

Learning climate as the strongest predictor of school performance: A multivariate analysis of the effects of instructional leadership and literacy culture

 Arifin^{1,*}, I Nyoman Jampel¹,  Dewa Bagus Sanjaya¹,  I Wayan Widiana¹

¹Universitas Pendidikan Ganesha, Indonesia; arifin1arsyad2@gmail.com (A); jampel@undiksha.ac.id (I.N.J); bagus.sanjaya@undiksha.ac.id (D.B.S); wayanwidiana85@undiksha.ac.id (I.W.W.).

²Universitas Muhammadiyah Kupang, Indonesia.

Abstract: School performance is a critical outcome in educational management, yet the simultaneous effects of school contextual factors remain insufficiently understood, particularly in Eastern Indonesia. This study examines the effects of instructional leadership, literacy culture, and learning climate on school performance and identifies the strongest predictor. A quantitative survey was conducted with 305 public senior high school teachers in Kupang City, East Nusa Tenggara. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with 5,000 bootstrap subsamples. The results showed that learning climate was the strongest predictor of school performance ($\beta = 0.550$), followed by literacy culture ($\beta = 0.242$) and instructional leadership ($\beta = 0.226$). Literacy culture was also the strongest predictor of learning climate ($\beta = 0.686$). Mediation analysis revealed that literacy culture and learning climate partially mediated the relationship between instructional leadership and school performance. The model explained 70.9% of the variance in school performance ($R^2 = 0.709$). These findings demonstrate that school performance emerges from the interplay of leadership, literacy culture, and learning climate. Practically, strengthening learning climate and literacy culture should be prioritized alongside instructional leadership to improve school performance.

Keywords: *Instructional leadership, IPOO model, Learning climate, Literacy culture, School performance, SEM-PLS.*

1. Introduction

The quality of education in Indonesia continues to be a major concern for the government and education stakeholders, considering that education is the main foundation for the development of quality human resources. The Government of Indonesia has consistently strengthened the policy of school quality standards, including through the establishment of minimum service standards as a reference for the development of school quality, especially in areas with limited resources [1]. In the context of secondary education, school performance is a crucial indicator that reflects the success of the educational process as a whole. School performance not only includes students' academic achievements but also includes the quality of the learning process, the effectiveness of school management, and the long-term impact of education on the development of students' competencies. Therefore, understanding the factors that affect school performance is very important for efforts to improve the quality of education that is sustainable [2].

Among the factors that affect school performance, the instructional leadership of principals has long been recognized as a key variable. Instructional leadership is the most relevant dimension of leadership for school effectiveness, as effective principals not only manage administration but also actively direct the improvement of the quality of learning [3-5]. The principal as an instructional leader is responsible for determining school objectives, managing learning programs, creating a conducive school climate, and developing the professional capacity of teachers [6, 7]. Various empirical studies have shown that instructional leadership has a significant influence on school performance at various levels of education [8-10].

Nevertheless, recent research suggests that the relationship between instructional leadership and school performance is not always direct, but rather operates through complex mediation mechanisms [11, 12]. Two variables that are increasingly receiving attention in the literature as potential mediators are literacy culture and learning climate. School literacy culture refers to a set of values, habits, and practices that support the development of reading, writing, and critical-thinking skills in the school environment [13]. Meanwhile, the learning climate is the collective perception of school residents regarding the quality of the learning environment, which includes aspects of safety, social relations, learning quality, and support for the structure of the school environment [14, 15].

Although several studies have examined the relationship between these variables separately, studies that simultaneously analyze the role of instructional leadership, literacy culture, and learning climate in school performance are still very limited, especially in the context of Eastern Indonesia. Kupang City, as the capital of East Nusa Tenggara Province, has unique sociocultural characteristics, including cultural diversity, relatively low economic levels, and challenges in access to education that are different from those in other regions of Indonesia. This condition provides an important empirical context in which to test the model of the relationship between these variables. Therefore, this study aims to fill the knowledge gap through multivariate analysis using SEM-PLS to identify the strongest predictor variables of school performance in Kupang City State Senior High School.

2. Literature Review

2.1. Principal Instructional Leadership

Instructional leadership is one of the most studied theories of educational leadership in the educational management literature. Hallinger [16] and Hallinger [17] define instructional leadership as leadership that focuses on improving the quality of learning. This concept includes three main dimensions, namely: (1) determining the goals of the school; (2) managing learning programs; and (3) creating a conducive school climate.

Several empirical studies have shown that instructional leadership has a significant influence on various aspects of school effectiveness. He et al. [8] found that the principal's instructional leadership plays a role in improving the quality of learning and teacher professional development, which ultimately impacts the school's overall performance. Elfira et al. [10] In their research, it is emphasized that instructional leadership does not work directly, but through mediation mechanisms such as improving the quality of learning and teacher efficacy in teaching. Sözer Boz and Tabak [9] further concluded that the leadership of the principal affects the learning climate, which in turn has an impact on the performance and involvement of school residents. These findings confirm that instructional leadership is not just a managerial function, but a strategic process that influences school performance through the creation of a conducive learning climate and effective learning management.

