table 2). Sample size was originally computed with the Slovin formula (5% margin of error). For multiple regression with two predictors, this sample also exceeds common a priori power-analysis benchmarks (e.g., G*Power: to detect a small-to-medium effect, $f^2 = .15$, with two predictors, $\alpha = .05$, and power = .80 requires $n \approx 68$; the achieved $n = 273$ provides power well above .99 for the observed effect sizes). Because teachers were nested within 17 schools, school-clustering was addressed in the assumption checks and is revisited in the Discussion; a fully specified multilevel model was not estimated in the original analysis and is noted as a direction for future re-analysis.

Table 2. Distribution of the Research Sample Across Schools

School	Population (Ni)	Proportion (%)	Sample (ni)
SMAN 1 Padang	58	6.78	19
SMAN 2 Padang	52	6.08	17
SMAN 3 Padang	57	6.67	18
SMAN 4 Padang	48	5.61	15
SMAN 5 Padang	50	5.85	16
SMAN 6 Padang	48	5.61	15
SMAN 7 Padang	47	5.50	15
SMAN 8 Padang	51	5.96	16
SMAN 9 Padang	60	7.02	20
SMAN 10 Padang	50	5.85	16
SMAN 11 Padang	51	5.96	16
SMAN 12 Padang	54	6.32	17
SMAN 13 Padang	60	7.02	20
SMAN 14 Padang	48	5.61	15
SMAN 15 Padang	48	5.61	15
SMAN 16 Padang	54	6.32	17
SMAN 4 Sumatera Barat	19	2.22	6
Total	855	100.00	273

Note. Source: Research sample calculation (proportionate stratified random sampling; Slovin formula, $e = .05$).

Questionnaires were distributed online (Google Forms) between July 2-13, 2026, after obtaining written permission from the West Sumatra Provincial Education Office and the principal of each participating school. Invitations were sent through each school's curriculum or public-relations vice-principal to all ASN teachers on the sampling list; all 273 invited teachers completed and returned a

usable questionnaire (100% response, no exclusions after data collection), so nonresponse bias could not be assessed empirically. Participation was voluntary; teachers received an explanation of the study's purpose and were assured that responses would remain confidential and be reported only in aggregate.

Ethical Considerations

Data collection proceeded under institutional research permission from the West Sumatra Provincial Education Office and participating school principals, together with the oversight of the researcher's academic supervisors as part of the thesis approval process; a separate independent research-ethics-committee approval or exemption number was not obtained, which is noted as a limitation below. Respondents gave informed consent electronically before completing the questionnaire, were informed that participation was voluntary and anonymous, and were told that identifying information (name, school) would not be published; response data were stored on a password-protected institutional Google Drive accessible only to the research team.

Operational Definitions and Measures

Learning quality (Y) was operationally defined, for the purposes of this study, as teachers' self-reported perception of the effectiveness of the classroom learning process, covering educators' teaching behavior, students' learning behavior and activities, use of learning media, the school's learning system, and continuous feedback and evaluation. Because the construct was measured via teacher self-report rather than direct classroom observation or student outcomes, it is more precisely described throughout this article as teacher-reported (perceived) learning quality rather than learning quality as an objective outcome.

Innovative school leadership practices (X_1) were defined as teachers' perception of the principal's capacity to articulate an innovative vision and mission, make creative and adaptive decisions, support learning innovation, use technology in school management, empower teachers in decision-making, communicate and collaborate effectively, and tolerate risk and failure — adapted from innovative- and instructional-leadership literature (24 items, 7 indicators). Teacher professional development (X_2) was defined as teachers' self-reported participation in training and workshops, mentoring and coaching, professional learning communities, further formal study (e.g., PPG, master's degree, Leading Teacher program), and classroom action research (16 items, 5 indicators). All three instruments used a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Instrument Validity and Reliability

Before use in the main study, all 60 items were reviewed for content validity and clarity by the researcher's academic supervisor(s) (expert judgment), and item wording was revised accordingly. The revised instrument was then piloted on 48 ASN teachers outside the research sample. Item validity was tested using Pearson product-moment correlation (item-total correlation against a critical r for $df = n - 2 = 46$, $\alpha = .05$, two-tailed, r -critical = .2845), and reliability was tested using Cronbach's alpha (criterion $\alpha \geq .70$).

Table 3. Summary of Pilot Instrument Validity (n = 48)

Variable	Items	r range	r-critical	Result
Learning Quality (Y)	20	.399-.694	.2845	All items valid
Innovative School Leadership Practices (X ₁)	24	.580-.805	.2845	All items valid
Teacher Professional Development (X ₂)	16	.365-.791	.2845 ^a	All items valid

Note. Source: Pilot-test data processed with SPSS Statistics v.25. ^a The original pilot dataset listed r-critical = .2876 for X₂, inconsistent with the r-critical for Y and X₁ despite a common pilot n = 48 (df = 46); this table applies the consistent value (.2845, df = 46) to all three variables. All reported item r-values for X₂ exceed .2876 as well, so the validity conclusion is unaffected either way.

