Digital Transformation in Education: Examining the Contribution of Madrasah Principal Leadership to Teacher Teaching Performance

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Abstract

This article investigates the influence of madrasah principal leadership on the madrasah teachers' teaching performance in the digital era. The study used a quantitative approach, and the survey method involved 124 respondents randomly selected from seven madrasahs in Jepara, Indonesia, based on cluster techniques. The results revealed that the F-test obtained $F_{statistic} > F_{table}$ (39.824 > 3.07) and significance (0.000 < 0.05), indicating that the leadership of the madrasah principal exerted a positive and significant influence on the madrasah teacher's performance. The coefficient of determination test results exhibited an R Square (R^2) value of 0.240, meaning that teacher teaching performance is influenced by the leadership variable of the madrasah principal by 24% and 76% by other variables. These findings provide a foundation for understanding the critical role of madrasah principal leadership in improving teacher-teaching performance. Further research is recommended to consider the factors affecting teaching performance and expansion.

Keywords: *Transformational leadership, teacher performance, madrasah principal leadership, digital era.*

A. Introduction

Education is one of the sectors that continues to experience significant changes along with the development of information and communication technology. Technological advances have opened up new opportunities in the learning process, changing the overall educational landscape. In this era, digital leadership is considered an essential factor in utilizing the potential of technology to improve the quality of education (Rosita & Iskandar, 2022).

Digital leadership refers to a leader's ability to leverage digital technology and innovation in designing and implementing effective educational strategies. A leader who understands and utilizes various digital tools, applications, and educational technology platforms can create an inclusive, dynamic, and relevant learning environment (Isya et al., 2021). Influential leaders in digital leadership can provide teachers with the motivation, guidance, and support they need to integrate technology into learning practices.

In an ever-evolving digital age, transformative leadership has become a relevant and essential concept in education. As a leader, adapting to technological change and leading through transformation is critical to achieving a competitive advantage in the digital age (Muslim, 2021). In this theoretical study, the concept of transformative leadership in the digital era and its relevance to the educational context is discussed.

Additionally, transformative leadership is the main foundation for managing change, innovation, and developing individual potential in the digital era (Mahfudh, 2022). As the prominent leader, the principal of the madrasah is responsible for guiding the madrasah in facing the challenges and opportunities offered by digital technology. An inspiring digital vision, openness to innovation, collaboration, and active participation from all madrasah members are vital in implementing transformative leadership (Hardian & Eric Hermawan, 2022). Digital skills development, monitoring and evaluation, and data-driven leadership are essential elements that need to be emphasized by madrasah principals (Zubaidah & Putra, 2022). In addition, continuous learning, the use of technology to improve efficiency, and the involvement of parents and the community are crucial in ensuring the success of the madrasah's digital transformation. An inclusive and diverse culture is fundamental to creating an equitable educational environment that supports the various needs of students.

Transformative leadership in the digital age has a significant impact on steering educational organizations toward successful transformation (Effendi et al., 2020). With a focus on change, innovation, and individual development, transformative leadership plays a crucial role in addressing challenges and capitalizing on the opportunities faced by digital technologies.

The teaching performance of madrasah teachers in the digital era is a significant concern for improving the quality of education (Timan et al., 2022). The theoretical foundation discusses the definition and concept of teaching performance of madrasah teachers in the digital era as a solid basis for understanding. The teaching performance of madrasah teachers in the digital era includes teachers' ability to use digital technology and its tools effectively to support the learning process, facilitate student development, and achieve quality education goals (Sojanah et al., 2021).

In the perpetually changing digital era, the teaching performance of madrasah teachers plays a crucial role in achieving the goals of quality education. Teachers must adapt to digital technology and utilize these tools effectively in the learning process (Ross, 2018). Digital competence, creativity and innovation, collaboration and networking, and assessment and monitoring are essential performance indicators (Gündüzalp, 2021; Lee et al., 2022). Effective online learning, professional development, information and media literacy, and learning differentiation are important for teachers in the digital era (Budiana, 2022). Teachers can provide students with a better and more relevant learning experience by developing relevant competencies and skills and using digital technology effectively.

