

Principal Leadership, School Climate, and Perceived School Productivity in Indonesian Vocational High Schools: Evidence from Solok Regency

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Abstract

Vocational high schools require organizational conditions that support effective resource use, instructional quality, and outcomes aligned with the world of work, yet evidence on how leadership and school climate relate to teacher-perceived school productivity remains limited. This study examined the associations of principal leadership and school climate with perceived school productivity in state vocational high schools in Solok Regency, Indonesia. A cross-sectional correlational survey was conducted with 150 teachers selected from a population of 240 using proportional random sampling. Data were collected using five-point Likert questionnaires and analyzed with descriptive statistics, bivariate correlations, and multiple regression. Principal leadership was positively but weakly associated with perceived school productivity ($r = .188$, $R^2 = .035$, $p = .021$), as was school climate ($r = .177$, $R^2 = .031$, $p = .031$). In the joint model, principal leadership and school climate showed a statistically significant but weak association with perceived school productivity ($R = .251$, $R^2 = .063$, $p = .008$), leaving 93.7% of the observed variance unexplained by the two-predictor model. These findings support an association-based rather than causal interpretation. Principal leadership and school climate may be relevant components of broader school-management conditions, but their practical importance should be considered alongside teacher capacity, resources, organizational processes, student characteristics, and external partnerships. Future research should use longitudinal or multilevel designs and objective school-level productivity indicators.

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Introduction

Vocational high schools are expected to convert educational resources into effective learning processes, employability-oriented competencies, and organizational outcomes that remain responsive to changing labor-market demands. In this setting, school performance is shaped by interacting organizational processes rather than by a single managerial input, and leadership effects frequently operate through instructional conditions, teacher collaboration, professional learning, and the wider school climate (Dutta & Sahney, 2022; Leithwood et al., 2020; Liebowitz & Porter, 2019; Wu & Shen, 2022). This perspective is particularly relevant to vocational high schools because their performance involves not only academic outcomes but also efficient resource use, stakeholder confidence, and the capacity to prepare graduates for further study, employment, or entrepreneurship.

Conceptually, institutional school productivity may encompass resource efficiency, educational-process quality, graduate quality, labor-market outcomes, and public trust. Empirically, however, the present study does not directly observe administrative, financial, or graduate-tracer

outcomes; it measures teachers' perceptions of school productivity through questionnaire responses. Accordingly, the term perceived school productivity is used to describe teachers' evaluations of how effectively their schools achieve educational goals, use resources, maintain process quality, and generate valued outcomes. This distinction is important because stakeholder perceptions provide meaningful organizational information but are not interchangeable with objective school-level indicators (Molinari & Grazia, 2023; Shen et al., 2021; Veletić et al., 2023).

The organizational demands placed on vocational schools also require leadership that connects internal school improvement with external relevance. Evidence from vocational education indicates that leadership, planning, human-resource management, and school-industry partnerships can support the alignment of educational practice with occupational requirements (Meirawan et al., 2022). More broadly, leadership-development initiatives have been associated with school improvement when they strengthen evidence-informed practice and professional learning communities (Agirdag & Muijs, 2023), while recent Indonesian evidence highlights the importance of adaptive, collaborative leadership in periods of institutional change (Sandy, 2024). Digital forms of transformational leadership have likewise been linked to teacher commitment and perceived school effectiveness, although such relationships remain context dependent (Berkovich & Hassan, 2025).

The study is situated in state vocational high schools (SMKs) in Solok Regency, Indonesia. These schools operate under comparable public-sector regulations while offering different vocational specializations and serving communities with varying resource conditions. Previous Indonesian work has emphasized the importance of strategic vocational-school management, principal leadership, and organizational learning for school development. In the present context, perceived school productivity is therefore examined as an organizational assessment made by teachers rather than as a direct measure of graduate employment or institutional efficiency.