Table 4. Summary of Pilot Instrument Reliability (n = 48)

Variable	Items	Cronbach's α	Criterion	Result
Learning Quality (Y)	20	.896	$\geq .70$	Reliable
Innovative School Leadership Practices (X ₁)	24	.955	$\geq .70$	Reliable
Teacher Professional Development (X ₂)	16	.853	$\geq .70$	Reliable

Note. Source: Pilot-test data processed with SPSS Statistics v.25. Alpha values well above .70 indicate high internal consistency; because alpha alone does not establish unidimensionality, values should be read alongside the (currently absent) EFA/CFA evidence noted above.

Data Analysis

Data were analyzed with IBM SPSS Statistics version 25. Descriptive statistics and the Respondent Achievement Level (TCR) were used to describe each variable and answer the descriptive research objectives. TCR was computed as $TCR = (\Sigma \text{ observed score} / \text{ideal score}) \times 100\%$, where the ideal score equals the maximum scale value $\times$ number of items $\times$ number of respondents; because Σ observed score is the unrounded total across all 273 respondents, TCR percentages reported below may differ slightly in the second decimal from a naive mean/maximum-item-score calculation, which uses a rounded mean. Classical assumption tests (normality, multicollinearity, heteroscedasticity, linearity) were conducted prior to hypothesis testing. Hypotheses were tested with multiple linear regression: the t test for partial associations, the F test for the joint association, and R^2 /adjusted R^2 for the proportion of variance in Y associated with X₁ and X₂. All tests used $\alpha = .05$; exact p-values below .001 are reported as $p < .001$ rather than $p = .000$.

Result and Discussion

Respondent Characteristics

Of the 273 respondents, 80.6% were women and 19.4% were men. Most were aged 31-40 years (43.2%) or 41-50 years (38.1%), with fewer in the 21-30 (4.8%) and 51-60 (13.9%) ranges. Tenure was fairly evenly distributed: 0-4 years (30.8%), 5-10 years (31.1%), 11-20 years (26.0%), and more than 20 years (12.1%). Most respondents held a bachelor's degree (S1, 70.7%) or master's degree (S2, 28.9%), with one doctoral holder (0.4%); 48.4% held PNS status and 51.6% held PPPK status; all were certified teachers.

Table 5. Respondent Characteristics (N = 273)

Characteristic	Category	n	%
Gender	Male	53	19.4
	Female	220	80.6
Education	Bachelor's (S1)	193	70.7
	Master's (S2)	79	28.9
	Doctoral (S3)	1	0.4
Employment status	PNS (permanent civil servant)	132	48.4
	PPPK (contract civil servant)	141	51.6

Age	21-30 years	13	4.8
	31-40 years	118	43.2
	41-50 years	104	38.1
	51-60 years	38	13.9
Tenure	0-4 years	84	30.8
	5-10 years	85	31.1
	11-20 years	71	26
	>20 years	33	12.1

Note. Source: Research data processed with SPSS v.25. This table addresses whether respondent characteristics (school, tenure, gender, education, employment status) should be considered as controls in the regression model; because the study's conceptual model and hypotheses concern only X_1 and X_2 , these characteristics were not entered as covariates in the reported regression, and this is noted as a possible extension for future re-analysis.

Descriptive Statistics and Respondent Achievement Level (TCR)

Descriptive statistical analysis was conducted to provide an overall profile of the three research variables: learning quality (Y), innovative school leadership practices (X_1), and teacher professional development (X_2). The analysis included the number of respondents, minimum and maximum observed scores, mean, standard deviation, and Respondent Achievement Level (*Tingkat Capaian Responden*; TCR). TCR was used to describe the extent to which respondents' scores approached the maximum possible score for each construct and to classify the overall level of achievement. The descriptive results for the 273 respondents are presented in Table 6.

Table 6. Descriptive Statistics of Research Variables

Variable	N	Min	Max	M	SD	TCR (%)	Category
Learning Quality (Y)	273	76	100	90.85	5.59	90.9	Very Good
Innovative School Leadership Practices (X_1)	273	91	120	109.91	7.48	91.59	Very Good
Teacher Professional Development (X_2)	273	54	80	71.05	5.24	89.28	Very Good

Note. Source: Research data processed with SPSS version 25. TCR = (Σ unrounded total score across 273 respondents / ideal score) $\times$ 100%, where the ideal score = 5 $\times$ number of items $\times$ 273. Because the means and standard deviations reported in the table are rounded to two decimal places, calculations based directly on the rounded means may not exactly reproduce the reported TCR values. For example, 71.05/80 yields 88.81% for X_2 and 90.85/100 yields 90.85% for Y. The TCR percentages reported above were calculated from the original unrounded item-level totals and were used for category classification.