The importance and urgency of digital leadership have been recognized, but previous research on the influence of digital leadership on teacher performance is limited. In this context, research investigating the influence of digital leadership on teacher performance is vital to provide a deeper understanding of how digital leadership can affect the quality of teaching and learning. Madrasah principals who support digital transformation also play an essential role in building a culture of innovation and adaptation. By emphasizing the importance of technology in education and encouraging teachers to continue learning and adapting to technological developments, madrasah principals can create a dynamic and growth-oriented environment. Teachers who feel well-supported and equipped are likelier to take the initiative, innovate in their teaching, and achieve higher performance (Shen, 2022).

Therefore, this study is intended to bridge the gap by investigating the influence of digital leadership on teacher performance in private madrasahs. Through comprehensive literature analysis and collection of relevant data, the study is expected to provide more operational insights into how digital leadership can impact teacher-teaching practices and student learning outcomes. The results of this study are also anticipated to provide practical recommendations for education unit leaders and policymakers in developing effective madrasah leadership strategies in the digital era. Subsequently, this research will improve education quality through appropriate technology and effective madrasah leadership.

B.   Methods

This research used a quantitative approach to investigate the influence of madrasah principal leadership on the madrasah teachers' teaching performance in the digital era, with a survey. Survey research collects data from samples to represent the entire population and uses questionnaires as the primary data collection instrument (Apuke, 2017). The quantitative approach referred to here is that the data collected were numbered and then processed or analyzed statistically. The population of this study was teachers of Madrasah Tsanawiyah in Jepara in the academic year 2020-2021, which amounted to 180 teachers spread across seven madrasahs. The number of samples taken was 124 teachers, calculated by the Slovin formula.

This study examined two variables: 1) the principal of the madrasah's leadership as an independent variable and 2) teacher teaching performance as a dependent variable. Data collection was carried out with a closed questionnaire in the form of a Likert Scale with 5 (five) alternative answers (options): Strongly Agree (SS), Agree (S), Hesitate (R), Disagree (TS), and Strongly Disagree (STS). The questionnaire comprised 1) a questionnaire on the leadership of the principal of a madrasah containing 33 items and 2) a questionnaire on teacher teaching performance containing 35 items. Both instruments had been tested for validity and reliability. The reliability coefficient value of the leadership questionnaire of the principal of the madrasah was 0.922, while the reliability coefficient value of the teacher-teaching performance questionnaire was 0.942.

Data analysis was then conducted in stages: 1) descriptive analysis, 2) requirements test, and 3) hypothesis test analysis. Descriptive analysis uses descriptive statistical techniques, namely mean, variance, and standard deviation. Requirements

tests include a) normality tests with the Kolmogorov-Smirnov test and b) linearity tests performed by finding the equation of the regression line of the independent variable (X) against the bound variable (Y). The significance of the regression line coefficient and linearity was then tested based on the line made. The hypothesis test analysis employed in this study was simple linear regression analysis. The SPSS for Windows Release 21 Program was utilized at all stages of the analysis.

C.   Results and Discussion

1.   Leadership of the Principal of the Madrasah

The variable data of the principal of the madrasah leadership is the score of measurement results given by teachers to the leadership of the principal of the madrasah through a questionnaire containing 33 points of statements developed from ten indicators about the leadership of the principal of the madrasah. Theoretically, the minimum possible score was 33, and the maximum score was 165. The data on the leadership variables of the principal of the madrasah obtained from 124 teachers of the Tsanawiyah madrasah in Jepara can be presented in the frequency distribution and descriptive statistical analysis in Table 1 as follows.