Earlier Indonesian scholarship framed school productivity in relation to resource management, work climate, leadership, and institutional effectiveness. These perspectives remain useful as contextual foundations, but contemporary school-effectiveness research increasingly emphasizes multilevel organizational mechanisms and the need to distinguish perceived organizational conditions from objective outcomes. This distinction is especially important when all variables are collected from the same respondent group because the resulting associations reflect teachers' shared perceptions of leadership, climate, and productivity rather than direct causal effects on institutional outputs.

Principal leadership is theoretically relevant because school leaders shape priorities, instructional support, professional learning, collaboration, and organizational conditions under which teachers work. Contemporary reviews and large-scale studies show that instructional, distributed, and transformational leadership can be associated with teacher and school outcomes, but the magnitude and pathway of these relationships vary substantially across contexts (Bellibaş et al., 2021; Carrington et al., 2022; Daniëls et al., 2019; Heystek, 2022; Liu et al., 2021, 2022; Oppi et al., 2022). This evidence supports a leadership-for-learning perspective in which principals influence organizational capacity indirectly as well as directly, rather than functioning as an isolated determinant of school performance.

School climate represents another organizational condition through which teachers experience their workplace. Earlier school-climate research emphasized the quality of interpersonal relationships, support, safety, innovation, autonomy, and work pressure. More recent evidence

shows that school climate is associated with instructional quality, informal professional learning, teacher enthusiasm, teacher self-efficacy, stress, and academic outcomes (Heinla & Kuurme, 2024; Holzberger & Schiepe-Tiska, 2021; Huang & Wang, 2021; Kouhsari et al., 2024; López et al., 2023; A. Nguyen et al., 2023). These findings indicate that climate should be treated as a multidimensional organizational construct rather than as a general description of whether a school feels pleasant or unpleasant.

Leadership and school climate are also theoretically intertwined. Transformational and instructional leadership can shape organizational health, supportive culture, collaboration, and teachers' efficacy, while climate can mediate or condition how leadership is experienced in daily practice (García-Martínez et al., 2021; Ma & Marion, 2024; Park & Byun, 2021; Velarde et al., 2022). Cross-national evidence further indicates that teachers and principals may perceive the same school climate differently, reinforcing the need to define whose perceptions are being analyzed (Veletić et al., 2023). In this study, both leadership and climate are evaluated from the teacher perspective, and the outcome is likewise teacher-perceived school productivity.

School productivity is unlikely to be explained by leadership and climate alone. Research on instructional-program coherence, collaborative inquiry, school learning organizations, middle leadership, and improvement in complex school systems demonstrates that organizational performance can also depend on curriculum coherence, teacher collaboration, professional learning, distributed expertise, and the capacity to coordinate improvement across organizational levels (Cravens & Hunter, 2021; Gouëdard et al., 2023; Highfield & Rubie-Davies, 2022; Malone et al., 2021; Moon et al., 2022). For vocational schools, these internal conditions interact with the additional requirement to sustain productive relationships with business and industry (Meirawan et al., 2022).

Within Indonesian educational management, leadership has long been discussed in relation to managerial responsibility, discipline, human-resource development, and school improvement. These traditions provide local conceptual continuity, but they should be read alongside international empirical work that cautions against assuming a uniform leadership effect across schools. Comparative studies have shown that leadership associations differ by national and organizational context and may depend on the specific leadership dimension, teacher response, or school process under consideration (Chen et al., 2022; Chen & Bos, 2023).

The international evidence base therefore points to a clear gap relevant to this study. Leadership has been linked to instructional quality, collaboration, teacher efficacy, and student achievement, while school climate has been linked to teacher and student outcomes; however, fewer studies examine principal leadership and school climate simultaneously in relation to teacher-perceived organizational productivity, particularly in Indonesian vocational high schools. In addition, research on educational leadership in developing contexts continues to emphasize the need for context-sensitive models and stronger methodological alignment between constructs, levels of analysis, and outcome measures (Baysu et al., 2023; Gamliel & Shapira-Lishchinsky, 2023; Hallinger, 2019; Khalfaoui et al., 2021; McChesney & Cross, 2023; Shen et al., 2020).