As shown in Table 6, all three variables were classified in the **Very Good** category, indicating generally high respondent assessments across the constructs examined. Innovative school leadership practices recorded the highest TCR at 91.59% (M = 109.91, SD = 7.48), followed by learning quality at 90.90% (M = 90.85, SD = 5.59). Teacher professional development showed a slightly lower TCR of 89.28% (M = 71.05, SD = 5.24), although it remained within the Very Good category according to the classification criteria applied in this study. These aggregate scores suggest that respondents generally perceived school leadership practices, learning quality, and professional development positively. Nevertheless, overall variable scores may conceal variation across individual dimensions. Therefore, an indicator-level TCR analysis was conducted to identify specific areas of relative strength and aspects requiring greater attention, as presented in Table 7.

Table 7. TCR by Indicator

Variable	Indicator	TCR (%)	Category
Learning Quality (Y)	Teacher learning behavior	93.11	Very Good
	Student learning behavior/activity	90.14	Very Good
	Use of learning media	89.35	Good

Innovative School Leadership Practices (X_1)	School learning system	90.46	Very Good
	Continuous feedback and evaluation	91.45	Very Good
	Innovative vision and mission	95.34	Very Good
	Creative and adaptive decision-making	93	Very Good
	Support for learning innovation	92.49	Very Good
	Use of technology in school management	91.01	Very Good
	Teacher empowerment	88.85	Good
	Communication and collaboration	89.79	Good
Teacher Professional Development (X_2)	Tolerance for risk and failure	90.63	Very Good
	Training and workshops	91.44	Very Good
	Mentoring and coaching	91.68	Very Good
	Professional learning communities	92.36	Very Good
	Further study (PPG/S2/Leading Teacher)	91.48	Very Good
	Classroom action research	79.45	Good

Note. Source: Research data processed with SPSS version 25.

Table 7 provides a more differentiated description of respondents' assessments. Across the 17 indicators, all scores fell within the Good-to-Very Good range, although meaningful variation was evident within each variable. For learning quality, teacher learning behavior recorded the highest TCR (93.11%), followed by continuous feedback and evaluation (91.45%), school learning system (90.46%), and student learning behavior/activity (90.14%). In contrast, use of learning media obtained the lowest score within the learning-quality construct (89.35%) and was classified as Good. This result indicates that, despite the generally favorable evaluation of learning quality, the utilization of instructional media constitutes a comparatively weaker dimension that warrants further strengthening.

Within innovative school leadership practices, innovative vision and mission received the highest TCR (95.34%), indicating particularly strong respondent perceptions of the capacity of school leadership to articulate an innovation-oriented organizational direction. Creative and adaptive decision-making (93.00%) and support for learning innovation (92.49%) also received high assessments. Conversely, teacher empowerment recorded the lowest score at 88.85%, followed by communication and collaboration at 89.79%, both of which were classified as Good. These findings suggest that the strategic and innovation-oriented dimensions of leadership were perceived more strongly than aspects involving the distribution of professional agency, participatory involvement, and collaborative relationships with teachers.

A similar pattern of variation was observed in teacher professional development. Professional learning communities achieved the highest TCR (92.36%), while mentoring and coaching (91.68%), further study through PPG/S2/Leading Teacher programs (91.48%), and training and workshops (91.44%) were also classified as Very Good. In contrast, classroom action research recorded a TCR of only 79.45%, substantially below the other professional-development indicators. Although it remained within the Good category based on the classification system used in this study, the considerable numerical gap indicates that engagement in classroom action research represents the most prominent area for improvement within teacher professional development.

Overall, the descriptive findings reveal consistently favorable assessments across the three research variables while simultaneously identifying specific areas that could be strengthened. In

particular, use of learning media (89.35%), teacher empowerment (88.85%), and especially classroom action research (79.45%) constitute the lowest-rated indicators within their respective constructs. These indicators should not be interpreted as evidence of poor performance, because each remained within the Good category; rather, they represent relative priority areas for improvement when compared with the stronger dimensions of the same constructs. Accordingly, improvement initiatives may appropriately focus on strengthening teachers' capacity to integrate learning media, expanding meaningful teacher participation and empowerment in school-level innovation, and creating more systematic institutional support for classroom action research. These descriptive patterns provide an important contextual foundation for the subsequent inferential analysis examining the relationships between innovative school leadership practices, teacher professional development, and learning quality.