Table 1. Statistics Descriptive
Madrasah Principal's Leadership

N	Valid	124
	Missing	0
Mean		134.98
Std. Error of Mean		1.326
Median		133.50
Mode		130
Std. Deviation		14.769
Variance		218.114
Skewness		.073
Std. Error of Skewness		.217
Kurtosis		-.740
Std. Error of Kurtosis		.431
Range		59
Minimum		105
Maximum		164
Sum		16738

a. Multiple modes exist. The smallest value is shown

From Table 1, it can be explained that 124 teachers were respondents who filled out the research questionnaire. The mean of the leadership score of the principal of the madrasah was 134.98, the median was 133.50, the value that often appeared (mode) was 130, the standard deviation was 14.769, the level of data distribution (variance) was 218.114, the range was 59, the minimum score was 105, and the maximum score was 164.

The distribution of the variable score of the leadership of the principal of the madrasah relative to the minimum and maximum scores can be displayed in the frequency distribution table and histogram graph as follows.

Table 2. Frequency Distribution and Criteria Based on Relative Scores
Variable: Leadership of the Principal of the Madrasah

No	Interval	Criterion	Frequency	Percentage
1	153 – 164	Excellent	21	**16.94**
2	141 – 152	Good	22	**17.74**
3	129 – 140	Enough	45	**36.29**
4	117 – 128	Not Good	27	**21.77**
5	105 – 116	Very Not Good	9	**7.26**

From Table 2 above, it is shown that the most frequency was in the score interval 129-140, in sufficient criteria or categories, and the mean score (134.98) was also in that interval and criterion. In detail, it can be explained that respondents who stated the leadership of the principal of the madrasah in the excellent category were 21 respondents (16.94%), good as many as 22 respondents (17.74%), enough as many as 45 respondents (36.29%), not good as many as 27 respondents (21.77%), and very not good as many as nine respondents (7.26%). Table 2 on the frequency distribution and leadership criteria of the principal of the madrasah can be visualized in a graph or histogram diagram as below.
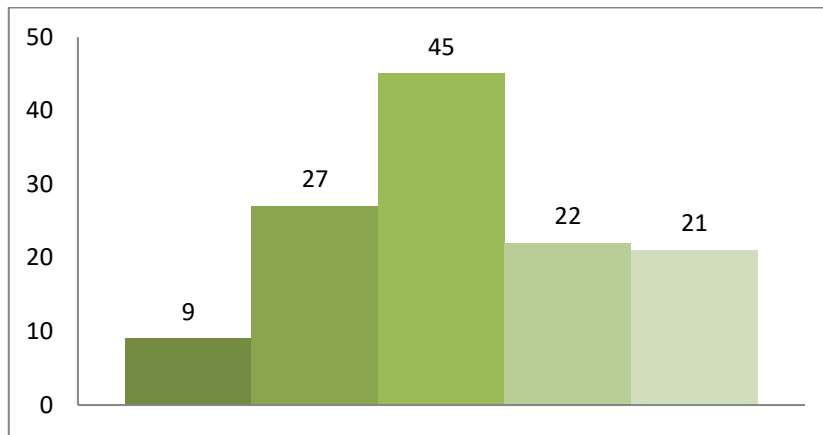
Figure 1. Madrasah Principal Leadership Histogram

2.   Teacher Teaching Performance

Teacher teaching performance variable data is a measurement score given by the principal of a madrasah on teacher teaching performance through a questionnaire developed by researchers containing 35 statements based on 13 indicators about teacher teaching performance. Theoretically, the minimum possible score was 35, and the maximum score was 175. The teacher teaching performance variables data were obtained from 124 madrasah teachers in Jepara. Data on teacher performance can be presented in frequency distribution tables and descriptive statistical analysis as follows.

Table 3. Statistical Descriptive Variables: Teacher Performance

Teacher's Performance

N	Valid	124
	Missing	0
Mean		148.86
Std. Error of Mean		.848
Median		148.50
Mode		142ᵃ
Std. Deviation		9.448
Variance		89.257
Skewness		.113
Std. Error of Skewness		.217
Kurtosis		-.174
Std. Error of Kurtosis		.431
Range		47
Minimum		126
Maximum		173
Sum		18459

a. Multiple modes exist. The smallest value is shown

From Table 3, it can be explained that there were 124 teachers assessed by the principal of each madrasah using a questionnaire developed by researchers based on 13 indicators of teacher teaching performance. The mean teacher teaching performance score was 148.86, the median was 148.50, the value that often appeared (mode) was 142, the standard deviation was 9.448, the level of data distribution (variance) was 89.257, the range was 47, the minimum score was 126, and the maximum score was 173.