In the Indonesian context, the role of instructional leadership is increasingly relevant along with the implementation of the education autonomy policy and the improvement of national education quality standards. Hallinger et al. [7] say that instructional leadership is closely related to the formation of a collaborative culture of teachers and the improvement of the quality of learning in schools. Principals who are active in the supervision of learning and the academic development of teachers are able to create a more professional work environment and support learning innovation. Thus, instructional leadership becomes an important foundation in efforts to improve the school's continuous performance.

2.2. School Literacy Culture

School literacy culture is a concept that refers to a series of values, norms, habits, and practices that develop in the school environment and support the development of literacy skills among school residents. This concept is not only limited to reading and writing activities but includes the development of critical, analytical, and creative thinking skills that are the foundation of lifelong learning. According to Merga and Mat Roni [13], a strong literacy culture in schools will contribute to increased student learning engagement, academic motivation, and overall learning quality. Literacy

culture encompasses various aspects, including school literacy policies, the provision of literacy facilities such as libraries and reading corners, the integration of literacy in intracurricular and extracurricular learning, and the development of a social-emotional environment that supports literacy activities.

Previous research has shown that literacy culture is closely related to various educational outcomes. Danacı and Totan [18] found that literacy culture and school learning culture are closely related to student academic engagement and the quality of the school's learning environment. Schools that have a literacy-based academic culture tend to be more successful in building student learning participation and better learning quality. Asamoah et al. [19] also concluded that school policies and practices play an important role in shaping the school climate and the quality of educational practices. Wang et al. [20] found that a physical environment that supports literacy has been shown to improve learning comfort, student engagement, and a sense of security in school. These findings confirm that literacy culture is not just an additional program, but a cultural foundation that strengthens the learning ecosystem as a whole.

2.3. School Learning Climate

School learning climate is a multidimensional concept that includes the collective perception of school residents of the quality of the learning environment they experience. Cohen et al. [21] define the school climate as the psychological and social experiences that school residents feel in their daily educational activities. The learning climate includes four main dimensions, namely: (1) safety, which includes a sense of physical, emotional, and psychological security; (2) social relationships, which reflect the quality of interaction between teachers, students, and all school residents; (3) the quality of learning, which includes the effectiveness of instruction, academic support, and student involvement in learning; and (4) environmental and structural support, which includes facilities, environmental management, and educational organizational systems that support academic activities.

Recent research further emphasizes the strategic role of learning climate in determining the quality of education. Persson et al. [22] show that the quality of school leadership, teacher collaboration, and school climate contribute to the quality of learning and school effectiveness. Amsalu and Belay [14] found that a positive learning climate is closely related to students' motivation to learn, the quality of social relationships, and the academic achievement of the school. Meng et al. [15] also found that the quality of the learning climate had an effect on learning effectiveness, students' psychological well-being, and the quality of social interaction in schools. Lindfors et al. [23] show that the security climate plays an important role in creating trust, reducing conflict, and improving the quality of interactions and learning outcomes. Research by Renick et al. [24] confirms that aspects of teaching and learning include the quality of instruction, academic support, and student involvement in learning.

From the perspective of *School Climate Theory*, the learning climate is the result of the accumulation of leadership practices and culture that take place in a sustainable manner in the school organization. Principals do not directly create learning climates, but influence the various conditions that allow them to thrive [25]. Similarly, literacy culture not only results in an improvement in students' academic abilities, but also shapes norms, values, and patterns of interaction that determine the quality of learning life at school. Castro et al. [26] conclude that positive social relationships between teachers and students strengthen students' learning interactions and social-emotional development. Therefore, the learning climate can be seen as a factor that integrates aspects of inputs, processes, outputs, and outcomes in education.

2.4. School Performance

School performance is a concept that reflects the success of schools in carrying out their educational functions as a whole. In this study, school performance was operationalized using the *Input-Process-Output-Outcome* (IPOO) model, which is a development of the CIPP (Context-Input-Process-Product) model. The IPOO model measures school performance through four dimensions: (1) inputs, which include the readiness of educational resources, including teacher quality, student readiness,

infrastructure, and school management support; (2) processes, which include the quality of learning implementation, academic supervision, curriculum development, and classroom management; (3) output, which includes student learning outcomes in the form of academic achievement and competency achievement; and (4) outcomes, which include the long-term impact of education on the development of students' 21st-century character, skills, and competencies.

The IPOO model was chosen because of its ability to comprehensively measure school performance, not only focusing on outputs but also paying attention to the quality of the process and the long-term impact of education. From the perspective of *School Effectiveness Theory*, high-performing schools are generally characterized by learning-oriented leadership, a strong academic culture, and a learning environment that supports student development [27]. These three factors are complementary elements in building the capacity of school organizations to achieve educational goals effectively. Thus, school performance is essentially the result of systemic interactions between leadership, culture, and learning environment factors.

