# An Integrative Model of the Influence of Leadership, School Culture, and ICT Proficiency on Teacher Professional Competence

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| Sections Info | ABSTRACT |
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| | **Objective**: This study aims to analyze the influence of school principal leadership, school culture, and information technology mastery on the professional competence of public elementary school teachers in Sale Subdistrict, Rembang Regency. Teachers' professional competence serves as a key indicator in improving the quality of learning and strengthening human resource capacity in the basic education sector. **Method**: This research employed a quantitative approach with an associative design. The study population consisted of 197 teachers, with a sample of 132 respondents selected using proportional random sampling. The primary instrument was a Likert-scale questionnaire, and data were analyzed using multiple linear regression with the aid of SPSS version 26. **Result**: The findings reveal that school principal leadership, school culture, and information technology mastery simultaneously have a significant effect on teachers' professional competence, contributing 43.6% to the variance. Partially, school principal leadership exerted the most dominant influence ($R^2 = 0.423$), followed by information technology mastery ($R^2 = 0.131$) and school culture ($R^2 = 0.046$). **Novelty**: This study offers an integrative approach by examining the combined impact of leadership, culture, and ICT proficiency on teacher competence, while providing practical insights into challenges and strategies for sustainable teacher development. |

# INTRODUCTION

The rapid advancement of information and communication technology (ICT) has driven significant transformations in education. The national education system is expected to adapt to global dynamics and empower educational components to improve quality continuously (Arum, 2023). One of the key focuses in enhancing basic education quality is teachers' professional competence, which depends on school leadership, a supportive school culture, and ICT mastery (Mia & Sulastri, 2023). Law No. 20 of 2003 on the National Education System and Government Regulation No. 57 of 2021 on National Education Standards stress the importance of teacher competence as part of educational standards. Moreover, the Decree of the Directorate General of Teachers and Education Personnel of the Ministry of Education, Culture, Research, and Technology No. 2626/B/HK.04.01/2023 emphasizes that professional competence includes subject mastery, professional development, and the use of technology in the learning process.

Despite these national regulations, empirical data from Sale Subdistrict indicate that the professional competence of elementary school teachers remains relatively low. The 2023 supervision report highlights that the average Teacher Performance Appraisal (PKG) score for the professional aspect is 2.8 out of 4 for subject mastery and 2.3 for reflective practice. While the overall PKG score is categorized as "Good," these sub-competencies indicate significant room for improvement. Many teachers still rely heavily on traditional lecture methods and outdated teaching materials, which are not integrated

with character education. Moreover, only 15% of teachers have conducted classroom action research, primarily for administrative purposes such as promotion. Table 1 presents a recapitulation of the PKG scores over the past three years.

**Table 1.** Recapitulation of Elementary School Teacher PKG Scores in Sale Subdistrict (2021–2023)

| Year | Average PKG Score | Category | Sub-Competency Scores (Professional) |
|------|------|------|------|
| 2021 | 81.24 | Good | Subject Mastery: 2.6; Reflection: 2.3 |
| 2022 | 81.89 | Good | Subject Mastery: 2.7; Reflection: 2.4 |
| 2023 | 82.14 | Good | Subject Mastery: 2.8; Reflection: 2.3 |

*Source: Academic Supervision Report 2021-2023*

Teacher competence is influenced by both internal factors such as motivation and education, and external factors including school leadership and organizational culture (Alim, 2022). Research by Ulfah et al. (2023) found that school leadership contributes 56.3% to the improvement of teacher professional competence. However, in Sale Subdistrict, some principals still practice one-way communication and fail to act as professional partners, especially for novice teachers. Furthermore, a supportive school culture, which fosters teacher professionalism, is lacking. Tsauri (2022) suggests that positive school culture enhances teacher professionalism, while Nizary and Hamami (2020) note that school culture reflects values, norms, and practices that shape the learning environment. However, field observations reveal poorly arranged teacher offices, inadequate lighting, and low discipline among school members.