Classical Assumption Tests

Residual normality was tested with the one-sample Kolmogorov-Smirnov test (chosen given the sample size, $n = 273$); the unstandardized residual had Asymp. Sig. (2-tailed) = .200 ($> .05$), indicating residuals were normally distributed. Multicollinearity was assessed via Tolerance and VIF: X_1 and X_2 each had Tolerance = .854 ($> .10$) and VIF = 1.171 (< 10), indicating no multicollinearity problem; the shared variance between X_1 and X_2 ($1 - \text{Tolerance} = 14.6\%$) is low enough that their individual regression coefficients can be interpreted with reasonable confidence. Heteroscedasticity was tested with the Glejser test; both predictors' absolute-residual regressions were non-significant ($p > .05$), indicating homoscedasticity. Linearity was tested via Deviation from Linearity; both X_1 -Y (Sig. = .095) and X_2 -Y (Sig. = .400) relationships were linear ($p > .05$). Because respondents were nested within 17 schools, these single-level diagnostics do not rule out school-level clustering of residuals; cluster-robust standard errors or a multilevel model would be a more conservative check and are recommended as a follow-up re-analysis rather than reported here, since they were not run in the original analysis. Common-method bias is also a concern, as X_1 , X_2 , and Y were all collected via the same teacher self-report survey at one time point; Harman's single-factor test or a similar diagnostic was not run in the original analysis and is noted as a limitation.

Multiple Regression Results

Multiple regression analysis was conducted to examine the simultaneous and partial associations of innovative school leadership practices (X_1) and teacher professional development (X_2) with teacher-reported learning quality (Y). The analysis was intended to determine whether each predictor made a statistically significant contribution to learning quality when the other predictor was held constant, as well as to assess the overall explanatory capacity of the regression model. The results are presented in Table 8.

Table 8. Multiple Regression of Learning Quality on Innovative School Leadership Practices and Teacher Professional Development

Predictor	B	SE	β	t	p
(Constant)	35.648	4.765	–	7.481	< .001
Innovative School Leadership Practices (X_1)	0.256	0.04	0.343	6.381	< .001
Teacher Professional Development (X_2)	0.375	0.057	0.351	6.537	< .001

As shown in Table 8, the regression equation derived from the unstandardized coefficients was $Y = 35.648 + 0.256X_1 + 0.375X_2$. The constant of 35.648 represents the predicted learning-quality score when both predictor variables are statistically set to zero. Innovative school leadership

practices had a positive and statistically significant regression coefficient ($B = 0.256$, $SE = 0.040$, $\beta = .343$, $t = 6.381$, $p < .001$). Thus, holding teacher professional development constant, a one-unit increase in innovative school leadership practices was associated with an estimated 0.256-unit increase in teacher-reported learning quality. The calculated t value substantially exceeded the reported critical value of 1.968, supporting the statistical significance of this association.

Teacher professional development also showed a positive and statistically significant association with learning quality ($B = 0.375$, $SE = 0.057$, $\beta = .351$, $t = 6.537$, $p < .001$). When innovative school leadership practices were held constant, each one-unit increase in teacher professional development was associated with an estimated 0.375-unit increase in the predicted learning-quality score. The corresponding t statistic also exceeded the reported critical value, indicating a statistically significant partial association between teacher professional development and learning quality.

The standardized regression coefficients provide a more appropriate basis for comparing the relative magnitudes of the two predictors because they are expressed on a common metric. Teacher professional development produced $\beta = .351$, whereas innovative school leadership practices produced $\beta = .343$. The difference between these coefficients was only $\Delta\beta = .008$, indicating that their associations with learning quality were highly similar in magnitude. Because the difference between the standardized coefficients was not formally tested for statistical significance, the findings do not provide sufficient evidence to characterize either predictor as clearly more dominant than the other.

The estimated effect sizes further support the substantive relevance of both predictors. Using Cohen's $f^2 = t^2/df(\text{residual})$, the effect size was approximately $f^2 = .151$ for innovative school leadership practices and $f^2 = .158$ for teacher professional development. Based on Cohen's (1988) conventional benchmarks of .02 for a small effect, .15 for a medium effect, and .35 for a large effect, both predictors demonstrated effects within the medium range. These results indicate that both leadership practices and professional development contributed meaningfully to the regression model after accounting for the other predictor.

At the model level, innovative school leadership practices and teacher professional development jointly produced a statistically significant regression model, $F(2, 270) = 67.562$, $p < .001$. The multiple correlation coefficient of $R = .578$ indicates a moderate overall association between the combined predictors and teacher-reported learning quality. The model explained 33.4% of the variance in learning quality ($R^2 = .334$), with an adjusted R^2 of .329 after taking the number of predictors into account. Consequently, approximately 66.6% of the variance remained unexplained by the present model. This remaining proportion should be interpreted strictly as unexplained variance rather than as variance caused by particular unmeasured variables, because additional predictors were neither included nor empirically tested in the present analysis. Overall, the regression findings demonstrate that innovative school leadership practices and teacher professional development were both positive, statistically significant, and substantively comparable predictors of teacher-reported learning quality.