2.5. Research Framework and Hypotheses

Based on the theoretical and empirical studies that have been described, the framework of this research was developed by integrating Instructional Leadership Theory [16, 17] with the IPOO model. Within this framework, instructional leadership (X_1) and literacy culture (X_2) are positioned as exogenous variables influencing the learning climate (X_3), the endogenous mediator variable, which in turn affects school performance (Y), the dependent variable. The learning climate is positioned as a mediator because it is theoretically a proximal variable that translates the influence of school leadership and culture into improved school performance. Based on this framework, this study proposes the following seven hypotheses:

H₁: There is a direct, positive, and significant influence of the principal's instructional leadership on school performance. H₂: There is a direct, positive, and significant influence of the principal's instructional leadership on the learning climate. H₃: There is an indirect, positive, and significant influence of the principal's instructional leadership on school performance through the learning climate. H₄: There is a direct, positive, and significant influence of literacy culture on school performance. H₅: There is a direct, positive, and significant influence of literacy culture on the learning climate. H₆: There is an indirect, positive, and significant influence of literacy culture on school performance through the learning climate. H₇: There is a direct, positive, and significant influence of the learning climate on school performance.

3. Method

3.1. Research Design and Approach

This study uses a quantitative approach with a cross-sectional survey design. The quantitative approach was chosen because this study aims to test the hypothesis of the relationship between variables through inferential statistical analysis. The cross-sectional design is considered appropriate when the researcher wants to test relationships based on the theoretical foundation of latent constructs, especially for variables that are perceptual and relatively stable over time, such as the variables of instructional leadership, literacy culture, and learning climate in this study [28]. This design allows data to be collected at a specific time from a representative number of respondents, thus providing an efficient picture of the relationships between variables without the need for repeated observations over a period of time.

3.2. Population and Sample

The population in this study is 797 public high school teachers in Kupang City. Sampling was carried out using the proportional stratified random sampling technique to ensure the representation of teachers from 12 state high schools. The number of samples was determined using the Slovin formula

with an error tolerance of 5%, so a sample of 305 teachers was obtained. The characteristics of the sample included 65% women and 35% men, with an age range of 28 to 55 years.

3.3. Research Instruments

The data collection instrument was a 5-point Likert-scale questionnaire (1 = strongly disagree to 5 = strongly agree). The questionnaire was compiled based on variable operational indicators (IOVs) developed from previous theories and research. Instructional leadership variables are measured through three indicators, namely determining school goals, creating a school climate, and managing learning programs. Literacy culture variables are measured through seven indicators, namely literacy policies in schools, reading corners, library visits, social-emotional environment, literacy in intracurricular learning, literacy in extracurricular learning, and literate academic environment. Learning climate variables are measured through four indicators, namely safety, relationships, teaching and learning, and environmental structure. School performance variables are measured through four indicators, namely input, process, output, and outcome.

3.4. Data Analysis Techniques

The data were analyzed using SmartPLS Software version 4.0. The analysis was carried out in two main stages: (1) analysis of the measurement model (outer model), which included the evaluation of convergent validity (outer loadings, Average Variance Extracted/AVE), discriminant validity (Heterotrait-Monotrait ratio/HTMT, cross-loadings), and reliability (Cronbach's Alpha, Composite Reliability/CR); and (2) structural model analysis (inner model), which included the evaluation of the path coefficient, statistical significance through bootstrapping with 5,000 subsamples, determination coefficient (R-square), and predictive relevance (Q-square) through PLS Predict. Mediation hypothesis testing was carried out using the procedure recommended by Hair et al. [29], taking into account the significance of direct and indirect influences.

4. Results

4.1. Respondent Description

The respondents in the study were 305 teachers from 12 state high schools in Kupang City. The distribution of respondents was even throughout the schools, with sample selection conducted through proportional random sampling techniques. Respondents consisted of teachers with various levels of teaching experience, from beginner teachers to senior teachers, representing a diversity of perceptions of the variables studied. The questionnaire was distributed directly to each school with the help of field coordinators, and the respondents' response rate reached 100% of the total questionnaires distributed.

4.2. Evaluation of Measurement Models (Outer Model)

The results of the measurement model evaluation showed that all indicators met the convergent validity criteria, with outer loading values above 0.70, an Average Variance Extracted (AVE) value above 0.50, and Composite Reliability (CR) and Cronbach's Alpha values above 0.70 for each construct. Discriminant validity evaluation through the HTMT ratio showed that all HTMT values were below 0.90, which confirms that each construct in the model is distinct and can be distinguished from the others. Thus, the measurement model is declared valid and reliable, so the analysis can be continued to the structural model evaluation stage.