The present study addresses this gap by testing a parsimonious model in which principal leadership and school climate are examined as teacher-reported organizational predictors of teacher-perceived school productivity. The contribution is deliberately bounded: it does not claim that leadership or climate causes objective school productivity, but assesses whether teachers who report more favorable leadership and climate also report higher school productivity within the observed

vocational-school context. This framing aligns the interpretation with the cross-sectional survey design and with contemporary evidence showing that leadership–performance relationships are often indirect, context-sensitive, and modest in magnitude (Dutta & Sahney, 2022; Shen et al., 2021; Wu & Shen, 2022).

The empirical setting includes state vocational high schools in Solok Regency, which share public-school governance arrangements while differing in specialization programs and local operating conditions. These characteristics provide a relevant context for examining whether organizational perceptions covary across multiple vocational schools rather than within a single institution. The analysis nevertheless remains teacher-level and perception-based; consequently, school-level heterogeneity and clustering require consideration when interpreting the findings.

At one participating school, SMK Negeri 1 Singkarak, principal leadership was described in the source manuscript through behaviors related to responsibility, commitment, facility provision, professional development, teacher participation in subject-teacher forums, supervision, discipline, and attendance monitoring. This school-level description is retained as contextual information and is not treated as evidence that the same leadership pattern applies uniformly across all participating vocational high schools.

The selection of state vocational high schools (SMKs) in Solok Regency as the research setting was based on their shared public-school status, broadly comparable governance and funding arrangements, and their range of vocational specialization programs. These common institutional features provide a coherent setting for examining the associations among teacher-reported leadership, school climate, and perceived school productivity while recognizing that teachers remain nested within different schools.

Initial observations on Monday, August 4, 2025, at SMK Negeri 1 Singkarak, based on information from Mairiswen, S.Ag., Deputy Principal for Student Affairs, indicated a decline in applicants. According to the manuscript's Basic Education Data (Dapodik) information for 2025, the school had 73 students across Grades 10, 11, and 12 and 27 teaching staff, reported as a 1:3 ratio. The source manuscript also noted a perceived mismatch between graduates and labor-market needs. These observations are presented only as contextual background for one participating school and are not generalized as evidence of a regency-wide productivity problem.

The source manuscript further reports that the school performance profile was generally good but included indicators requiring attention: literacy (84%), numeracy (64%), character, graduate employment, graduate income, graduate competence, learning quality, pedagogical leadership, and school climate. Graduate competency was classified as insufficient. These contextual indicators illustrate why organizational productivity warrants examination, but they should not be treated as equivalent to the questionnaire-based outcome analyzed in this study, which represents teachers' perceptions of school productivity.

Based on the theoretical and empirical synthesis above, this study examines three hypotheses: H1, principal leadership is positively associated with teacher-perceived school productivity; H2, school climate is positively associated with teacher-perceived school productivity; and H3, principal leadership and school climate are jointly associated with teacher-perceived school productivity. By testing these associations in state vocational high schools in Solok Regency, the study aims to contribute context-specific evidence while keeping claims proportionate to a cross-sectional, single-informant design.

Method

This study used a cross-sectional correlational survey design to estimate associations among teachers' perceptions of principal leadership, school climate, and school productivity at one point in time. The population comprised 240 teachers working in the state vocational high schools included in the Solok Regency study, and 150 teachers were selected using proportional random sampling from the school-based sampling frame. The design supports association and prediction analyses but does not establish temporal order or causal effects (Creswell & Creswell, 2022; Sugiyono, 2022). The sample size was calculated using the following finite-population formula:

$$n = \frac{N}{1 + N \cdot e^2}$$

Description:

n = sample size

N = population size (240 people)

e = margin of error (0.05)