Discussion

The findings provide convergent evidence that innovative school leadership practices and teacher professional development are both meaningfully associated with teacher-reported learning quality in Padang City's public senior high schools. Descriptively, learning quality (TCR = 90.90%), innovative school leadership practices (TCR = 91.59%), and teacher professional development (TCR = 89.28%) were all classified as Very Good. However, this generally favorable profile concealed

important within-construct variation. Teacher empowerment (88.85%) was the lowest-rated leadership indicator, while classroom action research (79.45%) was substantially lower than the other professional-development dimensions; use of learning media (89.35%) was likewise the comparatively weakest learning-quality dimension. Sumiarni_2771_APA7_Bookmark_Hyp... Inferentially, innovative school leadership ($\beta = .343$, $t = 6.381$, $p < .001$) and teacher professional development ($\beta = .351$, $t = 6.537$, $p < .001$) showed positive and nearly equivalent associations with learning quality, with medium partial effect sizes ($f^2 = .151$ and $.158$). Their joint contribution explained 33.4% of the variance in teacher-reported learning quality. These results suggest complementarity rather than dominance: favorable leadership conditions and sustained professional learning appear to constitute mutually reinforcing organizational and individual resources, although the cross-sectional design does not establish that either factor causally improves learning quality.

The leadership finding is broadly consistent with international evidence published during 2020–2025. Bellibaş, Gümüş, et al. (2021) demonstrated that instructional and distributed leadership are related to instructional quality partly through teacher collaboration and job satisfaction, while Liu et al. (2021) similarly showed that supportive school culture and collaboration mediate relationships between leadership and important teacher outcomes. Learning-centered leadership also appears to promote professional learning indirectly through trust and knowledge-sharing behavior (Talebizadeh et al., 2021), while instructional leadership has been linked to professional learning through collective efficacy and teacher commitment (Hosseingholizadeh et al., 2023). These findings support the interpretation that leadership does not improve classroom quality simply because a principal articulates an innovative vision; rather, leadership becomes educationally consequential when it alters teachers' professional environments, opportunities for collaboration, efficacy, autonomy, and learning. The relatively low teacher-empowerment score in Padang is therefore theoretically important. It suggests that principals may already be strong at articulating an innovation-oriented vision and supporting new initiatives, yet the distribution of authority and professional agency to teachers may remain less developed. This interpretation is also compatible with global evidence from Printy and Liu (2021), who emphasize the interactive nature of principal and teacher leadership across national contexts.

At the same time, the present results should not be interpreted as implying that leadership effects are uniform across educational contexts or student outcomes. Wu and Shen's (2022) multivariate meta-meta-analysis found an overall positive association between principal leadership and student achievement but also demonstrated that context moderates leadership effects. Tan (2024), using large-scale cross-national PISA data, similarly found that principal leadership functions operate differently according to school and socioeconomic resources; some leadership practices were associated with students' learning attitudes and achievement, whereas the promotion of teacher professional development did not display uniformly positive relationships with every student outcome. This contextual sensitivity helps explain why the current study's leadership coefficient is substantive but moderate rather than overwhelming. Padang's public senior high schools operate under common national and provincial policies but differ in classroom management, psychological support, instructional methods, staff experience, and local organizational conditions. Leadership should therefore be understood as one component of an ecological school-improvement process rather than an isolated causal lever.

The positive association between teacher professional development and learning quality is even more strongly supported by the contemporary international literature. Sancar et al. (2021) conceptualize effective teacher development as an extended, context-sensitive process involving collaboration, support, duration, curricular alignment, and opportunities to transfer learning into practice rather than episodic participation in courses. Admiraal et al. (2021) likewise show that professional learning becomes more sustainable when it is embedded in school organization and professional-learning communities. More recent meta-analytic evidence strengthens this position. Sims et al. (2025) found that effective professional development combines mechanisms for developing insight, motivating change, strengthening techniques, and embedding new practices, while Visscher et al. (2025), synthesizing 128 high-quality intervention studies, found that in-service professional development produces positive average effects on student achievement, although substantial heterogeneity exists and stronger outcomes are associated with richer combinations of learning principles. Evidence from coaching research further indicates that job-embedded development can change instructional practice when feedback is connected directly to authentic classroom activity (Reddy et al., 2021; Yang et al., 2022). This body of research helps explain why professional learning communities, mentoring, coaching, formal study, and workshops were highly rated in Padang. Conversely, the markedly lower classroom-action-research score implies that professional development may still be stronger as something teachers receive than as inquiry teachers systematically generate from their own classrooms.