4.3. Evaluation of Structural Models (Inner Model)

4.3.1. Coefficient of Determination (R-Square)

The R-square value of the learning climate variable was 0.651, indicating that 65.1% of the variation in learning climate can be explained by instructional leadership and literacy culture. The R-square value of the school performance variable was 0.709, indicating that 70.9% of the variation in school performance can be explained by instructional leadership, literacy culture, and learning climate. Both

values belong to the category of strong influence according to the classification of Cohen [30], so the research model has very strong predictive power. The results of the Q-square predictive relevance test also showed values of 0.645 for the learning climate variable and 0.597 for the school performance variable, both of which were above the 0.50 limit, confirming that the model has a high level of predictive relevance.

4.4. Hypothesis Testing

Hypothesis testing was conducted to examine the direct relationships among instructional leadership, literacy culture, learning climate, and school performance within the structural model. The significance of each hypothesized relationship was assessed using the bootstrapping procedure with 5,000 subsamples, based on the standardized path coefficients (β) and p-values. The results indicate that all direct relationships specified in the model are statistically significant ($p < 0.05$), although their effect magnitudes vary across paths. The complete structural model, including the path coefficients, significance values, outer loadings, and coefficients of determination (R^2) for the endogenous constructs, is presented in Figure 1.

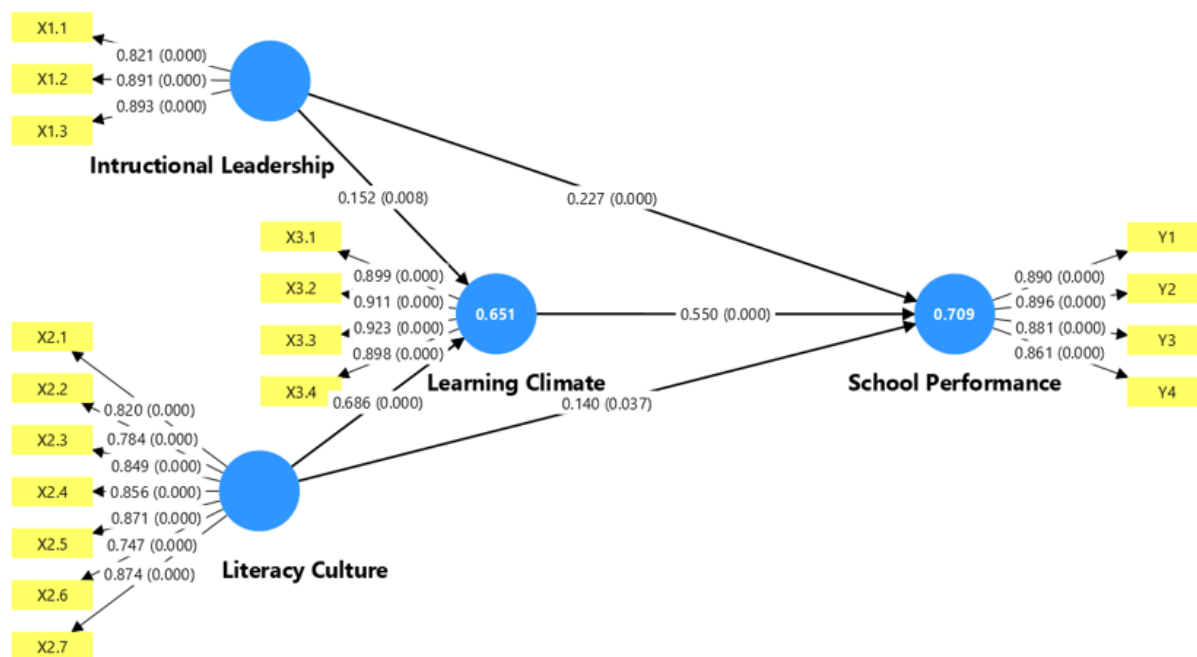


Figure 1.
PLS-SEM Structural Model for Hypothesis Testing

Based on the data in Figure 1, it can be explained that all research hypotheses are accepted, which means that there is a positive and significant direct and indirect influence between all variables studied. The H_1 hypothesis was accepted with a path coefficient of 0.227 ($p = 0.000$), suggesting that instructional leadership has a significant direct influence on school performance. The H_2 hypothesis was accepted with a path coefficient of 0.152 ($p = 0.008$), suggesting that instructional leadership has a direct effect on the learning climate. The H_3 hypothesis was accepted with an indirect effect of 0.084 ($p = 0.014$), indicating the role of partial mediation of the learning climate between instructional leadership and school performance. The H_4 hypothesis was accepted with a path coefficient of 0.140 ($p = 0.037$), showing that literacy culture has a direct effect on school performance. The H_5 hypothesis was accepted with a path coefficient of 0.686 ($p = 0.000$), showing that literacy culture is the strongest predictor of

the learning climate. The H_6 hypothesis was accepted with an indirect effect of 0.377 ($p = 0.000$), showing the role of partial mediation of the learning climate between literacy culture and school performance. The H_7 hypothesis was accepted with a path coefficient of 0.550 ($p = 0.000$), indicating that the learning climate is the strongest predictor of school performance.