Based on the sampling method, the sample size for this study was 150 teachers. Principal leadership and school climate were treated as predictor constructs, while teacher-perceived school productivity was the criterion construct. Data were collected using questionnaires with a five-point Likert response format ranging from 1 (strongly disagree) to 5 (strongly agree). The manuscript reports 24 items for each variable. Questionnaire responses were used to obtain construct scores, with higher scores indicating more favorable teacher perceptions. Because all three constructs were reported by the same teachers at the same time, the analysis is susceptible to common-method variance and the results must be interpreted as associations rather than causal effects. Methodological guidance for survey-based quantitative analysis informed the descriptive and regression procedures.

Descriptive statistics were used to summarize the distributions of the three study variables. Bivariate associations were examined using correlation coefficients, and the joint association of principal leadership and school climate with perceived school productivity was evaluated using multiple linear regression. Statistical significance was evaluated at $p < .05$. The available statistical output included R, R^2 , and p values for the bivariate and joint models.

Result and Discussion

Result

This section presents the research findings and discussion. The questionnaires used in the study consisted of 24 items for each variable. For the schools productivity variable, the highest score was 150 and the lowest was 85, with a range of 35; the mean score was 102.93, the standard deviation was 6.54, the median was 102, and the mode was 109, with 9 classes and an interval width of 4, the results showed that 18.67% of respondents scored in the average range, 42.66% scored above the mean, and 38.67% scored below the mean.

For the principal leadership variable, the highest score obtained was 120 and the lowest was 88, resulting in a range of 32. The mean score was 108.85, the standard deviation was 8.55, the median was 110, and the mode was 100; with 8 classes and an interval width of 4, the distribution showed that 16.00% of respondents scored in the average range, 40.67% scored above the mean, and 43.33% scored below the mean.

For the school climate variable, the highest score obtained was 120 and the lowest was 84, resulting in a range of 36. The mean score was 106.29, the standard deviation was 7.18, and both the

median and mode were 107. With 8 classes and an interval width of 5, the distribution showed that 24.67% of respondents scored within the average range, 43.33% scored above the mean, and 32.00% scored below the mean.

School Productivity

Based on the description of the school productivity data, the frequency distribution of the scores can be observed as shown in the table below.

Table 1. School Productivity Distribution

Class Interval	Frequency	Percentage (%)
85-88	1	0.67
89-92	4	2.67
93-96	20	13.33
97-100	33	22.00
101-104	28	18.67
105-108	24	16.00
109-112	32	21.33
113-116	7	4.67
117-120	1	0.67
Total	150	100

The frequency distribution of the data above can be represented as a histogram, as shown below.