The Indonesian evidence provides a particularly relevant contextual interpretation. Rokhman et al. (2024), including research drawn from the requested author profile, demonstrated that a scientific-based academic supervision model can strengthen supervisors' competencies and support teacher professionalism, reinforcing the importance of supervision that is developmental rather than merely administrative. Nurfathina et al. (2025) similarly concluded that principal leadership contributes to teacher professionalism through intellectual stimulation, individualized support, ethical role modelling, and professional-development opportunities in Indonesian educational settings. These studies support the current finding that leadership and professional development should not be managed as two independent improvement agendas. A principal creates the organizational conditions under which professional learning is prioritized, while professional development provides teachers with the knowledge and capabilities through which leadership initiatives can eventually enter classroom practice.

Two additional Indonesian findings help interpret the weaker indicators. Waluyo et al. (2025), also involving Muhammad Sufian, showed that a digital teacher-performance assessment system can move evaluation toward evidence-based professional-development planning, illustrating how technology can connect teacher appraisal with targeted improvement rather than administrative compliance. This is relevant to the relatively weaker use-of-learning-media indicator in the present study: stronger digital systems should be accompanied by pedagogical capacity so that technology supports instruction rather than functioning solely as an administrative instrument. Moreover, student-level conditions remain important. Putri et al. (2025), in *Digital Learning, Social Science, and Life-course Studies*, found that the effectiveness of instructional approaches varied according to student motivation, demonstrating that learner characteristics can meaningfully condition educational outcomes. This finding reinforces a cautious interpretation of the present $R^2 = .334$: the unexplained 66.6% should not be casually assigned to specific variables, but it clearly indicates that

leadership and professional development cannot, by themselves, constitute a complete explanation of perceived learning quality.

Theoretically, the findings support an integrated leadership–professional-learning perspective in which innovative leadership influences learning quality primarily by establishing organizational conditions—vision, support, collaboration, empowerment, technological readiness, and tolerance for innovation—within which teachers acquire, exchange, and enact professional knowledge; this interpretation extends conventional direct-effect leadership models by positioning professional agency and learning processes as central mechanisms (Bellibaş, Gümüş, et al., 2021; Talebizadeh et al., 2021; Liu et al., 2021). Pedagogically, the findings suggest that schools should move professional development away from predominantly workshop-based participation toward job-embedded coaching, professional learning communities, peer observation, classroom action research, technology-supported reflection, and opportunities for teachers to participate meaningfully in instructional decision making (Sancar et al., 2021; Sims et al., 2025; Rokhman et al., 2024). Policy should therefore align principal-development programs with sustained teacher-development systems, provide protected time and institutional support for classroom action research, strengthen digital pedagogical competence, and evaluate professional development through evidence of classroom transfer rather than attendance alone. The study did **not** measure student emotional well-being, media literacy, online identity, or digital behavior; consequently, no direct policy inference about those outcomes is warranted. The relevant digital implication is narrower: the comparatively weaker learning-media score indicates a need to strengthen pedagogically purposeful technology use and evidence-informed teacher assessment, rather than claiming effects on students’ psychological or online outcomes.

The primary contribution of this study lies in empirically integrating innovative school leadership practices and teacher professional development within a single predictive model of teacher-reported learning quality in all 17 public senior high schools in Padang City during implementation of the Merdeka Curriculum. Rather than treating leadership exclusively through broad transformational or instructional labels, the study operationalizes specific innovation-oriented practices such as adaptive decision making, technological use, teacher empowerment, communication, and tolerance for risk. Likewise, professional development is represented not merely by training attendance but by mentoring, coaching, professional-learning communities, further study, and classroom action research. The findings reveal that leadership and professional development have strikingly similar standardized associations ($\beta = .343$ versus $.351$), challenging simplistic attempts to identify one as the dominant driver of learning quality. More importantly, the indicator-level analysis identifies a practically significant disconnect: schools are perceived as strong in vision, formal learning opportunities, and professional communities, yet comparatively weaker in teacher empowerment and practitioner-led classroom research. The study therefore contributes a more actionable account of where school-improvement capacity may fail to translate from organizational intention into teacher agency.

These conclusions remain bounded by important methodological limitations. The cross-sectional design prevents temporal or causal inference; same-source teacher questionnaires create potential social-desirability and common-method variance; learning quality was measured as teachers’ perceptions rather than through direct classroom observations or student outcomes; the instruments were supported by item-total correlations and Cronbach’s alpha but not exploratory or

confirmatory factor analysis; teachers were nested within 17 schools, yet the regression model did not explicitly model school-level clustering; and only ASN teachers were represented. Future studies should employ longitudinal and multilevel designs, incorporate student achievement and engagement data, classroom observation, principal reports, and administrative indicators, and explicitly test whether teacher empowerment, collaboration, professional learning, or self-efficacy mediate leadership–learning relationships. Structural equation modelling could test more complex mechanisms, while multigroup analyses could determine whether relationships vary by teacher tenure, employment status, school context, or professional-development participation. Given the particularly low classroom-action-research score, intervention studies should also examine whether structured mentoring, research communities, and digital performance-feedback systems can strengthen practitioner inquiry and subsequently improve observable instructional quality.