5. Discussion

5.1. Learning Climate as the Strongest Predictor of School Performance

The significant finding of this study is that the learning climate is the strongest predictor of school performance, with a path coefficient (β) of 0.550 ($t = 9.404$; $p = 0.000$). The value of this coefficient is much higher than the coefficients of the instructional leadership path ($\beta = 0.227$) and literacy culture ($\beta = 0.140$) on direct school performance. These findings show that a conducive learning environment is the most decisive factor in shaping effective school performance. Substantively, a positive learning climate improves teaching and learning, relationships, safety, and environmental structure.

These findings are in line with previous research showing that a safe learning climate creates psychological conditions that support students' learning readiness (input) and a smooth learning process [23]. A good school climate provides a sense of security for students and school residents and is able to minimize the negative impact of socio-economic conditions [26, 31]. Research by Jiang and Liu [25] also confirms that school climate is influenced by structure, social relationships, and leadership, which directly impact school performance. In the context of Kupang City State Senior High School, these findings indicate that efforts to improve school performance will be more effective if they are focused on creating and strengthening a conducive learning climate, rather than relying solely on direct policies or leadership interventions.

5.2. Literacy Culture as the Strongest Predictor of Learning Climate

Literacy culture is the strongest predictor of learning climate, with a path coefficient (β) of 0.686 ($t = 13.260$; $p = 0.000$). This value is the highest path coefficient among all relationships in the research model, indicating that literacy culture has a very dominant influence on the formation of the learning climate in schools. Conceptually, these findings suggest that when literacy culture develops consistently in schools, academic interactions become more intensive, communication between teachers and students is more open, and student participation in learning increases. These conditions naturally form a more positive and conducive learning climate.

These findings reinforce the results of previous research by Asamoah et al. [19], which concluded that school policies and practices have an important role in shaping the learning climate and quality of educational practices. Research by Wang et al. [20] found that a physical environment that supports literacy has been shown to increase learning comfort, student engagement, and a sense of security. Meanwhile, research by Liu et al. [32] also shows that the active use of learning resources improves the quality of learning, and learning resource-based literacy activities contribute greatly to improving students' cognitive abilities. Further research by Ginting et al. [33] confirms that social interaction and the cultural environment have a significant influence on students' literacy abilities and skills. Thus, literacy culture functions as a cultural foundation that strengthens all dimensions of the learning climate, ranging from safety, relationships, teaching and learning, and environmental structure.

5.3. The Role of Learning Climate Mediation

The mediation analysis confirmed that the learning climate partially mediated the relationship between instructional leadership and school performance (indirect effect = 0.084; $t = 2.466$; $p = 0.014$), as well as between literacy culture and school performance (indirect effect = 0.377; $t = 7.764$; $p = 0.000$). This partial mediation role shows that instructional leadership and literacy culture influence school performance through two pathways: directly and indirectly through the learning climate. These findings have important theoretical implications, as they show that the learning climate is not only an

output of school leadership and culture but also a transmission mechanism that translates the influence of these variables into improved school performance.

The indirect effect of literacy culture through the learning climate (0.377) is much greater than the direct effect of literacy culture on school performance (0.140). This shows that the influence of literacy culture on school performance is more mediated by the learning climate than direct. These findings support the results of previous studies that concluded that school climate is a predictor of students' academic success; good literacy practices and a quality learning environment significantly improve students' academic outcomes [34, 35]. Research by Guo and Li [36] also concludes that literacy-based school culture contributes to an overall improvement in educational performance. Thus, the learning climate plays a role as a proximal factor that translates literacy practices into improving the quality of inputs, processes, outputs, and overall educational outcomes.

In the context of secondary schools in Kupang City, the finding that the indirect effect of literacy culture through the learning climate (0.377) is much greater than the direct effect (0.140) has very profound implications for educational practices in the area. State High Schools in Kupang City, which are spread across areas with diverse sociocultural characteristics and relatively high economic challenges, show that literacy culture does not stand alone as a factor in improving school performance, but rather requires a learning climate as a mediator that translates literacy values and practices into real educational achievements. This condition indicates that schools that have a strong literacy program but are not able to create a conducive learning climate will experience a gap between the literacy investment that has been made and the expected performance results. These findings confirm that strengthening literacy culture in Kupang City State High Schools must be carried out holistically, not only focusing on the provision of literacy facilities such as reading corners and libraries, but also on the creation of a psychologically safe learning environment, harmonious social relationships between teachers and students, and the quality of participatory and reflective learning interactions, so that the impact of literacy culture on school performance can be maximized optimally.