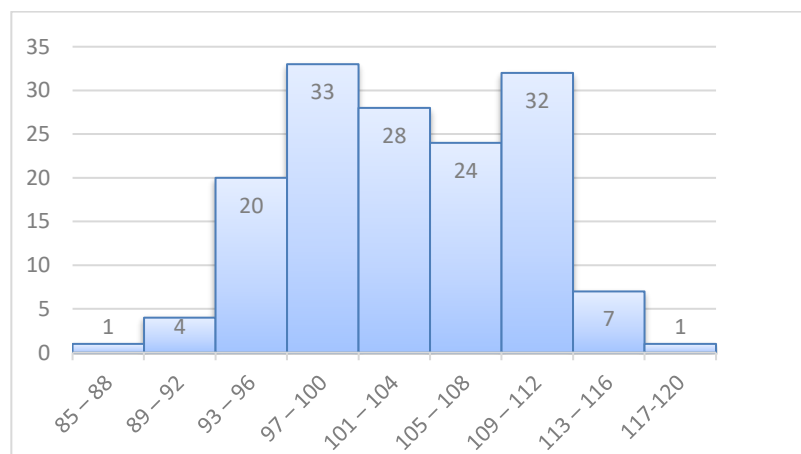


Figure 1. Histogram of School Productivity

Respondent ratings regarding the school productivity variable, based on specific indicators, are as follows: a. effectiveness of goal achievement sub-indicators: 1) attainment of educational goals 89.33% ("good" category), 2) student achievement and graduate quality 87.02% ("good" category), 3) school dropout and grade retention rates 86.84% ("good" category); b. internal and external efficiency sub-indicators: 1) resource utilization 85.78% ("good" category), 2) benefits of graduates to the community and the workforce 86.31% ("good" category); c. process quality sub-indicators: 1) student motivation and interest in learning 86.80% ("good" category), 2) teacher work spirit and discipline 84.18% ("good" category), 3) level of public trust 79.91% ("fairly good" category). The overall average of the calculated respondent achievement levels is 85.77 ("good" category).

Principal Leadership

Based on the description of the Principal Leadership data, the frequency distribution of the scores can be observed as shown in the table below.

Table 2. School Principal Leadership Distribution

Class Interval	Frequency	Percentage (%)
88-92	7	4.67
93-96	7	4.67
97-100	21	14.00
101-104	16	10.67
105-108	14	9.32
109-112	24	16.00
113-116	22	14.67
117-120	39	26.00
Total	150	100

The frequency distribution of the data above can be represented as a histogram, as shown below.

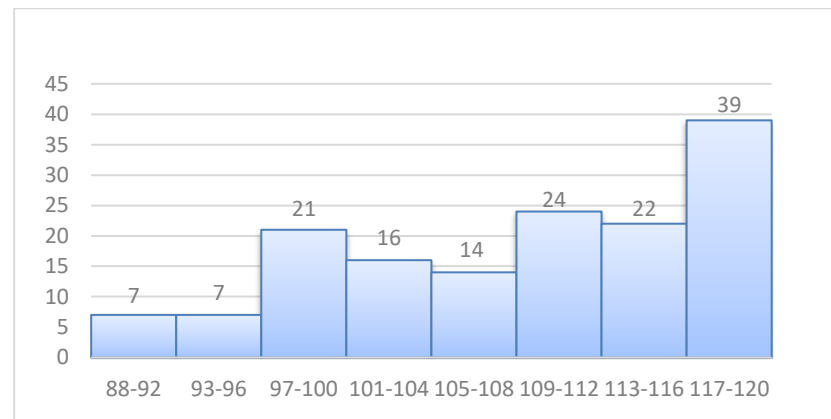


Figure 2. Histogram of Principal Leadership

Respondent ratings regarding the principal leadership variable, based on specific indicators, are as follows: a. Motivating work spirit 89.47% ("good" category), b. Fostering discipline 91.42% ("very good" category), c. Providing consultation 89.73% ("good" category); d. Building active and creative working relationships 90.58% ("very good" category), e. Demonstrating exemplary attitudes and behavior 88.93% ("good" category); f. Developing teacher professionalism 93.33% ("very good" category), g. Conducting teacher supervision 90.93% ("very good" category), h. Providing rewards 91.29% ("Very good" category). The overall average of the calculated respondent achievement levels is 90.71% ("Very good" category).

School Climate

Based on the description of the School Climate data, the frequency distribution of the scores can be observed as shown in the table below.

Table 3. School Climate Distribution

Class Interval	Frequency	Percentage (%)
84-88	3	2.00
89-93	3	2.00
94-98	17	11.33
99-103	25	16.67

Class Interval	Frequency	Percentage (%)
104-108	37	24.67
109-113	44	29.33
114-118	19	12.67
119-123	2	1.33
Total	150	100

The frequency distribution of the data above can be represented as a histogram, as shown below.