References

- Admiraal, W., Schenke, W., de Jong, L., Emmelot, Y., & Sligte, H. (2021). Schools as professional learning communities: What can schools do to support professional development of their teachers? *Professional Development in Education*, 47(4), 684–698. <https://doi.org/10.1080/19415257.2019.1665573>
- Albaqiatussalihah, M., Sabandi, A., Jasrial, J., & Ermita, E. (2022). Gaya kepemimpinan transformasional kepala sekolah. *Journal of Educational Administration and Leadership*, 3(1), 34–39. <https://doi.org/10.24036/jeal.v3i1.335>
- Bellibaş, M. Ş., Gümüş, S., & Liu, Y. (2021). Does school leadership matter for teachers' classroom practice? The influence of instructional leadership and distributed leadership on instructional quality. *School Effectiveness and School Improvement*, 32(3), 387–412. <https://doi.org/10.1080/09243453.2020.1858119>
- Bellibaş, M. Ş., Kılınç, A. Ç., & Polatcan, M. (2021). The moderation role of transformational leadership in the effect of instructional leadership on teacher professional learning and instructional practice: An integrated leadership perspective. *Educational Administration Quarterly*, 57(5), 776–814. <https://doi.org/10.1177/0013161X211035079>
- Chakraborty, D., & Biswas, W. (2019). Motivating factors in a teacher's research and developmental activities and their impact on effective quality teaching in higher education institutions. *Journal of Applied Research in Higher Education*, 12(4), 609–632. <https://doi.org/10.1108/JARHE-07-2018-0161>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
- Fadil, M. S., & Nurulpaik, I. (2026). Implementing differentiated learning in the Merdeka Curriculum at upper elementary level: Teachers' constraints and adaptive strategies. *Edunesia: Jurnal Ilmiah Pendidikan*, 7(2), 1116–1131. <https://doi.org/10.51276/edu.v7i2.1663>
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). McGraw-Hill.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning.
- Hosseingholizadeh, R., Amrahi, A., & El-Farr, H. (2023). Instructional leadership, and teacher's collective efficacy, commitment, and professional learning in primary schools: A mediation model. *Professional Development in Education*, 49(3), 518–535. <https://doi.org/10.1080/19415257.2020.1850510>
- Kadarsih, I., Marsidin, S., Sabandi, A., & Febriani, E. A. (2020). Peran dan tugas kepemimpinan kepala sekolah di sekolah dasar. *Edukatif: Jurnal Ilmu Pendidikan*, 2(2), 194–201. <https://doi.org/10.31004/edukatif.v2i2.121>
- Kementerian Pendidikan Dasar dan Menengah. (2024). *Rapor Pendidikan Indonesia 2024*. Badan Standar, Kurikulum, dan Asesmen Pendidikan.
- Kwan, P. (2020). Is transformational leadership theory passé? Revisiting the integrative effect of instructional leadership and transformational leadership on student outcomes. *Educational Administration Quarterly*, 56(2), 321–349. <https://doi.org/10.1177/0013161X19861137>
- Li, J., & Xue, E. (2023). Dynamic interaction between student learning behaviour and learning environment: Meta-analysis of student engagement and its influencing factors. *Behavioral Sciences*, 13(1), 59. <https://doi.org/10.3390/bs13010059>