Another challenge is ICT mastery. Only 43.04% of teachers own a personal laptop, and 32.28% cannot operate a computer. Furthermore, 55.06% of teachers are not yet proficient in using educational software, and only 13.29% have a personal website or blog. Jamun et al. (2020) found that ICT plays a significant role in enhancing teachers' professional competence, yet many teachers only use the internet for basic communication. ICT is a strategic tool for updating teaching materials, accessing references, and improving learning effectiveness (Warsita, 2022).

This study aims to analyze the influence of school leadership, school culture, and ICT proficiency on the professional competence of elementary school teachers in Sale Subdistrict, Rembang Regency. Professional competence encompasses mastery of subject matter, understanding of student characteristics, and the application of effective teaching methods and technology (Mia & Sulastri, 2023). According to the Decree of the Directorate General of Teachers and Education Personnel No. 2626/B/HK.04.01/2023, professional competence is one of the four core teacher competencies, alongside pedagogical, personal, and social competencies. Dharma (2019) asserts that professional competence includes expertise in one's field, mastery of teaching materials and methods, and a strong sense of responsibility. Bagou and Suking (2020) emphasize the importance of continuous reflection and updating of teaching skills.

School leadership, school culture, and ICT proficiency are vital in shaping teachers' professional competence. Syahputra et al. (2023) argue that school principals must possess personal, managerial, entrepreneurial, supervisory, and social competencies. Minsih et al. (2019) further stress the principal's role as a manager, administrator, motivator, innovator, and supervisor. School culture, which encompasses values, norms, and practices within the school environment, can enhance motivation, discipline, and

professionalism (Nizary & Hamami, 2020; Tinjak, 2023). Finally, ICT mastery, both in cognitive and psychomotor aspects, is essential in today's digital era, improving teacher performance and learning effectiveness (Jamun et al., 2020; Warsita, 2022).

## RESEARCH METHOD

This study employed a quantitative approach using an ex post facto or non-experimental research design. The quantitative approach was chosen because the main focus of the research is to examine objective phenomena that can be statistically measured (Zafri, 2023). The ex post facto design aims to investigate events that have already occurred and trace the factors that influenced those events (Sugiyono, 2019). This research was conducted without manipulating variables, instead observing the natural relationships between variables as they exist.

The study was conducted in 27 public elementary schools located in Sale Subdistrict, Rembang Regency, during the period of May to June 2025. The research stages included instrument development, data collection, data analysis, and preparation of the final report. The location was selected due to its diverse conditions in terms of school principal leadership, school culture, and the level of information technology mastery within public elementary schools.

This study used an associative research design aimed at examining the relationships between independent and dependent variables. The three independent variables are school principal leadership (X1), school culture (X2), and information technology mastery (X3), while the dependent variable is teacher professional competence (Y). These variables are illustrated in a causal model, which is tested using simple linear regression and multiple linear regression analysis.

The population of this study consisted of all public elementary school teachers in Sale Subdistrict, Rembang Regency, totaling 197 individuals. The sample size was determined using the Slovin formula with a 5% margin of error, resulting in a sample of 132 teachers (Zulfikar, 2024). The sampling technique used was proportional random sampling, which provides equal opportunity for each member of the population to be selected as a sample (Sugiyono, 2022).

The research instrument was a closed-ended questionnaire developed in the form of a Likert scale. Each item was based on theoretical indicators for each variable, as outlined in an instrument blueprint. The validity of the instrument was tested using Pearson Product Moment correlation (Arikunto, 2020), and reliability was tested using Cronbach's Alpha technique, with an alpha value greater than 0.60 considered reliable (Sugiyono, 2022).

Data collection was conducted by distributing the questionnaires directly to each sampled school. This method was chosen for its efficiency in reaching a large number of respondents across a wide geographical area and for enabling direct verification of responses. A five-point Likert scale was used to assess responses, with the scale points ranging from 1 to 5, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

Data analysis was performed using SPSS software version 26. The analysis steps included: (1) prerequisite tests, such as the normality test (Kolmogorov-Smirnov), linearity test, homogeneity test (Levene's Test), and multicollinearity test (VIF); (2) correlation test to examine relationships among variables; (3) simple linear regression to analyze the influence of individual independent variables on the dependent variable

(Sugiyono, 2022); and (4) multiple linear regression to examine the simultaneous influence of the three independent variables on teacher professional competence.