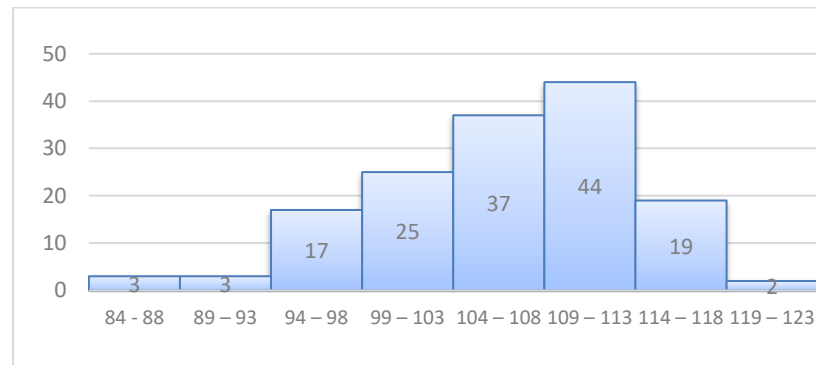


Figure 3. Histogram of School Climate

Respondent ratings regarding the school climate variable, based on specific indicators, are as follows: a. affiliation 86.40% ("good" category), b. innovation 90.18% ("very good" category), c. participation in decision-making 88.44% ("good" category); d. professional interest 88.89% ("good" category), e. adequacy of resources 88.13 % ("good" category); f. staff autonomy 89.33% ("good" category), g. student support 87.87% ("good" category), h. work pressure 89.80% ("good" category). The overall average of the calculated respondent achievement levels is 88.58% ("good" category).

Across the observed sample, principal leadership was positively and statistically significantly associated with teacher-perceived school productivity ($r = .188$, $R^2 = .035$, $p = .021$), while school climate showed a similarly positive but weak association ($r = .177$, $R^2 = .031$, $p = .031$). In the simultaneous model, the multiple correlation was $R = .251$ and $R^2 = .063$ ($p = .008$), indicating that principal leadership and school climate jointly accounted for 6.3% of the observed variance in perceived school productivity. The remaining 93.7% of the variance was not explained by this two-predictor model. These results indicate statistically detectable but weak associations and should not be interpreted as causal effects.

Discussion

The central finding is that principal leadership and school climate are each positively associated with teacher-perceived school productivity, but the observed relationships are weak. For principal leadership, $r = .188$ and $R^2 = .035$ indicate that the bivariate association is small even though $p = .021$. This pattern is consistent with international evidence showing that principal leadership is related to school outcomes but often through indirect organizational and instructional pathways rather than a large direct effect (Bellibaş et al., 2021; Chen & Bos, 2023; Dutta & Sahney, 2022; Shen et al., 2021; Wu & Shen, 2022). Leadership-development studies likewise suggest that effects depend on how leadership changes professional learning, instructional coherence, and collective capacity rather than on leadership behavior in isolation (Agirdag & Muijs, 2023; Carrington et al., 2022).

School climate also showed a statistically significant but weak relationship with perceived school productivity ($r = .177$, $R^2 = .031$, $p = .031$). The small effect magnitude is plausible because school climate is a multidimensional condition that is more proximally related to teacher learning,

efficacy, enthusiasm, stress, relationships, and instructional quality than to a broad organizational productivity construct (Holzberger & Schiepe-Tiska, 2021; Huang & Wang, 2021; Kouhsari et al., 2024; L. T. Nguyen et al., 2023). Studies using multilevel or multi-informant designs further show that climate effects vary across levels and respondent groups, which is important here because both climate and productivity were measured from teachers (López et al., 2023; Molinari & Grazia, 2023; Veletić et al., 2023).

In the joint model, $R = .251$ is the multiple correlation coefficient and $R^2 = .063$ indicates that principal leadership and school climate together account for only 6.3% of the observed variance in teacher-perceived school productivity. The modest explanatory power suggests that school productivity is likely shaped by a much broader set of organizational determinants. Recent research identifies instructional-program coherence, teacher collaboration, professional learning, collective efficacy, distributed expertise, and organizational citizenship as plausible contributors to school functioning and improvement (Cravens & Hunter, 2021; Gamliel & Shapira-Lishchinsky, 2023; Gouédard et al., 2023; Ma & Marion, 2024; Moon et al., 2022). In vocational schools, alignment with business and industry is an additional organizational requirement that may affect how stakeholders judge school productivity (Meirawan et al., 2022).