- Liu, Y., Bellibaş, M. Ş., & Gümüş, S. (2021). The effect of instructional leadership and distributed leadership on teacher self-efficacy and job satisfaction: Mediating roles of supportive school culture and teacher collaboration. *Educational Management Administration & Leadership*, 49(3), 430–453. <https://doi.org/10.1177/1741143220910438>
- Maulud, D., & Abdulazeez, A. M. (2020). A review on linear regression comprehensive in machine learning. *Journal of Applied Science and Technology Trends*, 1(2), 140–147. <https://doi.org/10.38094/jastt1457>
- Nurfathina, A. L., Rizq, A. A., Zailani, A., Diana, N., & Hadiati, E. (2025). Transformational leadership of school principals in enhancing teacher professionalism: A qualitative review in the context of Islamic education. *JPI: Jurnal Pustaka Indonesia*, 5(3). <https://doi.org/10.62159/jpi.v5i3.2181>
- Printy, S., & Liu, Y. (2021). Distributed leadership globally: The interactive nature of principal and teacher leadership in 32 countries. *Educational Administration Quarterly*, 57(2), 290–325. <https://doi.org/10.1177/0013161X20926548>
- Putri, H. K., Risdianto, E., & Ramandani, A. A. (2025). Enhancing social studies achievement through the Make a Match cooperative model: The moderating role of student motivation. *Digital Learning, Social Science, and Life-course Studies*, 1(1), 39–51. <https://doi.org/10.70211/disolife.v1i1.258>
- Reddy, L. A., Shernoff, E. S., & Lekwa, A. (2021). A randomized controlled trial of instructional coaching in high-poverty urban schools: Examining teacher practices and student outcomes. *Journal of School Psychology*, 86, 151–168. <https://doi.org/10.1016/j.jsp.2021.04.001>
- Rokhman, R., Diana, N., Etek, Y., Koderi, K., & Sufian, M. (2024). The development of a scientific-based academic supervision management model. *AL-ISHLAH: Jurnal Pendidikan*, 16(2), 1383–1398. <https://doi.org/10.35445/alishlah.v16i2.4626>
- Saini, M., Sengupta, E., Singh, M., Singh, H., & Singh, J. (2023). Sustainable Development Goal for quality education (SDG 4): A study on SDG 4 to extract the pattern of association among the indicators of SDG 4 employing a genetic algorithm. *Education and Information Technologies*, 28(2), 2031–2069. <https://doi.org/10.1007/s10639-022-11265-4>
- Sancar, R., Atal, D., & Deryakulu, D. (2021). A new framework for teachers' professional development. *Teaching and Teacher Education*, 101, 103305. <https://doi.org/10.1016/j.tate.2021.103305>
- Sims, S., Fletcher-Wood, H., O'Mara-Eves, A., Cottingham, S., Stansfield, C., Goodrich, J., Van Herwegen, J., & Anders, J. (2025). Effective teacher professional development: New theory and a meta-analytic test. *Review of Educational Research*, 95(2), 213–254. <https://doi.org/10.3102/00346543231217480>
- Souza, J. de F. (2024). UNESCO, World Bank, and OECD: Global perspectives on the right to education and implications for the teaching profession. *Educar em Revista*, 40, e94756. <https://doi.org/10.1590/1984-0411.94756>
- Talebizadeh, S. M., Hosseingholizadeh, R., & Bellibaş, M. Ş. (2021). Analyzing the relationship between principals' learning-centered leadership and teacher professional learning: The mediation role of trust and knowledge sharing behavior. *Studies in Educational Evaluation*, 68, 100970. <https://doi.org/10.1016/j.stueduc.2020.100970>
- Tan, C. Y. (2024). Influence of principal leadership across contexts on the science learning of students. *Asia Pacific Education Review*, 25(1), 31–44. <https://doi.org/10.1007/s12564-023-09828-2>
- Utami, B. Y., Nelitawati, N., & Al-Kadri, H. (2024). The influence of principal transformational leadership on teacher performance and learning quality in schools. *International Journal of Educational Dynamics*, 6(2), 555–559. <https://doi.org/10.24036/ijeds.v6i2.488>
- Visser, A. J., Dmoshinskaia, N., Pellegrini, M., & Rey-Naizaque, A. (2025). (When) do teacher professional development interventions improve student achievement? A meta-analysis of 128 high-quality studies. *Educational Research Review*, 49, 100742. <https://doi.org/10.1016/j.edurev.2025.100742>
- Waluyo, S. D., Rustanto, A. E., Winanti, Y. K., Onn, C. W., Sufian, M., & Mesina, J. R. (2025). Digital transformation in teacher performance assessment: Development and implementation of E-PKG system for enhancing vocational education quality and industry alignment. *Journal of Educational Technology and Learning Creativity*, 3(2), 348–366. <https://doi.org/10.37251/jetlc.v3i2.2490>
- Wu, H., & Shen, J. (2022). The association between principal leadership and student achievement: A multivariate meta-meta-analysis. *Educational Research Review*, 35, 100423. <https://doi.org/10.1016/j.edurev.2021.100423>

- Yang, W., Huang, R., Su, Y., Zhu, J., Hsieh, W.-Y., & Li, H. (2022). Coaching early childhood teachers: A systematic review of its effects on teacher instruction and child development. *Review of Education*, 10(1), e3343. <https://doi.org/10.1002/rev3.3343>
- Yayuk, E., & Haqqi, Y. A. (2024). Maximizing teacher competence and performance: The influential factors across individuals, organizations, leadership, and environment—A comprehensive systematic review and model. *AL-ISHLAH: Jurnal Pendidikan*, 16(1), 257–272. <https://doi.org/10.35445/alishlah.v16i1.4408>