Hypothesis testing was conducted using several techniques: the F-test to examine the significance of the simultaneous influence of the independent variables on the dependent variable (Mulyono et al., 2024), and the t-test to determine the partial influence of each independent variable on the dependent variable (Raptis et al., 2024). This approach is expected to provide an objective overview of the contributions of school principal leadership, school culture, and information technology mastery to improving teacher professional competence.

## RESULTS AND DISCUSSION

### Results

This study aimed to examine the influence of school principal leadership, school culture, and information technology mastery on the professional competence of public elementary school teachers in Sale Subdistrict, Rembang Regency. Data were obtained through questionnaire distribution to 132 teachers and analyzed using SPSS. The findings are presented in two main sections: data description and inferential analysis.

Descriptive analysis revealed that all four research variables obtained high average scores. The average score for school principal leadership was 87.82; for school culture, 86.20; for information technology mastery, 89.73; and for teacher professional competence, 88.13. These results indicate that teachers generally perceive all three independent variables and the dependent variable as being in the high category. The distribution of respondents' perceptions regarding teacher professional competence shows that 49.24% of respondents agreed or strongly agreed, while 50.76% disagreed or strongly disagreed. This indicates a significant discrepancy in teachers' perceptions, where, despite the high average score of 88.13, nearly half of the respondents do not feel fully confident in their professional competence. This gap suggests that although teachers might rate their skills and competence positively in general, they still feel there are areas for improvement or are uncertain about the depth of their capabilities in practice. For example, some teachers may rate their ability to perform certain tasks highly but may not fully recognize or feel the impact of their actions on their professional development.

The descriptive analysis shows that 69.7% of respondents expressed agreement or strong agreement with statements related to school principal leadership, while 81.1% indicated similar responses regarding school culture. In terms of information technology mastery, 50.8% of respondents reported agreement or strong agreement. Based on data from 132 respondents, the four variables under investigation school principal leadership, school culture, information technology mastery, and teacher professional competence were all categorized as high, indicating that teachers held favorable perceptions of both the independent and dependent variables in this study, as summarized in Table 2.

The discrepancy between the high average score of teacher professional competence and the relatively low agreement percentage (49.24%) can be attributed to several factors. One possibility is that the Likert scale, which uses a 5-point range, might have caused a tendency for teachers to choose the neutral or disagree options, even if they perceive their competence to be good. The self-assessment nature of the survey may have led teachers to be more cautious in their self-reporting, especially regarding reflective practices or areas of professional development that they consider still needing improvement. The lack

of confidence or perception of inadequate professional growth could also be linked to factors not directly captured by the survey, such as lack of resources, training opportunities, or administrative support that might hinder teachers from achieving their full potential, despite their positive self-evaluation.

**Table 2.** Average Scores and Percentage of Respondent Perceptions

| No | Variable | Average Score | Category | % Agree/Strongly Agree |
|----|----------|---------------|----------|------------------------|
| 1 | School Principal Leadership | 87.82 | High | 69.7% |
| 2 | School Culture | 86.20 | High | 81.1% |
| 3 | Information Technology Mastery | 89.73 | High | 50.8% |
| 4 | Teacher Professional Competence | 88.13 | High | 49.24% |

Source: SPSS Output, 2025

For school culture, the highest percentage of agreement at 81.1% with an average score of 86.20 suggests that a positive, collaborative, and supportive work environment has been established in many schools in Sale Subdistrict. School principal leadership recorded an average score of 87.82 with a 69.7% agreement rate, indicating that most teachers perceive their principals as playing a strategic role in leading and guiding the school. Finally, teacher professional competence achieved an average score of 88.13, yet only 49.24% of respondents agreed or strongly agreed. This suggests that despite objectively high scores, subjective perceptions of professional development among teachers remain uneven. In other words, some teachers still feel they have not fully mastered subject content or achieved optimal professional growth.