The distribution of variable scores of teacher teaching performance relative to minimum and maximum scores can be exhibited in the frequency distribution table and histogram graph.

Table 4. Frequency Distribution and Criteria Based on Relative Score

Variable: Teacher Performance

No	Interval	Criterion	Frequency	Percentage
1	166 – 175	Very High	7	5.65
2	156 – 165	High	25	20.16
3	146 – 155	Enough	44	35.48
4	136 – 145	Low	31	25.00
5	126 – 135	Very Low	17	13.71

Table 4 mentioned above shows that the most frequency was in the interval of the score 146-155, on the criteria or category of enough, and the mean score (148.86) was also in those intervals and criteria. In detail, it can be explained that respondents who stated teacher performance in the very high category were seven respondents (3.65%), high category as many as 25 respondents (20.16%), enough category as many as 44 respondents (35.48%), low category as many as 31 respondents (25%), and very low category as many as 17 respondents (13.71%).

Table 4, showing teachers' frequency distribution and teaching performance criteria, can then be visualized in a graph or histogram diagram below.
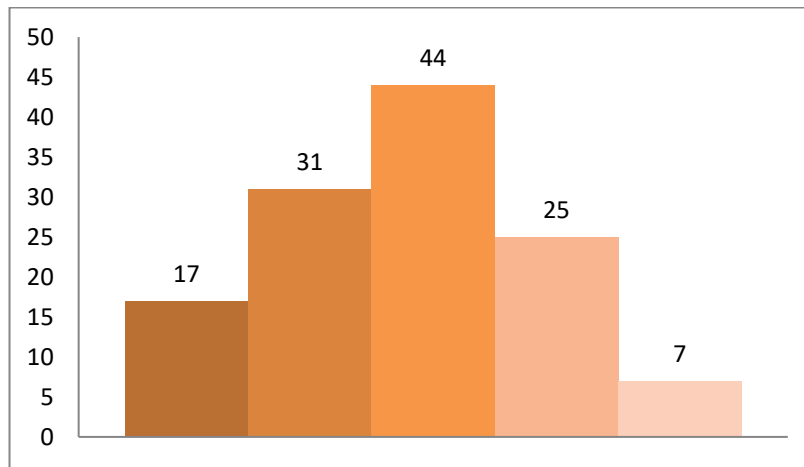
Figure 5. Histogram of teacher performance based on relative scores

3. Hypothesis Test

The hypothesis proposed in this study is: "There is a positive and significant influence of the leadership of the principal of the madrasah on the teaching performance of teachers." This hypothesis testing was done with a simple linear regression test. Here are the results of hypothesis testing:

a. Regression Equation Model

Table 5. Simple Regression Test for X1 with Y

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	106.026	6.828		15.528	.000
Madrasah Principal Leadership	.317	.050	.496	6.311	.000
a. Dependent Variable: Teacher Performance					

Based on Table 5, with values of a = 106.026 and b = 0.317, the simple linear regression equation is as follows.

$$\hat{Y} = a + bX_i$$

$$\hat{Y} = 106.026 + 0.317X_1$$

From the above equation, it can be explained as follows. a) The constant value of 106.026 states that if the leadership variable of the principal of the madrasah is considered constant, the teacher's teaching performance is 106.026. b) The regression coefficient of the leadership of the principal of the madrasah of 0.317 states that every increase in the value of the leadership variable of the principal of the madrasah by 1 unit will potentially increase the variable of teacher teaching performance by 0.317 units. c) The positive value (0.317) contained in the regression coefficient of the leadership variable of the principal of the madrasah illustrates that the direction of the relationship between variables X and Y is unidirectional.

b. F-Test

The results of the F-test are shown in Table 6.