The weak correlations should also be interpreted in light of the study's measurement structure. The descriptive ratings were already high for principal leadership (90.71%), school climate (88.58%), and perceived school productivity (85.77%), which may restrict score variability and attenuate correlations. At the same time, collecting predictors and the outcome from the same teachers at one time point creates potential common-method bias and does not capture discrepancies between teacher perceptions and objective institutional indicators. Multi-informant research demonstrates that teachers, principals, students, and parents can evaluate the same school environment differently (Molinari & Grazia, 2023; Veletić et al., 2023), while cross-national research shows that perceived climate and leadership effects depend strongly on context and level of analysis (Baysu et al., 2023; Chen et al., 2022).

The study's contribution is therefore contextual and construct-specific rather than causal. It brings principal leadership and school climate into one parsimonious model of teacher-perceived school productivity in Indonesian state vocational high schools, while explicitly distinguishing perceived organizational productivity from objective indicators such as graduate employment, resource efficiency, or administrative performance. This distinction extends local school-management research by aligning the outcome with the actual respondent source. It also adds a vocational-school perspective to a literature in which school leadership is increasingly examined as adaptive, collaborative, digital, and embedded in wider organizational systems (Berkovich & Hassan, 2025; Highfield & Rubie-Davies, 2022; Malone et al., 2021; Sandy, 2024).

Practically, the findings do not justify treating principal leadership or school climate as stand-alone levers that will necessarily increase school productivity. Instead, leadership development and climate improvement should be positioned as components of a broader school-management strategy that strengthens professional learning, teacher collaboration, resource coordination, instructional coherence, and vocational partnerships. Evidence on distributed and shared leadership indicates that organizational benefits are more likely when leadership supports teacher agency, collaboration, and collective efficacy (Liu et al., 2021, 2022; Oppi & Eisenschmidt, 2022; Park & Byun, 2021). This interpretation is also consistent with Indonesian management literature that emphasizes managerial responsibility, professional development, discipline, and coordinated resource use.

Several limitations constrain the strength of inference. First, the cross-sectional design cannot establish temporal or causal ordering. Second, all variables were measured through teacher self-report, increasing the possibility of common-method variance and leaving objective school-

productivity indicators unobserved. Third, teachers were nested within multiple schools, whereas the analysis was conducted at the teacher level and did not model school-level clustering. Fourth, the joint model explains only 6.3% of the variance, indicating substantial omitted determinants. Fifth, the sample is geographically bounded to state vocational high schools in Solok Regency. Future research should combine longitudinal or multilevel designs with administrative records, graduate outcomes, school-resource indicators, and multi-informant measures to test whether the observed associations replicate across vocational-school contexts.

Conclusion

Principal leadership and school climate were each positively and statistically significantly but weakly associated with teacher-perceived school productivity in state vocational high schools in Solok Regency. In the joint model, the two predictors accounted for 6.3% of the observed variance ($R = .251$, $R^2 = .063$, $p = .008$), indicating that most variation in perceived school productivity lies outside the present model. The findings should therefore be interpreted as cross-sectional associations rather than evidence that leadership or climate causes school productivity. Practically, leadership and school-climate development may form part of a broader management strategy alongside teacher capacity, resource adequacy, instructional coherence, student conditions, and school-industry partnerships. The main limitations are the single-time-point teacher self-report design, possible clustering within schools, the geographically bounded sample, and the absence of objective school-productivity indicators. Future research should use longitudinal or multilevel designs and combine teacher perceptions with administrative, graduate, and other objective school-level productivity indicators.

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