A dimension test was conducted to measure construct validity for each indicator within the research variables, using Principal Component Analysis (PCA). Indicators were considered valid if the communalities (extraction values) exceeded 0.60 (Hair et al., 2010). The extraction results for each variable are as follows:

**Table 3.** Dimension Test Results (PCA Extraction Values)

| Variable | No. of Indicators | Communalities (Range) | Description |
|----------|-------------------|------------------------|-------------|
| School Principal Leadership | 5 | 0,626 – 0,774 | Valid |
| School Culture | 3 | 0,906 – 0,975 | Valid |
| Information Technology Mastery | 4 | 0,414 – 0,714 | Valid (but with a lower value for some indicators) |
| Teacher Professional Competence | 5 | 0,633 – 0,986 | Valid |

*Source: SPSS Output, 2025*

The results of the dimension test show that all indicators across the four research variables had communalities greater than 0.60, except for Information Technology Mastery, which had one indicator with a communality value as low as 0.414. While this value is below the Hair et al. (2010) threshold of 0.60, it is important to note that the majority of the communalities for this variable ranged from 0.562 to 0.714, indicating that most of the indicators for ICT mastery are still valid and contribute significantly to

explaining the variable. The lower value may indicate that some specific aspects of ICT mastery, such as teachers' confidence in their ability to use certain software or educational technologies, require further attention or improvement.

For school principal leadership, communalities ranged from 0.626 to 0.774, indicating that each item in the instrument strongly contributes to explaining the leadership variable. School culture showed the highest communalities, ranging from 0.906 to 0.975, indicating that indicators such as values, norms, habits, and social interactions have strong validity in representing school culture. For teacher professional competence, communalities ranged from 0.633 to 0.986, indicating that indicators of content mastery, professional development, and learning evaluation are highly consistent in reflecting professional competence.

Thus, the dimension test results confirm that most items in the research instrument are valid in terms of construct and are suitable for further analysis. The high construct validity also reinforces the overall reliability of the instrument.

Before conducting regression analysis, classical assumption tests were performed. The normality test using Kolmogorov-Smirnov yielded a significance value of 0.360 (>0.05), indicating normal distribution. The homogeneity test produced a significance value of 0.154 (>0.05), confirming data homogeneity. Multicollinearity tests showed that all VIF values were <10 and tolerance values >0.1, indicating no multicollinearity. Linearity tests for all variables showed a linear relationship with teacher professional competence ($p > 0.05$).

Hypothesis testing was conducted to determine the influence of each independent variable on teacher professional competence, both partially and simultaneously. The complete results of simple and multiple linear regression analyses are presented below:

**Table 4.** Hypothesis Test Results (Partial and Simultaneous)

| Hypothesis | Correlation Coefficient (r) | Significance (p) | R² | Hypothesis |
|---|---|---|---|---|
| X1 → Y (School Principal Leadership) | 0.650 | 0.000 | 0.423 | X1 → Y (School Principal Leadership) |
| X2 → Y (School Culture) | 0.215 | 0.013 | 0.046 | X2 → Y (School Culture) |
| X3 → Y (ICT Mastery) | 0.362 | 0.009 | 0.131 | X3 → Y (ICT Mastery) |
| X1, X2, X3 → Y (Simultaneous) | – | 0.000 | 0.436 | X1, X2, X3 → Y (Simultaneous) |

*Source: SPSS Data Output, 2025*

The first hypothesis test indicates that the variable of school principal leadership (X1) significantly influences teacher professional competence (Y), with a correlation coefficient of 0.650 and a significance level of $p = 0.000$. The coefficient of determination ($R^2$) of 0.423 suggests that 42.3% of the variance in teacher professional competence can be explained by school principal leadership. This reinforces the strategic role of the school principal as an instructional leader in promoting teacher professionalism.

The second hypothesis test reveals that school culture (X2) also significantly affects teacher professional competence, with $r = 0.215$, $p = 0.013$, and $R^2 = 0.046$. Although its contribution is only 4.6%, this result indicates that the values, norms, and practices developed within the school environment still play a role in influencing how teachers cultivate their professionalism. Schools with a collaborative, disciplined, and

achievement-oriented culture can encourage teachers to innovate and improve their competence.

The third hypothesis test shows that information technology mastery (X3) significantly influences teacher professional competence, with r = 0.362, p = 0.009, and R² = 0.131. With a contribution of 13.1%, this finding indicates that the higher the teachers' mastery of ICT tools and applications, the greater their ability to deliver content, evaluate learning, and develop digital-based teaching materials. ICT skills are a crucial component in addressing the challenges of 21st-century education.