Table 6. F-Test Results for X with Y

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	2701.790	1	2701.790	39.824	.000[a]
Residual	8276.880	122	67.843		
Total	10978.669	123			

a. Predictors: (Constant), Madrasah Principal's Leadership
b. Teacher Performances

From Table 6, it is known that the results of the F-test obtained an F-statistics value of 39.824. Meanwhile, the F-table (error rate 5% and dk 121) was 3.07. Based on the results of the meaningfulness test, F-statistics > F-table (39.824 > 3.07) and significance (0.000 < 0.05). Thus, it can be concluded that the leadership variable of the madrasah's principal affected the teacher-teaching performance variable (Effendi et al., 2020).

c. T-Test

The results of the t-test are shown in Table 7.

Table 7. T-Test for X with Y

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	106.026	6.828		15.528	.000
Kepemimpinan Kepala Madrasah	.317	.050	.496	6.311	.000

a. Dependent Variable: Teacher Performance

From Table 7, it is known that the calculated value was 6.311. The calculated score was then compared with the table score. The value of the t-table at the error level of 5% and dk = 121 obtained the t-table = 1.657. The T-test calculates the leadership of the principal of the madrasah at 6.311 with a significance level of 0.000. It turned out that the value of t-$_{statistics}$ for the leadership of the principal of the madrasah> t-table (6.311 > 1.657), and the significant value of the leadership of the principal of the madrasah was less than the significance (0.000 < 0.05), rejecting Ho and accepting Ha. This indicates a positive and significant influence of the leadership variable of the principal of the madrasah on the variable of teacher teaching performance at the beta standard of 0.496.

d. Coefficient of Determination Test

The results of the determination coefficient test are presented in the table below.

Table 8. Coefficient of Determination for X with Y

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	.496	.246	.240	.8237

a. Predictors: (Constant), Madrasah Principal's Leadership
b. Teacher Performances

The coefficient of determination test results was shown at an *adjusted R Square* (r^2) value of 0.240. This means that teacher performance was determined or influenced by the leadership variable of the principal of the madrasah by 24% and 76% by other variables.

The research results uncovered that the principal of the madrasah's leadership significantly influences the teaching performance of madrasah teachers in the digital era. Analysis of the data revealed variations in respondents' assessment of the leadership of the principal of the madrasah. As many as 16.94% of respondents considered the leadership of the principal of the madrasah in the excellent category, while 7.26% of respondents considered it very not good. This indicates a difference in perception of the leadership of madrasah principals in the digital era.

Furthermore, the assessment of the teaching performance of madrasah teachers also showed significant variations. Only 3.65% of respondents considered teacher performance in the very high category, while 13.71% of respondents considered it very low. From the results of regression analysis, it was found that there was a positive relationship between the leadership variables of the principal of the madrasah and the teaching performance of madrasah teachers. The regression coefficient of madrasah principal leadership of 0.317 shows that every 1 unit increase in the madrasah principal leadership variable can potentially increase teacher teaching performance by 0.317 units. This denotes that the leadership of the principal of the madrasah has a positive influence on the teaching performance of teachers.

Moreover, the significance test results exhibited meaningfulness in the relationship between the leadership of the madrasah principal and the teachers' teaching performance. The F-statistics value obtained (39.824) was greater than the F-table value (3.07), with a significance level (0.000 < 0.05). This signifies that the leadership variable of the madrasah's principal significantly affects teachers' teaching performance. In addition, the test results also showed that the value of calculating the leadership of the principal of the madrasah was more significant than the t-table (6.311 > 1.657), and the value of the leadership significance of the principal of the madrasah was less than the significance (0.000 < 0.05). Therefore, the null hypothesis (Ho) was rejected, and the alternative hypothesis (Ha) was accepted, which means that the madrasah principal leadership variable positively and significantly influences the teacher's teaching performance variable.

Although the leadership of the principal of the madrasah had a significant influence, the results also revealed that only about 24% of the variation in teacher-teaching performance could be explained by the leadership variable of the principal of the madrasah. The rest, 76%, were influenced by other factors not examined in the study. Therefore, attention is needed to other factors that might affect the teaching performance of madrasah teachers in the digital era.