5.4. Instructional Leadership: Direct and Indirect Influences

Principal's instructional leadership was shown to have a significant direct influence on school performance ($\beta = 0.227$; $t = 4.414$; $p = 0.000$) and learning climate ($\beta = 0.152$; $t = 2.638$; $p = 0.008$). These findings reinforce the Instructional Leadership Theory, which emphasizes that instructional leadership is an important factor in determining the academic direction and quality of the school's learning environment. Principals who can set clear goals, manage learning programs effectively, and create a conducive school climate will contribute significantly to improving school performance. These findings are reinforced by He et al. [8], Sözer Boz and Tabak [9], and Elfira et al. [10], finding a significant relationship between instructional leadership and school performance.

However, it should be noted that the coefficient of the instructional leadership path to school performance (0.227) and learning climate (0.152) is relatively lower than the coefficient of the learning climate path to school performance (0.550) and literacy culture to learning climate (0.686). This suggests that although relatively low, instructional leadership still has an important contribution; its influence on school performance is more effective when mediated by the learning climate and literacy culture. These findings are in line with previous research showing that principals' instructional leadership plays a role in improving school performance through curriculum management, learning community development, and the creation of a positive academic climate [37]. Instructional leadership affects teacher performance and school performance, both directly and through strengthening the school climate [38, 39].

5.5. Daya Prediktif School-Controllable Factors

Another significant finding in this study is the high predictive power of the research model on school performance (R-square = 0.709), which shows that 70.9% of school performance variations can be explained by variables that fall into the category of school-controllable factors, i.e., factors that are

within the scope of school management itself. These findings have very important implications, both theoretically and practically. Theoretically, these findings indicate that school performance is essentially the result of an organizational process that takes place in a sustainable manner, where instructional leadership functions as a driver, literacy culture shapes academic values and habits, while the learning climate provides an environment that allows the educational process to take place optimally.

In practical terms, these findings suggest that schools have considerable room to control and improve their performance through internal factors. Improving school performance does not always have to depend on additional resources or external interventions but can be achieved through strengthening learning leadership practices, developing a productive academic culture, and creating a supportive learning environment. This perspective is important because it shows that schools are not just the object of education policy but learning organizations that have the capacity to carry out quality improvement independently and sustainably. The remaining variation of 29.1% that has not been explained by the model shows that school performance is also influenced by other factors, such as teacher competence, parental involvement, education policy support, and the socioeconomic conditions of the surrounding environment.

6. Conclusions

Based on the results of the analysis and discussion, this study concludes the following. First, the learning climate is the strongest predictor of school performance, with the highest path coefficient ($\beta = 0.550$) among all independent variables. These findings confirm that the creation of a safe, supportive, and conducive learning environment is the most effective strategy for improving school performance. Second, literacy culture is the strongest predictor of the learning climate ($\beta = 0.686$), indicating that the consolidation of literacy culture in schools plays a central role in creating a conducive learning environment. Third, the learning climate partially mediates the relationship between instructional leadership and school performance, as well as between literacy culture and school performance, suggesting that the learning climate is an important transmission mechanism for translating the influence of school leadership and culture into performance improvement.

Fourth, literacy culture has a dual role, namely as a direct predictor of school performance ($\beta = 0.140$) as well as an indirect predictor through the learning climate (indirect effect = 0.377), with a much greater indirect effect. Fifth, the research model has very strong predictive power, with an R-square of 0.709, showing that school-controllable factors have a dominant contribution to the formation of school performance. These findings provide theoretical implications in the form of enriching instructional leadership models by including learning climate and literacy culture as mediating variables, as well as practical implications that improving school performance should be prioritized through strengthening the learning climate and literacy culture as the main strategy, with instructional leadership serving as the main driver.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Acknowledgments:

The authors acknowledge support from the Indonesian Education Scholarship, Center for Higher Education Funding and Assessment, and the Indonesian Endowment Fund for Education. Twelve principals of state high schools in Kupang City and teachers.

Copyright:

© 2026 by the authors. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

References

- [1] J. Juharyanto, I. Arifin, S. Sultoni, M. A. Adha, and M. I. Qureshi, "Antecedents of primary school quality: The case of remote areas schools in Indonesia," *Sage Open*, vol. 13, no. 1, p. 21582440221144971, 2023. <https://doi.org/10.1177/21582440221144971>
- [2] Y. P. Kadarisman, M. R. Rahman, C. S. Abd Jabar, and A. Umar, "School improvement framework for Indonesia," *Center for Educational Policy Studies Journal*, vol. December, pp. 1–32, 2026.
- [3] P. Hallinger and R. H. Heck, "Reassessing the principal's role in school effectiveness: A review of empirical research, 1980–1995," *Educational Administration Quarterly*, vol. 32, no. 1, pp. 5–44, 1996. <https://doi.org/10.1177/0013161X96032001002>
- [4] P. Hallinger and D. Bryant, "Mapping the terrain of educational leadership and management in East Asia," *Journal of Educational Administration*, vol. 51, no. 5, pp. 618–637, 2013. <https://doi.org/10.1108/JEA-05-2012-0066>
- [5] P. Hallinger and R. Hosseingholizadeh, "Exploring instructional leadership in Iran: A mixed methods study of high- and low-performing principals," *Educational Management Administration & Leadership*, vol. 48, no. 4, pp. 595–616, 2020. <https://doi.org/10.1177/1741143219836684>
- [6] P. Hallinger, "Science mapping the knowledge base on educational leadership and management from the emerging regions of Asia, Africa and Latin America, 1965–2018," *Educational Management Administration & Leadership*, vol. 48, no. 2, pp. 209–230, 2020. <https://doi.org/10.1177/1741143218822772>
- [7] P. Hallinger, S. Liu, and L. Chen, "Principal instructional leadership and teacher attitudes: A meta-analytic review, 1989–2024," *European Journal of Education*, vol. 60, no. 4, p. e70199, 2025. <https://doi.org/10.1111/ejed.70199>
- [8] P. He, F. Guo, and G. A. Abazie, "School principals' instructional leadership as a predictor of teacher's professional development," *Asian-Pacific Journal of Second and Foreign Language Education*, vol. 9, no. 1, p. 63, 2024. <https://doi.org/10.1186/s40862-024-00290-0>
- [9] E. Sözer Boz and H. Tabak, "Exploring the relationship between learning climate in schools and agile leadership using multi-group path analysis: Does "Willingness to work" have a mediating role?," *Current Psychology*, vol. 44, pp. 4002–4015, 2025. <https://doi.org/10.1007/s12144-025-07450-6>
- [10] Elfira *et al.*, "How does principal's instructional leadership shape teacher performance mediated by teacher self-efficacy in Indonesian education context?," *Frontiers in Education*, vol. 9, p. 1401394, 2024. <https://doi.org/10.3389/educ.2024.1401394>
- [11] V. Dutta and S. Sahney, "Relation of principal instructional leadership, school climate, teacher job performance and student achievement," *Journal of Educational Administration*, vol. 60, no. 2, pp. 148–166, 2022. <https://doi.org/10.1108/JEA-01-2021-0010>
- [12] S.-M. Liu, Y.-C. Huang, and R.-J. Wang, "Challenges and professional support for principals at rural schools for sustainable development," *Sustainability*, vol. 16, no. 21, p. 9251, 2024. <https://doi.org/10.3390/su16219251>
- [13] M. K. Merga and S. Mat Roni, "'An uphill battle': School library professionals fostering student reading engagement," *English in Education*, vol. 59, no. 1, pp. 17–36, 2025. <https://doi.org/10.1080/04250494.2025.2456718>
- [14] A. Amsalu and S. Belay, "Analyzing the contribution of school climate to academic achievement using structural equation modeling," *Sage Open*, vol. 14, no. 1, p. 21582440241227271, 2024. <https://doi.org/10.1177/21582440241227271>
- [15] L. Meng, Y. Zhao, Y. Jiang, Y. Bie, and J. Li, "Understanding interaction rituals: The impact of interaction ritual chains of the live broadcast on people's wellbeing," *Frontiers in Psychology*, vol. 13, p. 1041059, 2022. <https://doi.org/10.3389/fpsyg.2022.1041059>
- [16] P. Hallinger, "Instructional leadership and the school principal: A passing fancy that refuses to fade away," *Leadership and Policy in Schools*, vol. 4, no. 3, pp. 221–239, 2005. <https://doi.org/10.1080/15700760500244793>
- [17] P. Hallinger, "Leadership for learning: Lessons from 40 years of empirical research," *Journal of Educational Administration*, vol. 49, no. 2, pp. 125–142, 2011. <https://doi.org/10.1108/09578231111116699>
- [18] F. N. Danacı and T. Totan, "The effect of school culture on school engagement: The mediating role of social and emotional learning," *Educational Academic Research*, vol. 55, pp. 46–56, 2024. <https://doi.org/10.33418/education.1449128>
- [19] D. Asamoah, M. Shahrill, and S. N. Abdul Latif, "Teachers' perceptions of school assessment climate and realities of assessment practices in two educational contexts," *Frontiers in Education*, vol. 9, p. 1278187, 2024. <https://doi.org/10.3389/educ.2024.1278187>
- [20] Y. Wang, J. Zhang, and K. Huang, "A study on the effect of school and family environments and self-efficacy on health literacy of college students," *Frontiers in Public Health*, vol. 12, p. 1449819, 2024. <https://doi.org/10.3389/fpubh.2024.1449819>