Simultaneously, the results of the multiple linear regression test show that the three independent variables collectively have a significant influence on teacher professional competence, with a significance level of p = 0.000 and an R² value of 0.436. This means that 43.6% of the variance in teacher professional competence can be collectively explained by school principal leadership, school culture, and ICT mastery. The remaining 56.4% may be influenced by other factors not examined in this study, such as intrinsic motivation, professional training, and family support.

*Discussion*

The results of this study indicate that school principal leadership, school culture, and information technology mastery simultaneously exert a significant influence on teachers' professional competence, contributing 43.6%. This finding highlights the importance of a holistic approach that integrates these three aspects to strengthen teacher professionalism.

School principal leadership was found to have the most significant influence, with a correlation coefficient of 0.650 and a contribution of 42.3%. This reinforces the view that transformational leadership, which fosters internal motivation, clarifies the school's vision, and supports a progressive culture, is vital for teachers' professional development (Ulfah et al., 2023). However, while respondents rated "serving as a role model" and "having a clear vision" highly, teacher participation in school planning remains low, pointing to a gap in participatory leadership (Erlena, 2022; Puspitasari et al., 2021). These findings align with Komariah and Triatna (2021), who emphasize that visionary leadership enhances trust in school policies and fosters innovation, while Karwati and Priansa (2020) stress that empathetic leadership builds professional loyalty.

The strength of this study lies in its contextual analysis, which critiques both statistical relationships and implementation aspects, such as limited teacher participation and generational conflicts between principals and younger teachers (Alim, 2022; Muhaimin, 2021). This contributes original insights into the discrepancy between formal leadership and the professional aspirations of teachers. Previous studies, such as Syahputra et al. (2023), found that leadership focused only on administrative tasks does not significantly impact teacher competence unless accompanied by continuous empowerment and mentoring.

School culture also plays a significant role, with a correlation coefficient of 0.215 and an R² of 4.6%. While its quantitative contribution is modest, qualitatively, a positive school culture acts as a psychological and social support factor that encourages loyalty, strong work ethics, and collaboration among teachers (Masanah et al., 2021; Muchroji et al., 2021). This study adds value by exploring the symbolic dimensions of school culture such as slogans, rituals, and visual environments often overlooked in earlier studies.

These elements help reinforce teachers' professional identity and foster a shared sense of purpose (Daryanto & Tarno, 2020; Mulyasa, 2020; Tinjak, 2023).

Moreover, despite principal leadership being dominant, school culture remains an independent foundation in shaping teachers' professional orientation, particularly in fostering loyalty and collective responsibility (Bagou & Suking, 2020; Jamun et al., 2020; Mia & Sulastri, 2023). A positive school culture can motivate teachers to voluntarily engage in professional development, share best practices, and participate in decision-making. This supports findings by Sambella (2024) and Samosir et al. (2025), who emphasize the role of collaborative culture in professional growth.

However, the symbolic dimension of school culture, such as the use of visual media, slogans, and rewards for exemplary behavior, remains underdeveloped in some schools. This highlights the need for a "Culture-Rich School" program that goes beyond formal procedures to touch upon the psychosocial aspects of school life (Muhaimin, 2021; Suhandi, 2023).

Information technology mastery contributes 13.1% to teacher professional competence, with a correlation coefficient of 0.362. While this is lower than the impact of leadership, ICT skills remain a crucial component of the digital education transformation in the Industry 4.0 era. Teachers with strong ICT skills can create interactive learning media, access global resources, and design digital evaluations (Dinata, 2021; Rahma et al., 2021; Saerang et al., 2023).

However, despite the high average score for ICT mastery (89.73), only 50.8% of teachers reported using technology effectively. This indicates a gap between technical proficiency and actual integration into teaching practices. The lower percentage of teachers using ICT for instructional purposes reflects a common challenge: while teachers may possess the skills to use technology, they often lack the confidence or support to apply these skills in their classrooms. This gap is consistent with findings by Syahid et al. (2022) and Subekti et al. (2024), who emphasize that barriers to ICT mastery are not purely technical but also involve affective and cultural dimensions, such as reluctance to change or lack of perceived value in using technology for pedagogy.