Based on these findings, it can be concluded that the leadership of madrasah principals significantly influences the teaching performance of madrasah teachers in the digital era. Nevertheless, taking a holistic approach and involving other factors that might contribute to a teacher's teaching performance is essential. To improve the quality of education in madrasahs, madrasah principals and relevant stakeholders need to develop strategies that focus on effective leadership development, providing appropriate support, and utilizing technology and innovation relevant to the digital era (Navaridas-Nalda et al., 2020).

In this study, the results unveiled that the leadership of madrasah principals has a positive and significant influence on the teaching performance of madrasah teachers in the digital era. The implications of this study can be explained as follows. *First* is the importance of leadership development of madrasah principals. These findings suggest that the leadership of madrasah principals has a vital role in improving the teaching performance of madrasah teachers. Therefore, madrasah principals need to develop and improve their leadership skills, especially when facing challenges in the digital age. Practical leadership training and development can help madrasah principals lead well and provide necessary support to teachers (Ali, 2022)

Second is support and training for madrasah teachers. The results showed that the teaching performance of madrasah teachers still has significant variations. Therefore, madrasah principals and related parties should provide support and training to madrasah teachers to improve their teaching quality in the digital era. Training may include using technology, innovative teaching strategies, and developing pedagogical skills relevant to the madrasah context (Thannimalai & Raman, 2018).

Third is the development of a holistic strategy. Although the leadership of the principal of the madrasah had a significant influence, only about 24% of the variation in teacher-teaching performance could be explained by these variables. This implies that other factors also contribute to the teaching performance of madrasah teachers in the

digital era. Hence, it is essential to develop a holistic strategy that involves various factors, such as work environment, motivation, team support, and other factors that can affect the overall teaching performance of teachers (Shen, 2022).

Furthermore, the limitations of this study need to be considered as a reference for future research. This study was conducted with a limited sample and may not represent all madrasas. Therefore, generalizing these findings needs to be done with caution. Future research may involve more extensive and diverse samples for a more comprehensive understanding. In addition, this study only focused on the relationship between the leadership of the madrasah's principal and the madrasah teachers' performance. The analysis did not include other factors, such as teacher motivation, student characteristics, and other environmental factors. As such, future research may consider these additional variables to gain a more complete understanding.

Moreover, this study employed a survey method to collect data from respondents. Other research methods, such as case studies or direct observation, can provide deeper insight into the relationship between madrasah principal leadership and teachers' teaching performance in the digital age. By taking into account the implications and limitations of this study, it can be expected that future research will provide a more comprehensive and in-depth understanding of the factors that affect the teaching performance of madrasah teachers in the digital era and the efforts that can be made to improve them.

D.   Conclusion

Based on this research, it can be concluded that the leadership of the principal of a madrasah exerted a positive and considerable influence on the teaching performance of madrasah teachers in the digital era. Although responses to the leadership of madrasah principals and the teaching performance of madrasah teachers varied, the analysis showcased a strong relationship between the two variables. The leadership of the principal of the madrasah contributes significantly to the teaching performance of the teacher, and other factors also play a role in influencing the teaching performance of the madrasah teacher.

These findings have important practical implications for the development of education in madrasas. Madrasah principals need to pay attention to the importance of effective leadership development in the digital era. Training and leadership development can assist madrasah principals in providing appropriate support to

teachers and improving the quality of teaching in madrasahs. In addition, there needs to be adequate support and training for madrasah teachers to develop their skills and knowledge in using technology and teaching strategies relevant to the digital era.

Future research may involve more extensive and diverse samples to generalize these findings. In addition, research can consider other factors that affect the teaching performance of madrasah teachers, such as teacher motivation, student characteristics, and other environmental factors. Different research methods, such as case studies or direct observation, can provide deeper insights into the relationship between madrasah principal leadership and teachers' teaching performance in the digital age. In addition, future research may focus on developing holistic strategies involving numerous factors in improving overall madrasah teacher performance.

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