- [21] J. Cohen, E. M. McCabe, N. M. Michelli, and T. Pickeral, "School climate: Research, policy, practice, and teacher education," *Teachers College Record*, vol. 111, no. 1, pp. 180-213, 2009. <https://doi.org/10.1177/016146810911100108>
- [22] R. Persson, E. K. Demir, and K. Wennberg, "Principal instructional leadership and teacher collaboration: A longitudinal study of the influence on pupil achievement," *Educational Management Administration & Leadership*, p. 17411432251350793, 2025. <https://doi.org/10.1177/17411432251350793>
- [23] E. Lindfors, A. Hilmola, L. Kiviranta, E. Luukka, and J. Kokki, "Safety climate in learning environments: A staff-centred analysis of comprehensive schools," *Learning Environments Research*, vol. 29, no. 1, p. 24, 2026. <https://doi.org/10.1007/s10984-026-09578-z>
- [24] J. Renick, S. M. Reich, and H. K. Phan, "Towards developmentally informed school climate research," *Contemporary School Psychology*, vol. 29, no. 4, pp. 695-714, 2025. <https://doi.org/10.1007/s40688-025-00565-4>
- [25] X. Jiang and R. Liu, "Factors influencing school climate: An empirical study based on the TALIS principal survey," *Humanities and Social Sciences Communications*, vol. 11, no. 1, p. 722, 2024. <https://doi.org/10.1057/s41599-024-03203-1>
- [26] C. Castro, M. C. Barata, and J. Alexandre, "Does school climate affect students' social and emotional skills? The importance of relationships," *European Journal of Psychology of Education*, vol. 40, no. 4, p. 111, 2025. <https://doi.org/10.1007/s10212-025-01007-8>
- [27] N. Goagoses *et al.*, "A systematic review of social classroom climate in online and technology-enhanced learning environments in primary and secondary school," *Education and Information Technologies*, vol. 29, no. 2, pp. 2009-2042, 2024. <https://doi.org/10.1007/s10639-023-11705-9>
- [28] C. Maier, J. B. Thatcher, V. Grover, and Y. K. Dwivedi, "Cross-sectional research: A critical perspective, use cases, and recommendations for IS research," *Elsevier*, vol. 70, p. 102625, 2023. <https://doi.org/10.1016/j.ijinfomgt.2023.102625>
- [29] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modeling (PLS-SEM)*. Thousand Oaks, CA, USA: Sage Publications, 2022.
- [30] J. Cohen, *Statistical power analysis for the behavioral sciences*, 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates, 1988.
- [31] B. Boykin, J. S. McBrayer, S. Pannell, R. E. Cleveland, S. B. Miller, and M. J. Carney, "Closing the gap: The relationship between school climate and student achievement in the middle school sector," *School Leadership Review*, vol. 18, no. 2, p. 4, 2024.
- [32] H. Liu, J. Van Damme, and W. Van Den Noortgate, "A cross-country comparison of school-based social capital effects upon reading literacy based on PISA data," *Sage Open*, vol. 15, no. 3, p. 21582440251365699, 2025. <https://doi.org/10.1177/21582440251365699>
- [33] D. C. A. Ginting, S. gusti Rezeki, A. A. Siregar, and N. Nurbaiti, "Analysis of the influence of social networks on social interactions in the digital era," *PPIMAN Pusat Publikasi Ilmu Manajemen*, vol. 2, no. 1, pp. 22-29, 2024. <https://doi.org/10.3389/fpls.2021.660446>
- [34] V. Chunduri *et al.*, "Gene expression and proteomics studies suggest an involvement of multiple pathways under day and day-night combined heat stresses during grain filling in wheat," *Frontiers in Plant Science*, vol. 12, p. 660446, 2021. <https://doi.org/10.3389/fpls.2021.660446>
- [35] S. N. Zynuddin, H. B. Kenayathulla, and B. Sumintono, "The relationship between school climate and students' non-cognitive skills: A systematic literature review," *Heliyon*, vol. 9, no. 4, p. e14773, 2023. <https://doi.org/10.1016/j.heliyon.2023.e14773>
- [36] X. Guo and X. Li, "A study on community public safety collaborative governance regime in the background of COVID-19: empirical analysis based on China and South Korea," *Sustainability*, vol. 14, no. 21, p. 14000, 2022. <https://doi.org/10.3390/su142114000>
- [37] N. Abid, S. Aslam, A. A. Alghamdi, and T. Kumar, "Relationships among students' reading habits, study skills, and academic achievement in English at the secondary level," *Frontiers in Psychology*, vol. 14, p. 1020269, 2023. <https://doi.org/10.3389/fpsyg.2023.1020269>
- [38] M. Alzoraiki, A. R. Ahmad, A. Ateeq, and M. Milhem, "The role of transformational leadership in enhancing school culture and teaching performance in Yemeni public schools," *Frontiers in Education*, vol. 9, p. 1413607, 2024. <https://doi.org/10.3389/feduc.2024.1413607>
- [39] S. Sugiyanto, N. Egar, and G. Abdullah, "The influence of school principal leadership and school organizational climate on the performance of public elementary school teachers," *Scaffolding: Jurnal Pendidikan Islam dan Multikulturalisme*, vol. 7, no. 2, pp. 68-89, 2025. <https://doi.org/10.37680/scaffolding.v7i2.7395>