Furthermore, many teachers still use ICT primarily for administrative tasks rather than for enhancing teaching and learning (Amalia, 2020; Slamet et al., 2020). This suggests that while teachers have the technical ability to use ICT, their professional development in digital pedagogy has been insufficient. This study contributes to the understanding that effective ICT integration requires more than just access to technology; it requires structured support, including relevant training and a clear understanding of its pedagogical value.

The study also mapped contextual challenges such as limited computer availability and the lack of functional ICT training. These challenges echo the findings of Kinas and Nilawati (2024) and Timotius and Purba (2023), who recommend enhancing digital competencies based on teachers' real needs. The study suggests a phased ICT training approach, beginning with basic applications and progressing to more complex digital tools. This concept is supported by Muthmainnah et al. (2025) and Nurillah et al. (2025), who stress the importance of tailored ICT training based on teachers' needs analysis.

The results of the multiple linear regression analysis show that the three independent variables school principal leadership, school culture, and information technology mastery collectively contribute 43.6% to teachers' professional competence. This suggests that an integrative approach involving leadership, culture, and technology adoption is

key to shaping professional teachers. This study highlights that improving teacher quality requires synergy among internal and external school factors (Mulyasa, 2020; Rahma et al., 2021).

These findings contribute to the literature by integrating three educational management pillars simultaneously, rather than examining isolated relationships between ICT, school culture, and teacher performance. This approach fills an empirical gap by exploring how these variables interact to shape teachers' professional competence (Dinata, 2021; Nahdi et al., 2020). The study also affirms that the effectiveness of one variable is enhanced when supported by others. For example, transformational leadership becomes more impactful when coupled with a collaborative culture and strong ICT mastery. This aligns with Timotius and Purba (2023) and Muthmainnah et al. (2025), who emphasize the importance of a mutually reinforcing support system for teacher professionalism.

In conclusion, this study provides valuable insights into the complex interactions between leadership, culture, and ICT in shaping teachers' professional competence. It demonstrates the importance of an integrated approach to teacher development, which takes into account both structural and psychosocial factors within the school environment.

## CONCLUSION

**Fundamental Finding**: This study found that school principal leadership, school culture, and information technology proficiency significantly influence the professional competence of teachers in public elementary schools in Sale District, Rembang Regency. Among these three variables, school principal leadership had the most dominant contribution, with a determination value of 42.3%, followed by information technology proficiency (13.1%) and school culture (4.6%). Collectively, these variables accounted for 43.6% of the variance in teachers' professional competence. This confirms that strengthening teacher professionalism requires an integrative approach involving leadership, organizational culture, and digital literacy. **Implication**: The practical implication of this research is the need for holistic and sustainable teacher quality improvement programs. School principals should be provided with transformative leadership training that promotes teacher involvement in strategic decision-making. School culture should be reinforced through shared values, norms, visual symbols, and recognition systems that motivate teachers. Additionally, teachers' mastery of information technology must be supported through targeted training, technical mentoring, and the provision of necessary infrastructure. These strategies will help enhance teachers' roles as adaptive, innovative, and professional learning agents. **Limitation**: While this study contributes to the field of educational management, several limitations should be considered. The research focused solely on elementary schools in one district and used a quantitative approach, which did not fully explore qualitative aspects such as teachers' perceptions, experiences, and the deeper contextual dynamics influencing professional competence. Additionally, other external factors such as teachers' intrinsic motivation, parental support, and educational policies were not examined, although they may also impact teacher professional competence. **Future Research**: Future studies could employ a mixed-methods approach to address the limitations of this study's solely quantitative approach, enabling a more comprehensive exploration of the experiences, perceptions, and contexts that influence the variables

studied. Qualitative methods could provide richer insights into the underlying factors that contribute to teachers' professional competence, such as teacher motivation and school climate. Extending the research to secondary education levels or other geographical areas would also help test the generalizability of the findings. Additionally, future research could incorporate variables such as emotional intelligence, work engagement, and teacher job satisfaction, offering a more comprehensive perspective on the factors shaping teacher professional competence in the challenges of 21st-century education.

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